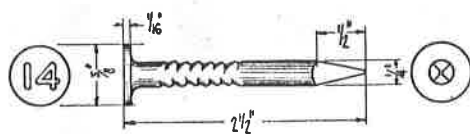
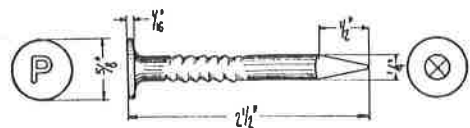

DATE NAILS *and* RAILROAD TIE PRESERVATION

Jeff Oaks

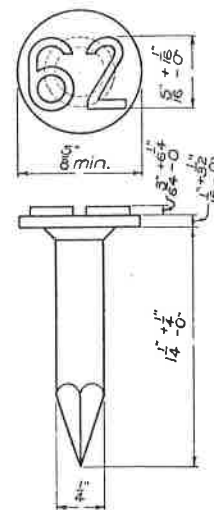
Volume I



Figures indicate Year



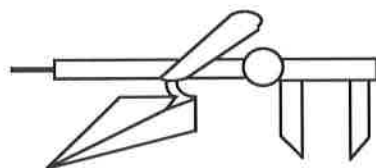
Letters indicate Kind of Timber.



DATE NAILS *and* RAILROAD TIE PRESERVATION

Jeff Oaks

Volume I



University of Indianapolis
Archeology and Forensics Laboratory
Special Report #3

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Foreword

I wrote this book for two different audiences: those interested in date nails as railroad collectibles, and those interested in the development of railroad tie preservation in North America. Trying to satisfy two different groups is usually not a good idea, but in this case I found it natural. It is impossible to understand date nails outside the context of the history of tie preservation, and the history is illuminated by the study of the nails. The biggest drawback is that the book is rather large, but I hope that this defect is offset by the price of the work.

Some of you no doubt would like a quick and easy guide to date nails. Unfortunately the subject is just too vast and complicated for that. Over 2,800 different nails, used by more than 240 railroads, are listed here. The nails were made by over three dozen steel companies during the period 1897 to the present. If you do not have the time or interest to study nails in depth, I have included a *guide for the impatient* below in the introduction to answer common questions. Hopefully you will be steered to the right pages quickly enough.

Introduction

How this book is organized

- Introduction. Here you will find a general introduction to date nails, a key to understanding the notation used in the railroad listings, and other assorted information.
- History of railroad tie preservation. To put into context all the information on tie preservation and date nails found in the railroad listings, read this. It is for me the most important part of the book. Following the history is a biography of Octave Chanute.
- Railroad listings. This is the main part of the book. For each railroad I list the date nails used by the line, and after that I include any information I have found on tie preserving and date nails, including what the code nails mean, and how the nails were used. I try to include information on which nails are rare, which are suspect, and where in the tie the nails are found. At the end of this section are listings of treatment company sets and shadow sets.
- Photos. To find out what the nails look like, there is the photo section in Volume III. The nails are arranged by manufacturer, and I include whatever additional information I have. This way if you want to know what nails were used by, say, the Grand Trunk, you first look at the list of nails in the railroad listings, then refer to the photos to find them. Of course this is not very convenient. It would be nice to have the photos right there with the railroad. But because often a particular style nail was used by several railroads, a plan like that would double the size of this book, and you would lose the connection with the nail companies.
- Reverse listing. Many people have some odd nails and want to know which railroads are listed as having used them. For this I include the reverse listing. Just look up your nail (for instance, look up $2\frac{1}{2} \times 1/4$ rnd I stl (07) 13) and the railroads which used the nail are listed. (That particular 13 has been found on two dozen railroads!)

Guide for the impatient

— *How do I find out what railroad used my nails?*

For a particular nail, look for it the photo section in Volume III. Because I lack photos for several nails, yours might not be there. Almost all nails are included, however, so unless you have a rarity, you will most likely find it. Many nails look alike! For example, these two nails have nearly identical numbers:

$2\frac{1}{2} \times 1/4$	rnd R	stl (06)	31
$2\frac{1}{2} \times 1/4$	rnd R	stl (07)	31

(Read on to decipher the notation.) You will want to try to read the shank markings as well as number style.

Then turn to the reverse listing in Volume III to find out which railroads used the nail. If you have several nails which are presumably from the same line, repeat this for each nail. If a single railroad used them all, and that railroad is close to the source of your nails, then you have probably identified the lot.

But be careful: in almost every bag of nails there are a few oddballs which were used by another railroad, or by a utility company in poles. This warning applies even if you were told that they are all from the same source.

— *What nails did my favorite railroad use?*

Look up your railroad in the listings (beginning on page 91 of this volume, and continuing through Volume II), and using the key here in the introduction, find them in the photo section in Volume III. Be sure to look over the text following the list to find any comments on particular nails. Some may have been used only in special test sections, some may be questionable, etc.

— *How much are my nails worth?*

Generally, if you are a dealer with a can of assorted nails, and you are not too concerned if there are any rarities, price them somewhere between a quarter and a dollar each. At a quarter they move fast, and at a dollar they will sell if they are interesting enough. Of course, the more you know about them, the better they will sell.

If you want to know what individual nails are worth, you have to contact an experienced nail collector. There are just too many nails for anyone to become expert enough in a short time to be able to price them. I do not include prices here for a couple reasons (see below under Money). Join the Texas Date Nail Collector's Association (TDNCA), a national club, to contact nail collectors who know prices. Membership information is found below.

— *How can I sell my nails?*

I do not buy or trade nails. Write to Jerry Waits, secretary of the TDNCA, to join TDNCA, or write to Charles Sebesta, editor of *Nailer News*, at Box 580, Caldwell, TX 77836 to place an ad. Charles can put you in contact with people who buy nails if you don't want an ad.

The Texas Date Nail Collector's Association

The TDNCA was founded in 1970 for people interested in collecting date nails. Included in the price of membership is the Association's newsletter *Nailer News*, which, beginning with Spring 1999, has been issued quarterly. Previously it came out six times a year. In the past year (2001) the issues have generally been 20 or 24 pages, and each issue has several articles on date nails, ads for nails for sale or trade, and information about shows.

The membership book, issued in March each year, contains the names, addresses, and interests of members. Right now about 175 people belong to TDNCA.

Date nail shows sponsored by TDNCA are held twice a year: once in Texas, and once outside Texas. Information on show dates and locations, and on the price of a table, is found in *Nailer News*. In addition to the two annual shows, monthly meetings are held in Texas.

Dues are \$16.00 per year, and should be mailed to:

Jerry Waits
501 W. Horton
Brenham, TX 77833
(409) 830-1495

Notation

Here is an example line decoded:

2 1/2 × 1/4 rnd I stl (07) 05,08:b,9,11-19,20:c

- 2 1/2 length of the nail, in inches. Because of the inaccuracy of nail making machines, your nail might not have exactly the nominal length. 2 1/2" nails, for example, generally fall in the 2 1/4" to 2 3/4" range.
- 1/4 diameter of shank, in inches. (1/4- is a diameter just under 1/4", and 3/16+ indicates a nail with a diameter just over 3/16".)
- rnd round head (and shank). See the key below for other shapes.
- I indented figures. (R = raised figures.)
- stl steel.
- (07) code for the manufacturer, identified by shank markings. (07) = American Steel & Wire Co. See the introduction to the photo section for other codes.
- 05 the numbers stamped on the nail's head. 05 stands for the year 1905. 08:b is the second 08 of the same dimensions shown in the photo section. These letters run up the alphabet: 08:c would be the third 08, 08:d the fourth, and so on. 9 is a 9 with a dot or triangle under the date. 11-19 means all dates from 11 to 19 inclusive.

I have tried to divide the list of nails into those used in ties, poles, bridge timbers, etc. Nails used in ties have no heading. The others are labeled. Usually not much information is available on just what nails were used in each type of timber aside from ties, so do not rely too much on the completeness of some of these categories. Also I listed for each railroad all nails which are known (to me) to come from second hand ties. These nails do not belong in the railroad sets. I included them mainly to show just how common these finds are, and to make nailers aware that many nails in their sets may belong to some other line. Dividing the lists into "first hand" and "second hand" can be difficult for those who pull the nails, and I have resorted to my "nailer's intuition" on several lines which I have never walked.

In the nail lists, the "/" means "over". So the EQUI / LEAS found on Illinois Central Gulf has "EQUI" over "LEAS".

Key

alm aluminum
brs brass
CL Chair-leg nail, stamped in sheet metal
cop copper
cp chisel point
dia diamond head
gm gripper marks

Used in addition to normal anchor markings. The proper term for a nail with gripper marks is "barbed," but nail collectors have called them gm for so long that I have decided not to change the terminology.

GM heavy gripper marks

Usually the only shank markings.

hb herringbone shank

These are really gripper marks on a square shank, so in turn "hb" really means "barbed."

Again the notation has been used for so long among nailers that I leave it intact.

hex hexagonal head
hs hand stamped

I.....indented figures
 irr.....irregular head
 mi.....malleable iron
 See type (11) in the photo section.
 os.....oval shank
 pnt.....pentagon head
 R.....raised figures
 rnd.....round head
 rs.....round shank
 sqr.....square head
 ss.....square shank
 stl.....steel
 tri.....triangular head
 ts.....twisted shank. The shank is square, and was turned.

Glossary

A glossary of treatment chemicals and treatment methods follows this general glossary.

Bottom of tie. The plane surface of the tie face down in the ballast.

Checks. "Small cracks in the wood, due to seasoning." [AREA '05, 767] Checking is usually most evident in the ends of the tie.

Cross tie. "That transverse member of a railway track which supports the rails and by means of which they are retained in position." [AREA '05, 766] In common usage this is the definition of "tie." A tie can be either a bridge tie, a switch tie, or a cross tie. Bridge ties are generally much thicker than cross-ties, and switch ties are the overlength ties used at switches for supporting more than two rails.

Cross ties varied greatly in size at the turn of the century. Standard tie sizes ranged from 6" × 7" × 8' up to 7" × 9" × 9' depending on the railroad. [AREA '05, 771-774] Even within a particular railroad the size of a tie depended much on the shape of the tree.

Despite this, the AREA set about to establish standards for tie sizes, and in 1905 came up with a scheme for classifying ties from sizes of 6" × 6" up to 7" × 10", with lengths 8, 8½, and 9 feet. [AREA '05, 765] This standard was revised later. See the Central RR of New Jersey listing for further discussion.

Cup-shaped head. A nail has a cup-shaped head if the head is shaped like a wide cone, and meets the shank at an angle slightly more than 90°. Nails were made this way to give more support for the head. Some copper nails and most type (17) nails were made this way.

Date nail. A definition of "date nail" is in order. I want to point out that my definition is neither proper nor fixed. It is offered here as a way to distinguish date nails from other items which are similar.

A date nail satisfies the following conditions:

- It has distinguishing marks which convey information about the item to which it is attached. Example: "27" indicates that the utility pole in which the nail was driven was treated in 1927. This excludes common unmarked nails whose position indicated the year (see Louisville & Nashville and Milwaukee Road among others).
- It comes in one piece, and is secured to its object by its form. This way I exclude tags nailed to ties, and markers glued to fenceposts (if such things exist). Also excluded are brands and notches in wood, and the plastic molds used to mark the date of concrete ties on the Burlington.

A refinement is made in the railroad lists. A *code nail* is any date nail which does not contain information about the date. A *date nail* (used in this refined sense) contains the date. The "F5" used by the Great Northern is a date nail, because the 5 refers to 1905. The "B" used by the CB&Q is a code nail, because it stands for red birch.

Date nails are called "dating nails" in the railroad literature. Because I wrote this book primarily for people interested in date nails as collectibles, I have kept the term "date nail," which has been in universal use in the railroadians crowd for at least three decades. Probably railroad and tie treating engineers would prefer to call them "dating nails."

The AREA still has an official definition of "dating nail": "A nail with a head having a raised or depressed number or symbol which is driven into a longitudinal surface of a pile, pole, tie, or timber to identify the year in which the material was treated or installed." (from the 1997 AREA Manual for Railway Engineering, p. 3-G-2)

End of tie. The small face at either end of the tie which results from a cross-cut of the stick. Date nails driven in the end of the tie were liable to fall out, since the nail is parallel to the grain and promotes checking. Date nails were driven in the end of the tie when it was convenient to do so because the ties were stacked in a yard. Nails were never driven in the end of the tie after the tie was laid in the track.

The end is the best place for hammer and machine stamps.

Hubbard nail. Found usually in poles, these nails have typically a 1 1/4" or a 1" diameter head with a raised rim. Their shanks are 1 3/4" long, with a diameter over .300". Different marks can be found on the underside of the head, like "HUBBARD COMPANY", "HH", "H4", etc. Here are some samples from poles (shown smaller than actual size):



Out of face. See Test section.

Retort. Also called a treating cylinder. See Treating plant.

Shadow set. A set of date nails, found in second hand ties, which were clearly used by the same railroad. Further, the railroad which originally used the nails is unknown. Often when a branch of a railroad was abandoned, the usable ties were sold to other railroads, usually short lines. These ties have the nails of the original owners.

Side of tie. Either of the two vertical, parallel faces extending the length of the tie.

Test section. A specially designated section of track, ranging usually from 100 ties up to six miles, on which a careful record of the life of ties is kept. Test sections come in two types:

- (a) Out of face. In these tests new ties are inserted in the entire section at once, and a record of their progress is kept.
- (b) Renewal. In these tests ties are monitored in the course of ordinary renewals. When a tie is replaced, the new tie becomes part of the test.

Almost all out-of-face test sections were established the year the ties were laid, but there are exceptions. On some railroads a stretch of track is found on which the ties were all laid years before, and had subsequently been forgotten. This happened with a stretch of track on the UP in the Wyoming territory. The ties were laid in 1868, and the test section was established in 1882

to keep track of those 1868 ties. Of course ties in renewal tests can date before and after the establishment of the test.

Tie. See Cross-tie.

Tie plate. "Something interposed between the rail and the tie to prevent wear of the tie." [AREA '04, 66] Tie plates are almost universally made of steel. Exceptions are mentioned here:

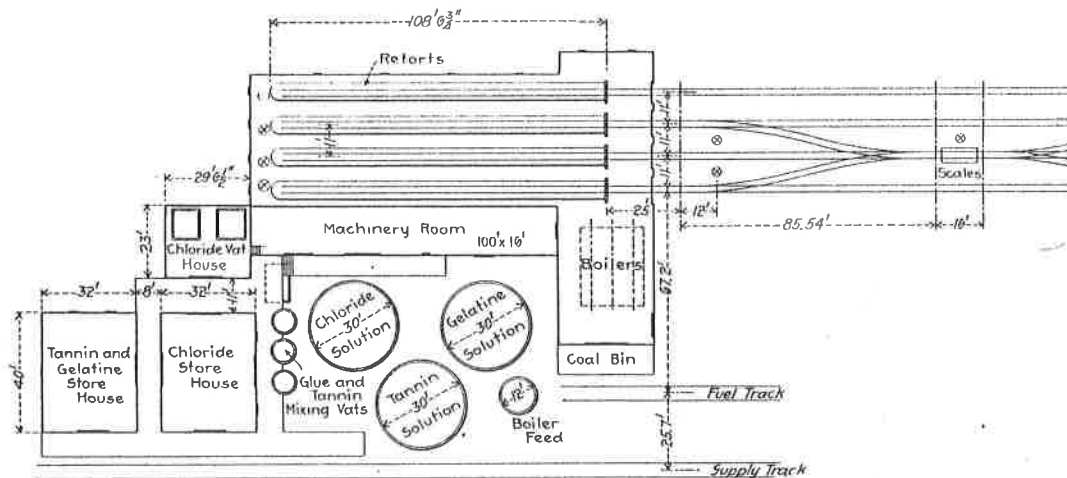
In France "tarred tie-plates, of animal felt, have heretofore been in use, but are now replaced by creosoted poplar tie-plates, which cost less than 1 cent each, and are said to be giving perfect satisfaction." [ASCE 6-01, 505].

In February, 1904 the Santa Fe began using wooden tie plates. By 1905 thousands were being tested from Illinois to Texas. They were made from cypress, gum, and elm, and were from 1/4" to 3/8" thick. [RG 1-20-05, 54].

Top of tie. The upper plane surface of the tie. The part on which the tie plates rest, and on which you walk.

Treating plant. A facility for treating wood. One or more retorts, or treating cylinders, are placed horizontally alongside each other. These steel tanks are typically from 70 to 160 feet long, are six to seven feet in diameter, and are covered from the weather by a building. For each retort a narrow gauge yard track leads right up to the round door at one end, and the track continues inside the cylinder. On this track small tram cars loaded with ties are sent in for treatment.

Next to the retort building are storage tanks for treatment chemicals. Via pipes and pumps the chemicals fill the retorts, pressure is applied, and chemicals are drained. Usually the treating plant is accompanied by large storage yards for keeping treated and untreated ties. A plan of the Great Northern's 1901 Somers, MT plant is shown here. It was a four retort plant designed to treat ties by the Wellhouse process.



Great Northern tie treating plant, built 1901. [RG 5-30-02, 396]

A railroad in the early twentieth century had three options if it wanted to use treated ties. It could

- (a) Build its own plant and treat its own ties.
- (b) Hire a treating company to build and operate a plant exclusively for the railroad. These are called "leased" plants, and they were often built on railroad property.
- (c) Buy treated ties from commercial companies. This was the most viable option for small railroads.

Usually a railroad would choose just one of these options. For those who chose (a) or (b), it was common for some slack to be taken up by acquiring some ties from commercial plants.

The first tie treating plant in North America was the Santa Fe's Las Vegas works, built in 1885. It was a railroad owned and operated plant. The next year the Rock Island began using ties treated at a leased plant owned and run by Octave Chanute and Joseph P. Card. Both options (a) and (b) remained common throughout the period discussed in this book.

The first commercial tie treating plant was perhaps the International Creosoting & Construction Co.'s Beaumont, TX plant, which was built in 1897. Commercial plants were rare at first, but became increasingly more common after the First World War.

Treatment chemicals

Carbolineum. Like creosote, this is a byproduct of the distillation of coal tar. It was first patented by Avenarius in 1888 in Germany. [GRB, 70] Carbolineum was tested in the U.S. in the period 1896 to 1914. Avenarius Carbolineum is also called Woodiline.

Coal tar. Mixed with creosote, coal tar was first used about 1908, and came into common use in the early 1920's.

Copper sulfate ($CuSO_4$). Also called blue vitriol. It was first used by Margary in England in 1837, but is most commonly associated with the Boucherie process. Copper sulfate was never used much in the U.S. [Weiss, 71]

Creosote. Also called creosote oil, or dead oil of coal tar. Creosote is a byproduct of the distillation of coal tar.

John Bethell patented the use of creosote oil under pressure in 1838. [Bethell, 1] By 1853 it was recognized in Europe as the best wood preservative, but its introduction for treating railroad ties in the U.S. was delayed because of its expense, its lack of availability, and the low price of timber. Creosote was first used in the U.S. for treating bridge piles in coastal waters in the 1860's. It has been used continuously since then for protecting wood against mollusks and other sea borers.

A zinc chloride-creosote mixture was first used in Germany in 1874, and in the U.S. in 1904 on the Big Four Route. See Rütgers, Allardyce, and Card processes. Straight creosote was first used on a large scale for ties in the U.S. by the Big Four Route in 1905. See the Bethell, Lowry, and Rueping processes.

Creosote-coal tar mixtures and creosote-petroleum mixtures came into common use in the early 1920's.

Mercuric Chloride ($HgCl_2$). Also known as bichloride of mercury or corrosive sublimate. $HgCl_2$ is the chemical used in Kyanizing. It has the strongest antiseptic properties among the metallic salts ($ZnCl_2$ being another), but it corrodes metal, making pressure treatment nearly impossible. Treatment with mercuric chloride was usually done in open vats made from wood or concrete.

Penta. Short for Pentachlorophenol. Penta is a pesticide, and has been tested by several railroads since the later 1940's. It is highly toxic.

Petroleum. Petroleum is used mixed with creosote. The first use of a creosote-petroleum mixture was in 1909, and it became common in the early 1920's. [H&G, 115]

Water gas tar. This tar is formed when steam is passed through live coke. Water gas tar creosote is a derivative of water gas tar. Use of WGT occurred mainly in the teens in the U.S. [GRB, 79][H&G, 108, 113]

Zinc Chloride ($ZnCl_2$). Use of zinc chloride for treating wood was first patented in 1838 by Sir William Burnett. His was an open-tank method, and in 1847 the chemical was employed by Burnett in a pressure cylinder. Apart from the open tank zinc chloride treatment used at the Lowell, MA plant (not for ties) beginning 1850, zinc chloride was always used under pressure in the U.S.

$ZnCl_2$ was the chief chemical used in tie preservation in the U.S. from 1885 to the period 1905-1910, when it was superseded by creosote. After a short revival in the late teens and early twenties due to the wartime shortage of creosote, zinc chloride began a long decline. It was little used after the 1930's.

See the Burnett and Wellhouse processes. Zinc chloride was also used combined with creosote in the Rütgers, Allardyce, and Card methods.

Zinc meta arsenite ($Zn(AsO_2)_2$). Patented in 1928 and 1934 by L. P. Curtin. [GRB, 161] ZMA was tested and used on ties between 1928 and the mid-1930's. It was more commonly used for posts and poles, however. [H&G, 132]

Treatment processes

Allardyce. Developed by R. L. Allardyce at the International Creosoting & Construction Co. It involves the injection of a 2 percent solution of $ZnCl_2$, followed by an injection of tar oil. This two-movement process was too costly because the ties had to be seasoned between the zinc chloride and the oil treatments. [ASCE 6-01, 511][H&G, 209] Allardyce's method was tested in the U.S. in the period 1902-1911.

Bethell. Patented July 11, 1838 by John Bethell in England. This is the standard pressure treatment of wood, originally using bituminous liquors containing creosote. It can be used with just about any preservative. Because Bethell's method makes creosoting practical, his process is generally associated with that substance. [Bethell]

Ties (or other timbers) are sent into a treating cylinder, a vacuum is produced to remove excess air from the wood, then the cylinder is filled with creosote. Pressure is applied, forcing the creosote into the wood. After the pressure is released, the creosote is drained, and the retort is subject to a final vacuum to withdraw some of the creosote. The last step just speeds up the natural expulsion of some creosote due to the expansion of the wood after the release of pressure.

The Burnett, Rütgers, Card, and some other processes are identical to it, except that they use different chemicals.

Boucherie. The introduction of a preservative by the natural absorbing power of living or recently felled trees. Copper sulfate was the chemical most commonly used. A bag of preservative is attached to the cut top of the tree, and the preservative replaces the sap by the evaporation of moisture from the leaves. The bark, branches and leaves of the tree were not removed until the treatment was completed. [H&G, 216]

This process was used extensively in France, and I include it here because it is interesting.

Burnett. Treatment with zinc chloride, developed by William Burnett in England in 1838. In its earliest uses, the timber was soaked in an open vat for 10 to 21 days. Since 1847 the Burnett process refers to treatment under pressure with zinc chloride. The process is identical to Bethell's. Only the chemical is different.

Card. Patented in 1906, this is Joseph B. Card's modification of Rütger's zinc-creosote process. An 80-20 zinc chloride-creosote solution is injected basically using Bethell's process. The Card method was fairly common in the U.S. from 1908 into the 1920's among railroads which did not believe empty cell methods work. It was last used in 1934. [H&G, 210]

In some sense the Card process replaced the Wellhouse process. Ties treated by Card's method were as water-tight as Wellhouse treated ties, and the creosote gave added protection against decay.

Empty cell. A pressure-treatment, almost always with creosote, in which excess preservative is expelled after pressure is released by air trapped in the wood. The two empty cell methods are the Lowry and Rueping processes. They are termed "empty cell" because the cell spaces are left empty (or partially empty) while the cell walls remain coated with creosote.

Full cell. Pressure treatment in which excess preservative is not expelled. Same as the Bethell process. The term "full cell" was created to distinguish the Bethell process from empty cell processes.

Hasselmann. "This consists in boiling the wood in a solution of the sulphates of copper and iron, with alumina and 'Kainit.' It possesses the merit of being cheap..." [ASCE 6-01, 511]

The Hasselmann process was introduced in the U.S. about 1901 at Perth Amboy, NJ. [ASCE 6-01, 511] Some Hasselmann treated ties were installed in the 1902 Bureau of Forestry test on the Santa Fe near Pelican, TX. At least 1902 and 1903 the CB&Q set aside a month for treating ties by this method. The method proved a failure.

Kyanizing. Treatment in which the timbers soak in an open vat of a solution of mercuric chloride. This method was developed by Kyan in England in 1832, and was the first method to be commonly employed in U.S. test tracks (1838-1856). It was not used after that, except for the Eastern RR's 800,000 Kyanized ties treated 1881-1891/2.

Lowry. An empty cell method developed in 1902-03 by Cuthbert B. Lowry. He was granted his patent in 1906, though the process was introduced commercially in the Spring of 1905 for the Big Four Route. Like the Rueping process, this is a modification of Bethell's method. Instead of an initial vacuum, creosote is admitted to the treating cylinder at atmospheric pressure. It is the air in the ties at this stage which will help expell excess creosote once the pressure is released. Because less air is trapped in the ties than is the case with Rueping's method, Lowry specified the need for a *quick, high* final vacuum to extract enough creosote. [H&G, 215]

Open tank. Timber is soaked with no pressure in an open vat of preservative solution. Penetration is thin, but no special equipment is needed. This was the process used for mercuric chloride. See Kyanizing.

Rueping. This empty cell method was patented in 1902 in Germany and in the U.S. by Max Rueping. Rueping's process, like Lowry's, is a modification of the Bethell process. Once the ties are in the retort, 80 to 100 lb. per square inch of air pressure is introduced. Creosote is then forced in at still higher pressure: about 150 lb. per square inch. After the pressure is released, the trapped air helps expell excess creosote. [Wallis-Taylor, 198-199]

Because the creosote is admitted to a retort under pressure, an extra "Rueping tank" is required to hold the creosote at the same pressure beforehand. The Rueping process was first tested in the U.S. by the Santa Fe in 1904, and was first used regularly by the Santa Fe and the El Paso & Southwestern in 1906.

Rütgers. A method of treating wood with a mixture of zinc chloride and creosote. It was developed by Julius Rütgers in Germany in 1874 and was widely used there. The Rütgers process was used on Big Four Route ties beginning 1904, but by 1908 it had been superceded in this country by the Card method.

Wellhouse. Also known as zinc-tannin, this process was patented in 1897 by William Wellhouse and Erwin Hagen. Because zinc chloride is water soluble, it washes out of ties over time in wet locations. The Wellhouse process was developed to solve this problem. It is a combination treatment in two movements. First ties are treated in a solution of zinc chloride and gelatin (or glue). Then the ties are treated in a tannin solution. The idea is that the gelatin and the tannin react to form an artificial leather which clogs the pores of the wood, making the tie waterproof.

The Wellhouse process was first applied commercially by Joseph P. Card in St. Louis in 1879. Along with the Burnett process, it was the major method employed in this country from 1885 to about 1903, when it fell out of favor. One can think of the Card process as its replacement.

Octave Chanute improved the Wellhouse process in 1896. His modification was to change it to a three-movement process. Ties were first treated in zinc chloride, then in gelatin, and finally in tannin. Chanute's method was used at his Chicago Tie Preserving Co. plants, which treated ties for the Rock Island, and later (1899) for the Chicago & Eastern Illinois. The Great Northern (1902-03) and the Mexican Central (as of 1906) also used it. [H&G, 211]

Zinc creosote. Any process using zinc chloride and creosote, either injected separately or in a mixture. See Allardyce, Card, and Rütgers.

Zinc tannin. See Wellhouse process.

Shank markings

See the introduction to the photo section for an explanation of shanks. These are critical, along with number style, in identifying nails.

How date nails were made

Date nails were manufactured by steel companies, such as Jones & Laughlin Steel Co. and Colorado Fuel & Iron Co. For the most part they were wire nails, which means they were manufactured by the following process:

The basic method of marking common nails is to feed a wire of the proper gauge into a clamp with a portion of the wire above the clamp. The exposed wire above the clamp is struck a sharp blow to flatten it to form the head. To make a date nail the exposed wire is simply hit with a hammer containing a die having the reverse of the marking desired on the finished nail. The wire is almost simultaneously cut to the proper length to form the point. Nails are made on high speed automatic machinery at speeds of up to 800 per minute. [DNC, 41]

The American exceptions to this are the cast nails made by the American Casting & Manufacturing Co. (see type (11)), and the cut nails made by various companies.

Some companies made blank wire nails, then stamped the figures into the head at a later date. This is the case with some of the newer aluminum nails used in poles and fenceposts.

How nails were used

Date nails were used by railroads, utility companies, treating companies, and others for use in ties, poles, bridge timbers, fenceposts, and perhaps mine and dock timbers. Besides using them in ties, railroads often placed date nails in bridge timbers, poles, and other types of timber. In this book I include the nails used by railroads only, in any type of timber, though I try to picture all nails.

When a company decided to use date nails, they ordered them from a steel company, specifying the figures to be stamped into the head, the shank and head shape, shank dimensions, metal, and whether the figures were to be raised or indented.

No date nail has the railroad name, initials, or monogram. Several nails used by treating companies have the firm's monogram or name. These were almost universally used in utility poles.

Which railroad used which nail?

There are two questions I try to answer for the nail collector. The first is "Which railroad used which nail?" The second is "Exactly how were the nails used, and what did they signify?" The method of answering the second question is straightforward: we look through old railroad engineering journals and railroad papers to find the answers. It is the first question which is difficult, because many nails are attributed by collectors to the wrong railroad for a great variety of reasons.

Before I list all the causes of mistaken attribution, I must first define what it means for a railroad to have used a particular nail. At first this seems an easy question to answer: a nail was used by a railroad if it was ordered by the railroad and was driven into one of its ties (or poles, etc.). This definition conveniently excludes nails from second hand ties, nails from keg mix-ups and borrowed nails from other railroads.

But there is still a problem. For example, in 1981 I pulled a rnd I (07) 18:b from a Buffalo, Rochester & Pittsburgh tie. All of the hundreds of other 18's I have seen on that railroad are 18:a. The 18:b seems to be the result of a keg mix-up. But if we could ask a BR&P man if that was the nail intended for his railroad, he would certainly respond "yes," because it matches their specifications of being round, 2 1/2" long, etc. I have not included it in the BR&P list. But what if, instead of one nail, a dozen 18:b's were found? Do we still call this a keg mix-up? What about hundreds?

In addition to the common rnd I 18, many people have found rnd R 18's on the BR&P. I have probably pulled a dozen in various spots on the line. Are these the result of keg mix-ups, or did the BR&P order raised as well as indented nails? I do not know. Because so many have been found, I list it as a BR&P nail.

To insure against including the wrong nails into a railroad's listing, I usually follow this rule: a nail is suspect if it is found on only one branch in one location in small numbers, and it was manufactured by the same company in the same year as other common nails on the line. Therefore the six Erie (07) 10:a's I found mixed with the more common (07) 10:d's are probationary.

Problems of misattribution arise at two distinct stages. First, the person who pulls a particular nail may be confused about its origin. Here are the scenarios:

- 1) Because of poor maps, the nail collector may believe he is on a different railroad. Where several railroads are crammed into a river valley or in some industrial area, it is difficult to keep lines straight, especially where they have interchanges or share yards.
- 2) Because of mergers, the collector might mistakenly think his nails were driven by a predecessor or successor railroad. I once received a report of 1920's nails from the Rome, Watertown & Ogdensburg. This railroad became part of the NYC in 1891, and sure enough all the nails in the list are common on the NYC.
- 3) The nails he pulls may come from second hand ties. Many railroads, especially financially-strapped short lines, often bought ties second hand from other railroads, or from some tie distributor. The result is that nails used by one railroad can turn up in ties on another railroad. Steve Worboys and I found Nashville, Chattanooga & St. Louis RR nails in ties on the Arcade & Attica in New York, and Southern Pacific nails have been found on the Rutland in Vermont. Finds like these are fairly common, though usually the railroad which originally used

the nails is not so far away. I have listed all nails known to have come from second hand ties in this guide partially to warn the nailer of this possibility.

4) The nails may be the result of a keg mix-up at the nail factory. It is not uncommon in a keg of nails to find one of the wrong dimensions. A six penny nail might wind up in a keg of eight penny nails by mistake. This type of error happened with date nails, also, and is usually not hard to detect: the odd nail will be made by the same company as other nails on the line, and only one or very few will be found. Again the BR&P is my example. In a stretch of track in which every tie had a 2 1/2" rnd I (07) 22, I found one tie with a 2" rnd R (07) 22. No one else has found the short 22 on the BR&P, which was probably intended for the Union Pacific.

This kind of error is difficult to detect if *all* nails from that year are rare on the railroad. John Iacovino found a rnd I (07) Z10 in a New Haven tie. The railroad definitely used a standard rnd I (07) 10, which is scarce enough. It is likely that even if they did use the Z10, only one would have turned up. But the Z10 is known also to be a Milwaukee Road nail. How likely is it that such a specialty nail ordered by the Milwaukee Road was also used in small numbers on the New Haven? I think John's nail is from a factory mix-up, and John thinks the railroad ordered it. Both conjectures are reasonable.

I do not list factory mix-ups in the nail lists.

5) Due to a manufacturing mistake, the nails may have been made too short or too long. The few 2" Great Northern nails from the period 1902-1906 which have turned up were probably intended to be 2 1/2". I do not list the short nails. Most rnd R (07) 14's, intended to be 2 1/2", were actually made closer to 2" or 2 1/4". I list them as 2 1/2".

6) Nails are often found far from the railroad, often in ties reused as fenceposts or lining parking lots. It is often very hard to determine who used the nail. If you pull such a nail from a tie, check the ends of the tie for stamps.

Second, many nailers buy or trade for misattributed nails, or the nails in their collections become hopelessly mixed up. Dealers at antique shops and railroadiana shows usually know very little about their date nails, and though most are honest about their uncertainty, some will give you definite answers as to what railroad used their nails when they really have no such knowledge. *Make sure you write down where you got your nails!* You will then be able to make some kind of judgement about their authenticity once you have learned more about the hobby, or once you have contacted more experienced collectors.

Many collectors deliberately place a nail from one railroad into another railroad's set. One collector, lacking a nice New York Central sqr I 11, placed a Lehigh Valley 11 in his NYC set. The same nail? According to my lists, yes. But if you examine NYC and LV 11's closely, you will notice that the NYC nails have a slightly thinner shank, and that the shank markings are different. (Such differences are too minor to warrant separate designations for the nails.) Even I once switched nails myself, substituting a bad RF&P 57 with a nice example pulled elsewhere. I have since cleaned up my sets by removing the impostors. Probably many novice collectors who substitute nails do not even pay attention to the WESIS type or number style, and make far worse mistakes. The problem is that more often than not the replacement nail is not identical to the original, and as collections are traded and sold, the misinformation seeps into nail books like the one you are reading.

Another argument against mixing nails from different railroads has to do with why we accumulate sets. If I have a set labeled "Union Pacific," I claim that the nails displayed were used by the Union Pacific, not some other railroad. To have even an identical replacement nail is like having an identical 1936 Ford in the Bonnie & Clyde Museum. It is not the same thing. Lantern collectors know this. I talked with a Maine Central railroadiana collector who steers clear of lanterns marked "MCRR" because they might have been used on the Michigan Central. What

is the problem? The Maine Central and Michigan Central lanterns are identical. This collector wants relics which were definitely used on the Maine Central. He does not want potential substitutes.

How accurate are the railroad listings?

I have listed nails under each railroad which have been found on the railroad. Not included are nails known to have been used but have not yet been found. There are many, many of these, from the BR&P "T" to the CB&Q 99 to the special nails used in the 1902 Pelican, TX test track on the Santa Fe. The question above should really read "How much do the railroad listings reflect the nails which have been found?"

Some railroad lists are more reliable than others. Generally, lists for eastern railroads, like the Lehigh Valley, Buffalo, Rochester & Pittsburgh, and Norfolk & Western are more accurate than lists for western railroads, like Cotton Belt, Southern Pacific, and Union Pacific. This is due partly to the fact that eastern nail collectors generally keep better records and trade less than their western counterparts. But in general, the character of each railroad set, east or west, is clear. Where there are mistakes, they are in detail only. I will be missing some nails on a railroad because no one has written to me about them, or a couple nails might be misidentified because the person who pulled them is not a shank expert. Also, there are problematic nails, maybe one or two found, which might be from second hand ties from another railroad. I have tried to spell out all these uncertainties in the text following the lists.

One way I monitor the accuracy of the lists is by seeing how much I am changing them. I continually receive mail from nailers, and I am continually going back over my lists. I can safely say that the sets for every major railroad are fairly stable, except where noted.

Complete sets

Many collectors want to put together a complete set of date nails for a particular railroad. That is nearly impossible for two reasons. First, I believe that for every major railroad there are many nails which have never been found. For example, the Chicago & Eastern Illinois used nails every year from 1899 to 1910, yet the 99, 01, 02, 06, and 07 have never turned up, and probably never will. Second, on most major lines there are unique nails, and many problematic nails which we are not quite sure the line used. Interestingly, after over 500 nail outings mostly in New York state, my only "complete set" is from the Western Maryland.

Money

All this leads us to a problem which is common in just about any group of people who collect: fraud. In reading over an American Indian artifacts magazine I was stunned by the explicit references to fraud. Dealers fabricate their own fake artifacts to be sold to novice collectors, archaeological sites are looted illegally, and artefacts from one tribe are attributed to another, all for profit.

These kinds of activities are also known in our hobby, but on a smaller scale. Fake date nails were being made in the early 1970's, usually by altering a real date nail. Continuing to the present I hear stories of nails from one railroad or utility company being traded or sold as if they were used by another railroad. One person tried to trade a square 61 as a rare Rock Island 19 by merely turning the nail upside down!

All this said, probably 99% of all nails traded or sold are legitimate. No one, for instance, will misrepresent nails they are selling for a quarter apiece, and that is all most nails are worth. *Do not pay lots of money for a nail until you either (a) have experienced collectors verify it, or (b) you yourself become expert enough to know what you are doing.* Not only will you be sure you are getting the real thing, but you will also know you are not paying too much.

And just how much money can a nail fetch? Recently \$600.00 was paid for a Santa Fe square raised 52. That is an exceptional case, and most top-dollar nails sell in the \$100.00 to

\$200.00 range.

Now some tips on price:

- Just because a nail is rare, it does not mean that it is worth a lot. Steve Worboys has a unique code 7 from the Short Line code set. It is an interesting nail, but I doubt anyone would pay \$10.00 for it. There aren't enough people interested in that set for the nail to be worth much.
- Condition counts for a lot, but not as much as it does for items like U.S. coins. A rusted or damaged nail will be worth between 5% and 20% of the value of the same nail in nice shape. But a pristine, unused example will not command a price many times more than a reasonable problem-free nail.
- If you have a copy of *Date Nails Complete* (see Sources below), you will notice that prices are attached to each nail. These prices are on the whole too high, even though the book was published over two decades ago. I have refrained from pricing the nails in this book because the market is too small to really give a good idea of the value of most nails, and because I do not deal in nails myself. I personally do not know how much most nails are worth.

Pulling nails

If you walk down a railroad track and pull date nails out of ties you are committing two crimes: trespassing and theft. Ask for permission before you pull nails. I have done it many times, and I have rarely been refused. Sometimes a landowner will have some nails stashed away which he will give you!

New Directions

When I originally made hundreds of photocopies of articles from old railroad engineering journals in February, 1995, I was not a good judge of what was important. Now that I have pieced it all together, I can see that I need to make much better use of the *Proceedings* of the AWPA and the AREA, as well as other journals. Also, there are a few books I have not yet seen.

There is still a big untapped resource of information on tie treating and marking, and it is scattered in thousands of railroadiana collections: original railroad documents. If any of you have standard plans, instructions, or any other document relating to ties, from treating to laying, I would like photocopies. In return you will be acknowledged for your contribution.

Also, I have done little to improve on Wiswell's and Evan's classification of nails. I now have some photocopies of shank drawings from the 1920's or 1930's, and some information on the steel companies, but this is still a wide open field. For the next edition of this book I will concentrate on organizing the nails themselves. This includes getting more and better photographs.

And of course I will continue to make corrections to the lists themselves.

If you have any additions, corrections, or just comments, write to me at:

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Sources

Most statements are referenced by source and page number. When you see [DNC, 211], you should read "*Date Nails Complete*, page 211." [J-A '78, 2] means "The July-August 1978 issue of *Nailer News*, page 2". My notation, with square brackets, is not standard. I adopted it for my own use long ago, and if there is enough interest in the book, I will change it.

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The website: <http://facstaff.uindy.edu/~oaks/DateNailInfo.htm>

Here you will find a vast, illustrated introduction to date nails, including all back issues of my free e-mail date nail newsletter *Nail Notes*. Contact me via e-mail at oaks@uindy.edu if you would like to subscribe, or if you have questions or comments on date nails or tie preservation. Also on the site I maintain errata for the book, so you can read up-to-date corrections.

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History of Railroad Tie Preservation

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0. Introduction

The 153,703,000 crossties purchased by U.S. railroads in 1907 amounted to 7.5% of this country's output of forest products for the year. Of all these ties, barely 1 in 8 was chemically treated to resist decay. The remaining ties were expected to be removed and discarded within a decade. This was an enormous waste, considering that our forests were being cut at a rate three times faster than they were growing, and that America's once vast woodlands had been reduced to a scattering of forests in only a few regions.¹

This problem had come to the attention of the railroads in 1880, and for a half century railroad officials often declared it to be an impending, if not an immediate emergency. In this history we will follow the railroads' responses to this crisis by tracing the development of tie preservation in North America, with special emphasis on record keeping.

1. Early wood preserving

Wood rots. When placed in the ground it can be eaten away by various mold-producing fungi, or it can be the victim of ants, termites, and beetles. Woodpeckers weaken wooden structures in the air while shipworms such as the dreaded *Teredo navalis*² devour piles in coastal waters.

Seen another way, such persistent and blatant destruction is really necessary for the continuation of life. Just imagine a forest after 20,000 years if dead wood did not rot! It is a good thing that the decaying log is converted to fertile soil for new plants. Only we humans³ have a reason to prevent the natural breakdown of wood. When we pressure treat lumber we are repeating a process much like the ancient Egyptians did with their royal dead. Our motives may not be so other-worldly, but it remains a fact that we embalm pieces of dead trees to somehow preserve their strength and resilience, to delay their re-entry into the cycle of life and decay.

Wood preserving had a long history before railroads began to take an interest in increasing the longevity ties and other wooden structures. In antiquity it was known that charring wood before placing it in contact with the ground delayed its decay, and wood was often given a coat of oil to prolong its life.⁴ Also, salt became a common preservative after it was noted that the wood used in salt-carrying ships and in salt mines lasted longer than wood used for other purposes.⁵

¹ [AREA '10, 749] ['11, 215, 221]

² These and other marine borers are so removed from our daily lives that they carry only their Latin names, like *Xylotrya*, *Sphaeroma*, and *Limnoria*.

³ and perhaps beavers

⁴ [Boulton, 13]

⁵ [ASCE 6-01, 532]

The earliest known scientific process was developed by the German chemist Johann Glauber in 1657. His method involves carbonizing the wood by fire, coating it with tar, and then dipping it in pyroligneous acid. Other methods came after Glauber's, but progress in wood preserving was sporadic until the end of the eighteenth century. At that time chemists began more intensive investigations: between 1798 and 1831 over a dozen treatment methods were developed, most of them in England. These methods generally employed various salts, oils, and tar, and none of them came into long term general use.⁶

Beginning 1832 progress was more rapid. By the end of the decade over twenty new methods were developed. This research was driven largely by the shipping industry, but it was also beneficial for docks, buildings, fences, and other wooden structures. Three of these new methods became common for tie treating in the U.S., and these are described now.

- Kyan's method. In 1832 John Howard Kyan, continuing the work of MacBride and Borde-nave, patented the use of mercuric chloride (HgCl_2 , also called corrosive sublimate) to treat wood. His process involves simply immersing the lumber in an open vat of solution until enough sublimate is absorbed.⁷

- Bethell's method. John Bethell patented his use of pressure for treatment in 1838. The patent is titled "Rendering Wood, Cork, and Other Articles more Durable, &c."⁸ Although he claimed his process will work with just about any chemical, his method is best known for making creosoting practical. Because of this, the "Bethell" process usually refers to the pressure treatment of wood with creosote.

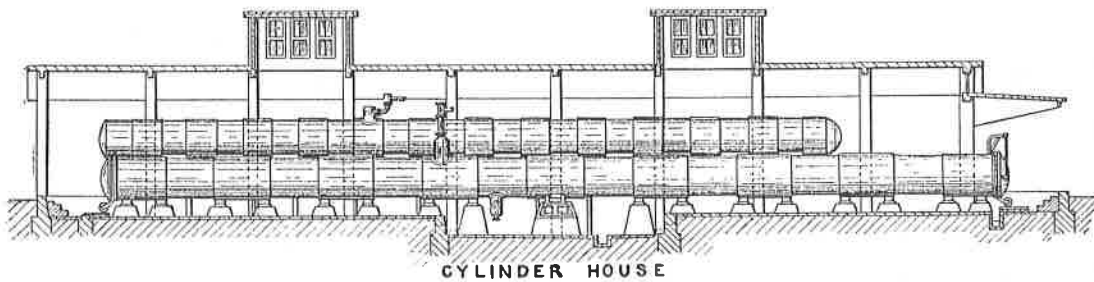
Together with some modifications, Bethell's is to this day the principal method of preserving ties and other timbers. In order to describe how it works, I will go over some tie treating plant vocabulary now. A *retort*, or *treating cylinder*, is a long steel cylinder, usually at least six feet in diameter and anywhere from 70 to 160 feet long. There is a narrow gauge track which runs inside the cylinder for its entire length. This track is connected to yard tracks through a door at one end of the retort. Ties are loaded on *retort cars*, secured, and are run into the retort. For a 100 foot treating cylinder, about ten carloads of ties can be treated at once. The steps in Bethell's process are:

⁶ [13, 180-183]

⁷ [14, 239]

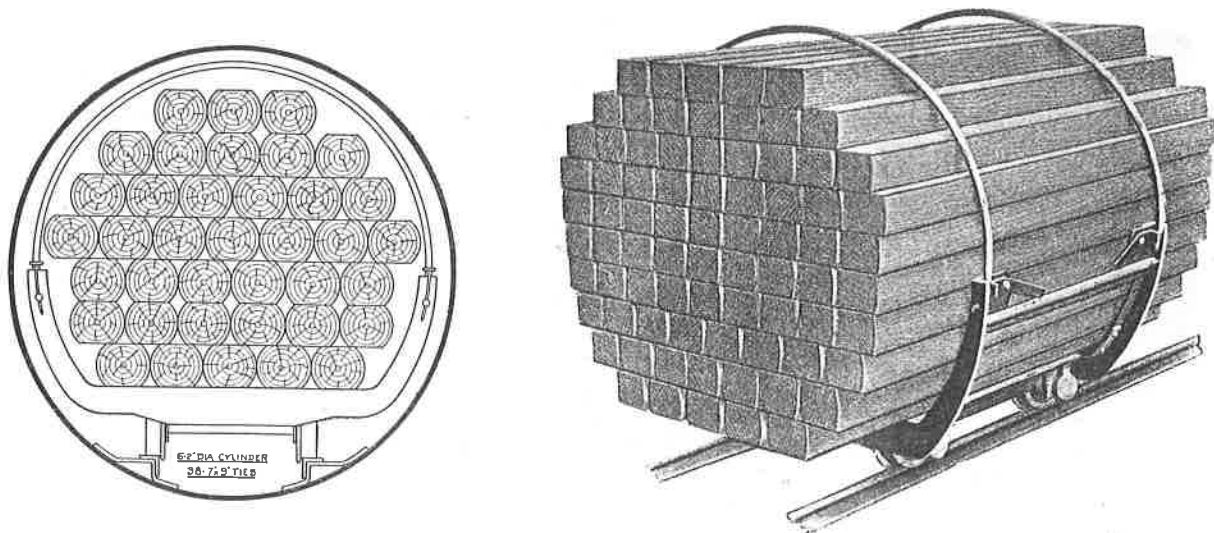
⁸ [Bethell]

- (1) The ties are sent into the treating cylinder on retort cars,
- (2) the cylinder is closed and a vacuum is introduced to draw some of the air from the ties,
- (3) the cylinder is filled with creosote (or another preservative), and pressure is applied to the retort,
- (4) the pressure is released, the preservative drained,
- (5) the cylinder is subjected to a final vacuum,
- (6) the door is open and the cars are removed.



Side view of a retort. In this drawing there is an extra "Rueping" tank (to be described later) above the retort. [Wallis-Tayler, 143]

Without the final vacuum the ties would continue to drip creosote for hours. The vacuum speeds up the natural expulsion of excess preservative due to expansion. The total time for one treating cycle was typically about eight hours.⁹ Some retorts had doors at both ends for ease in switching, and some newer retorts, such as the 1924 National City facility of the Atchison, Topeka & Santa Fe (hereafter Santa Fe), were large enough to accomodate standard gauge track.¹⁰



Retort cars filled with ties. [Wallis-Tayler, 139, 146]

⁹ [H&G, 207]

¹⁰ [RA 8-30-24, 360]

• Burnett's method. Sir William Burnett in 1838 perfected a method of treatment with zinc chloride (ZnCl_2). Originally he soaked the wood in an open vat, but in 1847 he adopted Bethell's pressure treatment for the chemical.¹¹ Since then the "Burnett" treatment has referred to pressure treatment of wood in a zinc chloride solution.

2. The invention of ties

Concidentally, just as sound wood preserving methods were being developed, ties were invented. The first railroads spiked each rail to a sequence of square stone blocks. In late 1832 a shipment of these blocks to the Camden and Amboy RR in New Jersey was late. As a temporary fix, Robert Stevens, president and chief engineer, had logs spiked perpendicularly under the rails. This quick solution was immediately recognized as superior to the use of stone, and soon other railroads constructed or rebuilt their tracks using wooden crossties.¹²

3. Tie treating abroad

With treatment methods being patented mainly in England and other European countries, it is no surprise to find railroads there experimenting early. In England the use of mercuric chloride on ties was implemented about 1838, and quickly gained wide acceptance. Sulphate of copper (Margary's method of 1837), zinc chloride, and creosote also came into general use, and the four chemicals were "in active competition"¹³ until 1853, when Henry Potter Burt read his "Paper upon Timber Preserving"¹⁴ to the Institute of Civil Engineers. Burt's paper, and the discussions which followed, revealed that creosote is the superior wood preservative. Eventually, perhaps by about 1865, Bethell creosoting had replaced all other methods in England, despite the fact that creosote is also the most expensive preservative.¹⁵

French railroads did not embrace creosote quite so early. This is partly because it was more expensive there, and also because the French favored the method of their countryman, Boucherie, who had developed a novel way of treating freshly cut timber with copper sulphate.¹⁶ Zinc chloride was also used in France to some extent. Creosoted ties, imported from England, were first used on France's Western Ry in 1859. Creosote was adopted for general use on that line in 1864,¹⁷ and

¹¹ [H&G, 10]

¹² [Watkins, 670]

¹³ [Boulton, 19]

¹⁴ [Boulton, 12]

¹⁵ [Boulton, 20-21]

¹⁶ In this process the solution "is forced into the wood by gravity. The timber to be treated is set on end covered with a water-tight cap, and the solution, consisting of 1 part of sulphate of copper to 100 parts of water, is delivered into this cap from a tank placed at a considerable height by means of a flexible pipe. The sap of the wood is forced out at the lower end, its place being taken by the solution." [Wallis-Tayler, 15]

¹⁷ [Boulton, 95]

by the end of the decade the majority of French railroads were using the Bethell process.¹⁸ Some railroads were still using other methods late in the century, but by 1900 creosote was used by all lines save one, the State Ry, which was treating ties with a mixture of zinc chloride and creosote.¹⁹

The use of creosoted ties in India began with the construction of their first railroads in 1851. The British found it cheaper to import creosoted Baltic timber into the country than to use the indigenous woods.²⁰

Originally German lines treated ties with either mercuric chloride, copper sulphate, zinc chloride, or creosote, "but gradually there was an evolution which curiously recalls that of the Pullman Car Company in the United States. Mr. Julius Rütgers' father, who had learned the business in some French tie-treating works, erected a plant or two, took his son in with him, and did so much better work than the railroads did for themselves that the business gradually came into his son's hands. At the present time Mr. Rütgers controls some twenty plants, while the Prussian State Railroad has four, and there are five more in other hands."²¹

The preceding quote dates from 1900. Rütgers' method, introduced in 1874,²² involves treating ties with a combination of zinc chloride and creosote. At the turn of the 20th century just over two thirds of all ties used in Germany were treated by the Rütgers method. The remainder were treated with straight creosote by the Bethell process.²³

Other European countries which began creosoting ties before 1900 include Belgium, Holland, Denmark, Switzerland, Spain, and Portugal. As of 1900 Russia and Roumania were switching to creosote. Chanute wrote in 1900 "...ample experience for 60 years has now been gained abroad, and the economy and expediency of tie treating is so well established that a railroad manager abandoning it there would occupy about the same position as a railroad man in America who went back to iron rails."²³

My information on record keeping in Europe is sketchy, and is restricted to date nails. It is difficult to say whether these marked nails were first used to date ties in England or France. I found nails dating back to 1870 in Eastern France in 1988.²⁴ In England no nails are known before 1900, though they were certainly used. The English clean up their discarded ties quickly for other uses, while in France old ties are commonly reused as fenceposts near the railroad. Also, the French used

¹⁸ [Boulton, 18, 21]

¹⁹ [ASCE 6-01, 502-503]

²⁰ [Boulton, 24]

²¹ [ASCE 6-01, 506]

²² [Wallis-Tayler, 207]

²³ [ASCE 6-01, 505-506]

²⁴ From ties reused as fenceposts I pulled 70, 74, 76, and two 77's. From ties in an abandoned yard I found five 79's and a few 81's. I also got an 83, 84's, 86's, thirteen 88's, and dates in the 1890's were fairly common. I passed up at least a dozen 99's.

more creosote in their ties, getting a longer life out of them.

By the end of the 1800's date nails were the norm in Europe. They were used in every treated tie on railroads in France, Germany, Luxembourg, Belgium, and certainly England.²⁵ This use of nails has persisted for over a century. Anyone who has travelled to Europe to find nails is amazed at their abundance. In 1987 in Luxembourg I found 1986 nails in many ties (I did not pull them!), but 1979 seems to be the last year for Italian nails.

4. Early U.S. experiments, 1838-1880

When treatment methods were first introduced in Europe in the 1830's, a few U.S. railroads began conducting experiments. Very little was known about the life of treated ties, or if treatment would be cost effective. While in Europe it was quickly found that treatment on a large scale was desirable, the large and cheap timber supply in America meant that railroads were hesitant to commit themselves to treating ties long term.

What I have found on early tie treating in America is contained in Table I (page 64). Right from the start railroads were experimenting with wood preservation. The South Carolina RR treated its structural timbers even before ties were invented (1830-33). 1838 saw the first use of mercuric chloride: that year the Northern Central RR near Baltimore installed a test mile of HgCl_2 -treated ties, and the South Carolina began regular use of the preservative, which they kept up through 1841. Kyan himself came to the U.S. soon after he patented the use of mercuric chloride, and his visit may have prompted some of these early experiments. Others include the 1840 test by the Louisa RR in Virginia, and the 1842 Baltimore & Ohio experiment. Mercuric chloride was the subject of nearly all the early tests through 1851. The process was not used after 1856, except for the Eastern RR revival in the 1880's, which I shall review soon. The reasons given by the Northern Central for not adopting mercuric chloride were its high cost and severe toxicity. On other lines it was noted that the solution leaches out of the wood in wet locations.²⁶

Zinc chloride, another metallic salt, was introduced in this country at Lowell, MA in 1850 for bridge and building material.²⁷ It was first used on ties in 1855 by the Union RR in Cambridge, MA. ZnCl_2 is not poisonous like mercuric chloride, and is much cheaper. The Vermont Central (1856-59) and the Erie (1861-69) used Burnett's process regularly for some time, but after 1868 this process was abandoned as well. Delays and capacity problems plagued some railroads.²⁸ Others got

²⁵ In Luxembourg I found a 97 (1897). Nails were in use in Belgium by 1892 [AREA '26, 700]. German railroads were using nails by 1894 [Trat II, 224].

²⁶ [ASCE 7-85, 256]

²⁷ [ASCE 7-85, 257]

²⁸ Delays: Vermont Central [ASCE 7-85, 269]; plant not large enough: Union Pacific [ASCE 7-85, 262]

poor results because the ties and timbers were treated green,²⁹ treated too hastily,³⁰ or with too strong a solution, which caused the wood to become brittle.³¹ Even when done properly, treatment would not pay because timber prices were still just too low.

Creosote was first tested on ties in 1868 on the Chicago, Burlington & Quincy (CB&Q). Charles Seeley developed an open tank method in which unseasoned ties were given a partial dose of the preservative. The advantage of this, of course, was the low cost. Unfortunately the Seeley-treated ties used by the CB&Q in 1868-69 and the Chicago, Rock Island & Pacific (Rock Island) in 1872 rotted as fast as untreated ties.

The Central RR of New Jersey (CRR of NJ) tested ties creosoted by the Hayford method in 1872. The Bethell process was first used on ties in test sections of the Houston & Texas Central (1877), Louisville & Nashville (1878-79), and the CRR of NJ (1879). The Bethell process was used on all subsequent creosote tests.

There was some interest in copper sulphate in the late 1870's. Thilmany's process was employed on experimental ties of four Eastern railroads in 1877-79, but it was a failure.³² Other chemicals and methods were tested in the period 1838-1879, but none was successful.

5. The Wellhouse process

Zinc chloride is a reasonable alternative to creosote. It is cheaper and easier to obtain, though it does not protect the ties quite as well. The big problem with ZnCl_2 is that in wet conditions it dissolves out of the ties. Unlike creosote, the zinc chloride solution is water soluble.

This problem was overcome by William Wellhouse and Erwin Hagen, who in 1879 patented a two-step method for treating ties. First the ties are treated under pressure in a solution of zinc chloride and gelatin (or glue). After the pressure is released and the chemical drained, the ties are treated again, this time in tannin. The glue and tannin mix to form a kind of artificial leather which clogs the pores of the wood, preventing the zinc chloride from leaching out.³³

The new process became known as the Wellhouse, or zinc-tannin method. It was first practiced by Joseph P. Card at his works in St. Louis, and railroads in the area quickly established tests of crossties with the new treatment in 1879-1880.³⁴

²⁹ Erie RR [ASCE 7-85, 260]

³⁰ Erie RR [ASCE 7-85, 260-261]

³¹ Philadelphia, Wilmington & Baltimore; Reading; Union Pacific [ASCE 7-85, 262]

³² [16, 328][Weiss, 259]

³³ [H&G, 211]

³⁴ In addition to the tie tests, the St. Louis Bridge RR tested pine bridge stringers and gum blocks treated by the Wellhouse process in 1879. [ASCE 7-85, 258]

6. Which chemical is best?

In 1853 the superiority of creosote as a wood preservative was established. Creosote is more expensive than inferior chemicals such as zinc chloride, and partly for this reason its general use on ties in the U.S. happened much later than in Europe. It is the ratio between the price of timber and the price of the preservative which determines the economy of treatment. If ties are really cheap, it is not worth wasting even zinc chloride on them. If ties are moderately expensive, the extra life they gain from ZnCl_2 is enough to cover the cost of treatment. Finally, if ties are very expensive, the use of creosote is the most economical solution.

Octave Chanute³⁵ wrote in 1885 "creosoting is notoriously more expensive here than in England." "...the supply [of creosote] in this country is not equal to the demand, so that it has to be imported from England."³⁶ The reason for this discrepancy is explained in the 1913 AWPA *Proceedings*:

The production and composition of domestic creosote are regulated to a large extent by the demand for pitch, which is the primary product for which coal tar is distilled. Creosote is a by-product of insufficient value in itself to pay for the cost of manufacture. The pitch takes out a large proportion of the heavier constituents of the tar and leaves a proportionately increased amount of light oils.

In Europe the conditions are quite the reverse. There is little demand for pitch, but a large demand for the lighter constituents of the tar, which are used in the manufacture of the aniline dyes. Hence the lighter constituents are removed and the heavier left in the creosote. In the United States these heavier constituents are considered the most valuable components of the preservative, and consequently at the same price the foreign oils are preferred.³⁷

So the small amount of creosote which *was* produced in the U.S. was of poor quality. This was a problem which persisted into the 1920's.

The other variable in the economy of treated ties is the price of wood. At the turn of the century an untreated pine tie cost about \$1.40 in Germany and about 30 cents in the U.S.³⁸ The difference was certainly just as pronounced in the mid-19th century. With expensive ties and a ready creosote supply, the Bethell process came into general use early in Europe. In North America most railroads would continue to allow untreated ties to rot in the tracks well into the 20th century.

7. Creosoting bridge timbers

There is one type of structural timber which needed creosote: bridge piles. Whenever wood docks or bridges are built in salt water, the teredo and other shipworms feast on them. The destruction is less pronounced in northern waters, but along the Gulf of Mexico bridge piles have

³⁵ See the brief biography of Chanute after this history.

³⁶ [ASCE 7-85, 290]

³⁷ [13, 41]

³⁸ [ASCE 6-01, 509]

been eaten to the point of collapsing in under two years.³⁹ It is far more expensive to replace all the piles in a bridge than it is to renew a few ties, so railroads in the U.S. began pressure-treating these timbers with creosote in the 1860's. Salt solutions like zinc chloride are not suitable for marine use because they are water soluble.

The first use of creosote for preserving wood in North America occurred on the Old Colony RR. The railroad erected a treatment plant at Somerset, MA in 1865 for creosoting bridge piles by Bethell's process. The first wood treated were the 700 piles used in the bridge over the Taunton River, and despite trimming after treatment, it was considered a success. The works still operated as of 1885, but had been abandoned by 1901.⁴⁰

The first permanent railroad treating facility in North America was the Louisville & Nashville's West Pascagoula creosoting plant. In 1875 the railroad decided to pressure treat all bridge piles along the gulf coast with creosote, and the new plant opened the next year. The railroad had tried boiling timbers in an open tank of creosote as early as 1869, but the penetration was not enough to protect the wood.

Soon other railroads were creosoting bridge timbers. The New Orleans & North Eastern built a plant for creosoting piles and timbers for a bridge over Lake Pontchartrain in 1879. When the work was completed, the plant was abandoned. The Houston & Texas Central (H&TC) first used creosoted piles in 1876, but they did not begin to treat them regularly until 1883. Other railroads, such as the Chesapeake & Ohio (C&O) and Lehigh Valley (LV), began treating piles by the Bethell process in the 1880's. At the same time treating plants were built along the coast to handle the lumber used in other types of marine construction, such as docks. These can be identified in Table II (page 65).

The H&TC (1877), L&N (1878-79), and the LV (1886+) did treat some experimental ties at their creosoting plants, but, as Tratman wrote of the L&N in 1890, "...with ties at 23 to 30 cents apiece the additional expense [of creosoting] would not be justified."⁴¹

8. Zinc chloride in the West, 1881-1897

The railroads' tepid attitude towards tie treatment changed about 1880. At that time the price of timber was on the rise, and America's once vast forests were revealing that they were not the unlimited resource they once seemed to be. The 1880 census report, released in 1881, validated what railroad engineers already knew: unless measures were taken to curtail consumption, the U.S.

³⁹ [WPN 3-41, 32]

⁴⁰ [ASCE 7-85, 267-269]

⁴¹ [Trat I, 31]

would suffer a severe timber shortage.⁴²

In response to the potential crisis, in 1880 the American Society of Civil Engineers created a committee to study timber preservation. Progress was slow at first, so they appointed Octave Chanute to take over as chair of the committee in 1882. For the next three years they compiled information, and on June 25th, 1885 Chanute delivered his address "The Preservation of Timber."⁴³ His report lists every known American use of treated wood, most of them ties, together with explanations of failure or success. Included is a general evaluation of the methods tried, and of the economic advantages of treatment. The report deals very little with European wood preservation. The conclusion of the committee was that some U.S. railroads could benefit from the use of preservative chemicals, in particular from zinc chloride. Even apart from our low-cost timber, the high price of creosote, and the difficulty in obtaining a constant and sufficient supply, obviated its use.

The Santa Fe began serious experiments with tie treating in 1881, when Joseph P. Card of St. Louis supplied the railroad with 384 Wellhouse treated crossties. They were laid in 1881-82 at Topeka, KS and La Junta, CO. Careful records were kept, as indicated by the fact that on the La Junta test section the ties were labeled with numbered brass tags. The success of these experiments led the Santa Fe to construct the first permanent tie treating plant on the continent. The works were erected at Las Vegas, NM under the supervision of Octave Chanute, and they began treating ties by the Wellhouse process in July, 1885.

Treated ties were used on four divisions: Rio Grande, New Mexico, Western, and Colorado. The Santa Fe treated 111,503 ties in 1885, and an average of about 250,000 ties annually through 1897. This is much less than the number of ties required for the maintenance of 1,000 miles of track. In this period the railroad was placing treated ties only in regions where ties decayed the fastest. Untreated ties were still the norm on the other divisions.

Other tie treating plants appeared in the next couple years. In 1886 the Rock Island began long term use of zinc-tannin treated ties. They bought their ties under contract from Octave Chanute's and J. P. Card's newly formed Chicago Tie Preserving Co. The plant, located in Chicago, treated ties which were used only on divisions where untreated wood was exceptionally short-lived.

In 1886, using William Rowe's plans and under the supervision of the Chicago Tie Preserving Co., the Union Pacific (UP) built a plant at Laramie, WY. For two years they treated ties with zinc-tannin, after which the plant was abandoned for short-term savings. UP officials were not

⁴² [ASCE 7-85, 133]

⁴³ [ASCE 7-85, 133ff]

convinced that treatment would pay.⁴⁴

“In 1887 the Southern Pacific Company leased the creosoting works of the Houston & Texas Central Railway, at Houston, Tex., and began “Burnettizing,” or the injection of chloride of zinc by itself, without subsequent treatment.”⁴⁵ The SP built its own treatment works near Houston in 1891, and they constructed a portable plant for use in California and Oregon in 1894. From 1887 to 1894 treated ties were used only on the Atlantic System (lines east of El Paso). The Pacific System first received treated ties when the 1894 plant opened.

After the UP plant shut down, the Santa Fe, Rock Island, and Southern Pacific were alone in pursuing tie treatment on a regular basis up to the end of the century. Timber prices did not climb after 1880 as was predicted, so other railroads continued to use and discard untreated ties as regular practice. We might, however, consider two minor exceptions: the Eastern RR in Massachusetts and the Pennsylvania RR. From 1881 to 1891/92 the Eastern RR used about 800,000 Kyanized ties. This is the only known use of mercuric chloride after the 1856 test of the Boston & Providence, apart from a small experiment by the Forest Service in 1911. The Pennsylvania RR bought nearly 200,000 Wellhouse treated ties from the Chicago Tie Preserving Co. in the period 1897-1902. In all, the PRR used over 300,000 ties treated by either the Wellhouse, Burnett, or Bethell process during 1892-1903. These were still just used in test sections, though some tests were quite extensive.

9. Tie tests by other railroads, 1881-1897

The quick adoption by the Santa Fe and the Rock Island of the Wellhouse process attracted some attention, and there were a few tests of zinc tannin by other lines in the ensuing years. The process was tested by the Erie in 1882, perhaps because Ocatve Chanute himself was Chief Engineer there. The Chicago & North Western (1888), Duluth & Iron Range (1890), Delaware & Hudson (1892), Norfolk & Southern (1897), and the Pennsylvania (mentioned above) all conducted tests of zinc-tannin treated ties.

At least eight Eastern railroads⁴⁶ conducted tests of creosoted ties in the last two decades of the century, while the Santa Fe, Illinois Central, Pennsylvania, CB&Q, and Norfolk & Southern all dabbled with Burnett’s process. Some lines⁴⁷ experimented with Vulcanized ties. This method involves subjecting the ties to high heat and pressure, which chemically alters the wood making it unsuitable for fungi and insects. In 1894 the Galveston, Harrisburg & San Antonio was the first to

⁴⁴ [Rowe, 328][RG 10-29-86, 737]

⁴⁵ [AREA '01, 106]

⁴⁶ NYC, LV, ACL, NYNH&H, PRR, CRR of NJ, and N&S.

⁴⁷ Metropolitan (1883); Delaware & Hudson (1892); Norfolk & Southern (1897)

try a combination zinc chloride–creosote treatment.

10. Record keeping and experiments

Even before they adopted tie treating, railroads had always kept records of how long ties lasted. By knowing how many ties are renewed per mile of track per year, the average life of ties can be found. For example, if a railroad replaces on average 400 ties per mile, and they have 2,800 ties in each mile of track, then they are replacing $\frac{400}{2800}$, or one seventh of their ties every year. That means that the average tie lasts seven years.

When the Santa Fe and other railroads began using treated ties, such an average could not reveal how long treated ties were lasting compared with untreated ties, nor whether ties in one year were outlasting ties inserted in another year. To answer these questions, the year of treatment was hammer stamped into the ends of ties at the treating plant.

The Santa Fe began stamping the year of treatment when the Las Vegas plant opened in 1885, but they did not commence keeping a record until 1897. The Southern Pacific did better. They began stamping the date in 1887, and began a record that year, keeping track of the dates on ties removed each year. In 1892/3 three railroads owned by the New York Central⁴⁸ began stamping the date, probably in untreated ties.

Through stamps the Santa Fe found that its Wellhouse treated ties were lasting on average twelve years.⁴⁹ They even got more specific information, like the fact that treated ties laid in the period 1885-1888 experienced an immunity to checking which later ties did not have. Also, the earlier ties rotted from the bottom while later ties showed no particular pattern of decay.⁵⁰

Early test sections were designed to answer the question “How long will ties last if treated with this chemical?” It was necessary only to place a lot of ties in one stretch of track and wait. No markings on the ties were necessary. As the price of ties rose and railroads gained some experience with treated ties, some companies refined their tests to answer more specific questions, usually about the type or amount of treatment, the kind of ballast, or the species of wood. As mentioned above, when the Santa Fe laid ties of four species of wood at La Junta in 1881-1882, they used numbered brass tags to mark the ties. The records certainly pertained to the species of wood, but may also have contained other information.

In 1881 the Allegheny Valley RR began careful records of untreated ties, and from 1883 to 1887 they dated their ties with notches. The position of the notch indicated the year.

⁴⁸ Big Four Route; Lake Shore & Michigan Southern; Michigan Central.

⁴⁹ [Rowe, 87]

⁵⁰ [RG 8-21-03, 606]

The Delaware & Hudson established a test section in 1892 consisting of hemlock and yellow pine ties, both untreated and treated two different ways. They were testing different track fastenings—the Davies spike, Servis tie plates, and rail joints—as much as they were the treatments.

On the Pennsylvania RR in 1892 two test sections were established to determine the relative merits of rock vs. gravel ballast, and zinc-tannin treated hemlock and tamarack vs. untreated white oak. Beginning in 1894 and continuing into the 1900's they conducted various tests of different woods treated with wood tar creosote, zinc chloride, and zinc-tannin.

The Norfolk & Southern in 1897 laid several hundred ties on their Norfolk Division, testing four species of wood treated four different ways, along with untreated ties. Some ties were hewed while others were sawed, and some were placed on curves and others on tangent track.

11. Cost

Railroads were not going to invest money in tie treating unless ties became more expensive. Even in the face of predictions of the deforestation of America, the decision of whether or not to treat ties, and which process to use, always boiled down to cost. It was economic considerations which led Chanute in 1885 to recommend treatment to *some* railroads. The Santa Fe, Rock Island, and Southern Pacific were not so much the first to become concerned with the preservation of our forests as they were the first to find treatment economical. Their ties had the shortest lives in the track. For example, while the Santa Fe got about 4.5 years out of an untreated Rocky Mountain pine tie, the New York Central was getting 11.5 years from untreated yellow pine. Also, the NYC had a closer and cheaper timber supply. Major railroads kept tabs on the price of ties, the price of treatment, and the long term savings, if any, of treatment.⁵¹ Just how much woodland remained in America and how long it would last were only of interest in predicting the price and availability of timber.

For those railroads with permanent treatment works, the extra investment paid off. In locations where the Santa Fe used treated ties, they saved in the long run about \$150.00 per mile of track each year. Tie expenditures on those divisions were cut in half, and the savings in one year were enough to cover the cost of building the Las Vegas plant.⁵²

Burnettizing on the Southern Pacific also paid off. "The untreated pine ties cost about 50 cents each when *laid in the track* in their natural state, and last some 4 years; this produces a charge of 12½ cents a year per tie, while if, when treated, they cost, say 66 cents each when laid in the track,

⁵¹ Unfortunately, as in the case of the UP, they did not always make the best decisions.

⁵² [Rowe, 87]

and last at least 8.25 years, they then produce an annual charge of 8 cents per tie.”⁵³

12. The rise in the price of timber, 1898-1905

The great rise in the price of timber which was predicted by the 1880 census came suddenly in 1898. The cost of a quality tie nearly doubled from 1898 to the beginning of 1900. Naturally the inflated price was a reflection of the scarcity of woodland. Samuel M. Rowe wrote in January, 1901 “In the last 30 years we have seen such destruction of our great forests as seems appalling. With the exception of a small territory in northern Maine, some small areas in the South and the region of the extreme Northwest, the forests have been invaded and the most valuable timbers have been more or less cut away.”⁵⁴ These valuable timbers were white oak, cedar, and other durable species which are suitable for use as untreated ties. What remained untapped at this point was a large supply of pine, red oak, and other species which would give satisfactory service if treated.

By the end of 1899 a few new tie treating plants emerged. The Santa Fe began treating ties for the majority of its divisions in 1898 with new plants at Somerville, TX and Bellemont, AZ. These were built before the big price jump. It may be that by 1897 timber prices had risen just enough since the 1880's to justify their construction.

In 1899 the Chicago Tie Preserving Co. completed the construction of a portable plant at Mt. Vernon, IL for treating Chicago & Eastern Illinois (C&EI) ties by the Wellhouse process. Here Chanute continued the kind of work he was already doing for the Rock Island in Chicago.

Also in 1899 the CB&Q built a plant at Edgemont, SD. Frank J. Angier, Superintendent of Timber Preservation, built the plant for lack of an outside company to do the job. The facility opened in November and treated ties for Western lines by the Burnett process.

The Great Northern began using large numbers of treated ties in 1899 from a temporary plant in Minnesota. They built their permanent plant in 1901-1902 at Somers, MT, where ties for Western lines were treated with Chanute's three-step modification of the Wellhouse process.

While these companies reacted quickly to the timber situation, other railroads which could have benefitted from treated ties were slower to respond. This was probably due as much to lengthy administrative red tape as it was to the suspicions many railroad engineers still had about the value of wood preservation.

By 1903 at least twelve more companies had adopted either the Wellhouse or Burnett process for their ties. After 1903 there was a shift away from the Wellhouse process. Several lines switched to the Burnett method, probably on account of cost (see Table III, page 68).

⁵³ [AREA '01, 108]

⁵⁴ [RG 1-4-01, 7]

13. Cooperative efforts

Octave Chanute's appointment to head a committee to study wood preservation in 1882 was prompted by the threat of a serious shortage of lumber for ties, and by a moderate price jump. In his 1885 report he spoke of the treatment methods tried by American railroads. Little reference was made to European practices, despite the fact that British, French, and German railroads were far advanced over their counterparts in the U.S.

The new jump in prices at the end of the century prompted Chanute to look into tie preservation again, and in October, 1899 he went to Europe to study timber preservation. In particular he wanted to investigate the possibility of treating ties with a combination of zinc chloride and creosote. He had always considered the water resistance of the Wellhouse process superior to straight zinc chloride, and substituting creosote for the glue and tannin would not only answer to the moisture problem, but would further help protect ties from decay. His trip was again sponsored by the American Society of Civil Engineers. Chanute collected data in England, France and Germany, and he was back in the U.S. that December. He wrote after his return:

...it would cost 45 cents each to creosote according to the English practice, and 15 to 16 years' life would be obtained; it would cost about 85 cents to creosote after the best French or German practice, and 27 to 30 years' life would be obtained in thoroughly drained ballast; but it would not be economical to spend them upon ties costing 20 to 40 cents each untreated, while it is economical to spend them upon ties costing from 90 cents to \$1.50 each abroad.

We must be content, therefore, either to allow our cheap ties to decay in the good old way, or to adopt for the present some of the cheaper and inferior methods which will produce shorter lives than obtained in Europe. By the light of past experience, those cheaper methods may be said to be three in number: 1st, straight Burnettizing; 2d, the zinc-tannin process, and 3d, the zinc-creosote process.

The writer is satisfied that the zinc-tannin process, as modified by himself in 1896, is superior to straight Burnettizing, and that the record of the next few years will demonstrate this, yet he is desirous of doing still better work, and he went abroad chiefly to investigate the zinc-creosote process. He now thinks that it is probably superior to the zinc-tannin process, although part of the greater life shown by records is attributable to other causes, such as the better ballast and drainage, and the better modes of fastening, as well as the climatic conditions. There are, however, some serious difficulties to be overcome before the process can be introduced here. Suitable tar-oil, as described in the specifications of Appendix C, is just now very scarce and high in price, so high that the freight, the leakage and the cost of the barrels render the cost almost prohibitory.⁵⁵

So the two factors which prevented American railroads from adopting creosote—high price for the chemical and cheap timber—would render even zinc-creosote unviable, at least for the time being. Even after the recent price increase of timber, ties here were still too inexpensive for creosote.

In March of 1900 the newly formed American Railway Engineering and Maintenance-of-Way Association held its first meeting in Chicago. (The name changed in 1916 to the American Railway

⁵⁵ [ASCE 6-01, 509]

Engineering Association, and I refer to it as the AREA from now on.) The *Proceedings* of the annual meeting consisted of reports from nineteen committees which covered every topic from Ballast to Iron and Steel Structures to Electricity. With both a Tie Committee and the Wood Preservation Committee, the AREA became the first forum in which railroads could share information on ties and tie treating. The 1900 volume is rather slim, but from 1901 on the AREA put out an impressive collection of information. Some of the work done by the AREA was to compile and publish wood preservation statistics, to report on experiments done by various railroads, and to establish standards.

The Bureau of Forestry of the U.S. Department of Agriculture became involved in 1901. That year they planned a large test section of treated ties on the Santa Fe in Texas. It was desired to know the relative values of various preservatives, and to see how they performed on different woods. At a location near Pelican, TX on which ordinary untreated ties lasted only two years, 5,481 ties treated six different ways were installed from February to March, 1902. Treatments included Burnett (straight zinc chloride), Wellhouse (zinc-tannin), Allardyce (ZnCl_2 -creosote), Hasselmann (Barshall salts), spirittine, and zinc chloride & oil. Thirteen species of wood were tried, and results of the tests were appearing as early as 1903.⁵⁶ The test was organized by two special agents of the Bureau of Forestry: Hermann von Schrenk and Gellert Alleman. The energetic Von Schrenk was twenty-eight years old at the time, and he would continue to have a major impact on tie preservation into the 1950's.⁵⁷

In 1905 a second organization was formed which would be invaluable to tie treaters. In January the first meeting of the Wood Preservers' Association was held in New Orleans. The annual meeting, published each year, offered treating engineers a more focused outlet for their research. The name was changed in 1912 to the American Wood-Preservers' Association. Without the *Proceedings* of the AWP and the AREA, this history would not have been possible.

On June 4, 1910 the Forest Products Laboratory (FPL) opened in Madison, WI.⁵⁸ This lab was operated in connection with the University of Wisconsin, and they still conduct wood preservation research today. The lab initiated many test sections on railroads throughout the U.S., most notably on the Chicago, Milwaukee & St. Paul (Milwaukee Road) in 1911 and from 1916 to 1940. The FPL also had tests on the Northern Pacific, the Union Pacific, the Indianapolis, Columbus & Southern Traction, and the Tennessee Coal Iron & RR Co.

⁵⁶ [AREA '01, 119][DNC, 21][AREA '10 II, 768]

⁵⁷ See his biography by Cronin, which I discovered too late to incorporate into this history.

⁵⁸ ['11, 25]

14. Record keeping: the introduction of date nails

E. E. Russell Tratman noted the need for accurate records of ties in 1894: "It is an excellent plan to mark the ties in some way so that their length of service can be seen at once, and a record kept of them. Then, if ties are found to be taken out after only a few years' service, the reason should be investigated." After describing the hammer stamps used by the Big Four he wrote "In Germany it has been found that the impressions made by such hammer stamps on preserved ties became effaced before the time for renewal, and nails or tacks with distinguishing letters or marks were therefore substituted."⁵⁹

At the 1900 AREA meeting Tratman again mentioned date nails: "Very few records are kept, unless the ties are of special importance. I think Mr. Kittredge [of the Big Four] tried marking them with hammers. I do not know whether those marks remained long enough, but it seems to me some system of marking with tacks or tags should be used if you are going to keep accurate records."

In fact the Big Four's stamps did not work, as George Kittredge replied: "We did not find that it worked very well, because at the end of a few years, a great many of the marks were effaced and the practice was discontinued..." W. C. Curtis of the Southern Pacific added "I think it important that the life of ties should be determined in some such way. I think the better way may be to use a galvanized tack, such as our friend here, Mr. Chanute has devised, with date on the head..."⁶⁰

These suggestions were put into practice by Octave Chanute in 1899. Date nails were driven into all ties treated at the Chicago Tie Preserving Co.'s Mt. Vernon, IL plant beginning with its opening that July. He had tried in 1889 and 1893 to get the Rock Island, his principal customer, to adopt date nails, but the railroad balked at the cost. Chanute, writing from Chicago in 1900 on the marking of ties, told the reason he initiated the use of date nails:

It is not sufficient to do this with the stamping hammer. That is what we are doing at the works here, but at our new works at Mt. Vernon we are not only stamping the tie with a hammer, but we are furnishing at our own expense a galvanized nail for the purpose of dating the tie, in order to be dead sure to be able to identify it 10 or 15 years hence. We do that because we found that upon one of the railroads here the records as to where the ties had been laid had got into such condition that there was no telling what was the age of those in the track, and the report went out among the men that our ties were giving out in three or four years, and, at the maximum, in seven years. The question was only settled by the heroic measure of having the ties counted in the track, twelve millions of them, whereupon it appeared that the statements that had become prevalent upon the road were not correct, and that, knowing the number that had been furnished and the number that was still in the track, it was proved that they were lasting, instead of five or six or seven years, an average of nine or ten years—although that, I think, is not enough; we want to do better. So in order to preclude the possibility of any such questions coming up hereafter, we have undertaken, in new contracts, to furnish the nails at our own expense, so that there

⁵⁹ [Trat II, 222-224]

⁶⁰ [AREA '00, 76-77][DNC, 8-9]

shall be no question as to the age of the ties.⁶¹

The railroad in question is the Rock Island, and the date of the incident is given in another article as August, 1898.⁶² Chanute's Chicago Tie Preserving Co. had been stamping the date into Rock Island ties since 1895.

We have here two threads on the introduction of date nails: one from Tratman, the other from Chanute. According to Tratman, nails are a more permanent mark than hammer stamps. For Chanute, the statement "in order to be dead sure to be able to identify it 10 or 15 years hence" agrees with Tratman's evaluation. The stamps used since 1895 on the Rock Island were not good enough to maintain a reliable record.

But while hammer stamps on the Big Four, the Rock Island, and in Germany were not permanent, the Santa Fe and Southern Pacific reported no problem with them. Both railroads maintained a reliable record of treated ties removed from the track from stamps which dated back to the mid-1880's.⁶³ Nevertheless they too became convinced of the superiority of nails. In 1901 the Santa Fe stopped stamping its ties and introduced date nails. The SP began using nails in addition to stamps no later than 1903.

Even before the timber crisis began, the Mississippi River & Bonne Terre (MR&BT) was using date nails. Despite the fact that I have encountered no record of this railroad in the literature apart from a 1902 test section, MR&BT nails have been found for each year 1897 through 1900. This is the first known use of date nails in America.

In 1899 both the Great Northern and the CB&Q began using date nails. It is only by chance that we have an account of the nails used by the Pittsburgh & Lake Erie beginning 1899—and we have no firm evidence that the ties were treated. See Table X (page 70) for the years other railroads began using nails.

Hermann von Schrenk saw to it that date nails were used in the 1902 Pelican test section, and George Kittredge, president of the AREA, strongly recommended nails thereafter. From a November 12, 1902 circular addressed to "the Managing Officers of American Railroads" Kittredge wrote

The plan proposed is similar to that adopted by the United States Department of Agriculture in a section of experimental track laid in the State of Texas, and briefly described as follows: Each tie is marked with a dating nail; this is placed between the rails on top of the tie, generally at a specified distance from the rail. They are of steel, covered with zinc or tin, and have the year stamped in the head.

⁶¹ [RG 7-27-00, 507]

⁶² [AREA '05, 776-777]

⁶³ [RG 9-19-02, 720], [AREA '04, 70]

When renewals take place, the date at which each tie was laid is noted, and in this way an absolutely reliable record is obtained. The nails cost very little (about 6 cents per pound—thirty nails), and when put in by the section gang, the labor is slight. Several American railroads have already adopted this plan, and it is to be hoped that the practice will eventually become general. Accurate statistical information in regard to the life of treated and untreated ties, a comparison of the different kinds of wood used for crossties under varying conditions of soil and climate, etc., is essential to the proper study of the tie question. For the purpose of making data of this character available and presenting it from year to year, a series of blank forms has been prepared by the Committee on Ties, which have been adopted by the Association as standard, and it is suggested that each road take the necessary steps to at once inaugurate the system of keeping tie records in the manner proposed by the Committee.⁶⁴

And most railroads which treated their ties *did* use date nails in these years, though the nails were not always of galvanized steel, and were not always driven between the rails.

Just as the methods of treatment did not change after the 1898 timber crisis, the switch from hammer stamps to date nails for record keeping did not involve a change in the nature of the records. U.S. railroads continued to record the dates of treated ties removed from track, and apart from a couple rare instances,⁶⁵ no effort was made by individual railroads to determine the relative values of different treatments, or to distinguish between species. This should not be too surprising. For treatments, there were realistically only two to choose from: Burnett and Wellhouse. This fact was reiterated by Chanute in 1900. Also, most railroads used only one or two species for the vast majority of their ties, and in most cases the look of the wood gave it away.

The Santa Fe expanded their record keeping somewhat in 1904. That year they began to keep track of all ties put in and taken out of track, including untreated ties. The type of information they got from such a record did not differ qualitatively from that obtained by their former plan, however.

15. Lowry, Rueping, and the rise of creosote

The new tie treating plants which popped up in the period beginning 1897 operated on the standards set over a dozen years earlier by the Las Vegas, Chicago, and Houston works. Chanute's European tour revealed no new economical ways to treat ties. American railroads remained satisfied with the results obtained by the use of zinc chloride, which was proven to more than double the life of an untreated tie. Creosote was too expensive, and other processes were avoided mainly because they were untried. Few railroads were willing to invest large amounts of capital into methods which were not yet proven cost effective. This stability, the culmination of a slow yet definite progress

⁶⁴ [AREA '02, 99-101][DNC, 22-23]

⁶⁵ CB&Q used the nail "H" to designate Hasselmann treated ties as of 1903; beginning 1904 the Great Northern used nails which designated both the wood and year treated.

with zinc chloride sanctioned by low cost lumber, would be shattered unexpectedly in the years beginning 1905.

By regulating the pressure and the amount of time ties remain in the retort, treating engineers can control the amount of preservative which ties absorb. In France, some companies treated ties to refusal, which means that they maintained the pressure until the ties could absorb no more creosote. About 29 pounds per cubic foot of creosote went into beech ties this way.⁶⁶

In 1878 the Western Ry Co. in France decided to diminish the amount of creosote absorbed by each tie by about a third. The result was that the lives of these ties was proportionally reduced, and the railroad reinstated its policy of treatment to refusal in 1885.⁶⁷ The experience of the Western Ry as well as others showed that the more creosote a tie received, the longer it remained serviceable.

Just as the price of timber was shooting up in the first years of the 20th century, two men, Max Rueping of Germany and Cuthbert B. Lowry of the U.S., developed methods which would give a long life to ties with little creosote. The problem with earlier small-dose methods was that the creosote only penetrated the outer shell of the tie, leaving the interior unprotected. Bethell's process works because the penetration of the oil is deep, and not because a large amount of creosote is used. Lowry's and Rueping's methods ensure that the cell walls are coated with creosote to a reasonable depth, but most of the creosote in the cell spaces is left empty. Thus they were termed "empty-cell" processes. The Bethell process became known as the "full-cell" process because creosote fills all the empty space in the wood.

I will describe Lowry's process first. C. B. Lowry, a native of Lexington, KY, was involved for a number of years in the lumber business before 1900, and was part owner of the Slidell, LA creosoting plant. About 1901/02 he traveled to Germany where he studied methods of wood preservation. In September, 1902, back in the U.S., he formulated the idea of a new treating method, which was perfected in experiments he conducted in 1903 and 1904.⁶⁸

Here is the process:

- (1) the ties are placed in the treating cylinder,
- (2) the cylinder is closed and filled with creosote at atmospheric pressure,
- (3) pressure is applied to the retort,
- (4) the pressure is released, the creosote drained,
- (5) the cylinder is subjected to a "quick, high vacuum" for 1 1/2 to 2 hours.

There are two differences between the Lowry and Bethell processes. In the Lowry process creosote is pumped into the cylinder at atmospheric pressure, while in the Bethell process an initial

⁶⁶ [ASCE 6-01, 503]

⁶⁷ [AREA '07, 490]

⁶⁸ [Rowe, 272][Goltra I, 49]

vacuum withdraws air from the wood prior to the admission of creosote. Also, Lowry's final vacuum is quick and high because it needs to assist in drawing out excess creosote. It is the air trapped in the ties during treatment which pushes the excess creosote out during the quick vacuum. Lowry maintained in his Patent application that "This saving is made possible by the quick production of the vacuum, thereby enabling the oil to be withdrawn from the cells or pores of the wood before the air can escape through the oil forced thereinto."⁶⁹

I believe that this point has caused lots of confusion, and may have been partly responsible for the later controversy surrounding empty-cell treating. Lowry meant that without a *quick* final vacuum, the air which was compressed in the ties behind the creosote would leak to the surface without forcing out much oil. The vacuum assists the trapped air in expelling creosote. It is not the sole reason the Lowry process works.

George Kittredge of the Big Four Route was impressed by all this, and Lowry secured a contract with the railroad in February, 1904. Lowry's newly formed Columbia Creosoting Co. built a treating plant at Shirley, IN to treat 550,000 ties annually by the new process. The Big Four became the first U.S. railroad to use creosoted ties on a regular basis when the plant opened in the Spring of 1905. In 1904 the railroad had become the first U.S. line to use large numbers of zinc chloride-creosote treated ties. I will discuss that later.

Other contracts followed. Lowry established the American Creosoting Co. to build plants for the Rock Island, St. Louis-San Francisco (Frisco), C&EI, Monon Route, and others. By 1912 an incredible fourteen creosoting works had been built to treat ties by the Lowry process. As of 1910 the method was used on a third of all ties treated in the U.S.⁷⁰ (see Table IV, page 68).

Lowry himself advanced quickly to leadership within the wood preserving world by his election to First Vice President of the AWP in 1905, to President in 1906 and 1907, and again to FVP in 1908. He died in a railroad accident near New Orleans on November 11, 1908.⁷¹

The other empty cell method was developed by Max Rueping of Germany. He obtained a patent for his method in 1902, so we may presume his discovery predates Lowry's.⁷² The Rueping process consists of the following steps:

⁶⁹ [Goltra I, 44]

⁷⁰ [Goltra I, 45]

⁷¹ ['09, 7, 11][Goltra I, 42]

⁷² [Goltra I, 46]

- (1) The ties are placed in the treating cylinder,
- (2) the cylinder door is closed and the ties are subjected to pressure.
- (3) Maintaining pressure, creosote is admitted to the cylinder,
- (4) higher pressure is applied to the retort,
- (5) the pressure is released, the creosote drained,
- (6) the cylinder is subjected to a final vacuum.

Here the air which is forced into the ties at step (2) will assist in pushing out excess creosote after the pressure is released in step (6). With the Lowry process there is less air in the ties during treatment, which is why a *quick, high* vacuum is necessary. More creosote oil can be extracted by the Rueping process, but the disadvantage is that it requires extra equipment. Creosote is pumped into the retort under pressure, so an extra "Rueping" tank is required to hold the creosote under the same pressure before step (3) is performed. In general, ties treated by the Rueping process retained about 5 to 6 pounds per cubic foot, while Lowry treated ties retained about 7 to 8 lb/ft³. Their depth of penetration was about equal.

The Rueping process was introduced to the U.S. in 1904 and 1905 in test sections on the Santa Fe. In 1905 the railroad purchased and rebuilt the Texas Tie & Lumber Preserving Co.'s Somerville, TX plant. Early in 1906, when the plant reopened, the Santa Fe switched entirely to the Rueping process.

Other railroads soon began treating ties by Rueping's method. The El Paso & Southwestern (1906), Illinois Central (1907), Rock Island (1908), Missouri, Kansas & Texas (1909), Pennsylvania (1909) and others adopted it. By 1915 at least nine railroads in the U.S. were using Rueping treated ties. The process was also used extensively in Germany, and possibly other countries in Europe as well (see Table IV, page 68).

In most cases railroads which used Rueping treated ties operated their own plants and paid a royalty to the company with the patent rights, Messrs. Halsberg & Co., M.B.H. of Germany. Railroads using Lowry treated ties leased a plant from Lowry's company, with the exception of the Northern Pacific.

16. Initial reaction against empty cell creosoting

The quick and magnificent rise of Lowry's and Rueping's processes in the wood preserving world was not accepted without criticism. Chanute, the revered past-president of the ASCE, the pioneer who was largely responsible for the introduction of the Wellhouse process, had gone to Europe in 1899 and concluded that creosote was too expensive for U.S. ties. Lowry traveled to Europe on Chanute's heels and returned claiming creosote is the best treatment. This, combined with Lowry's brash tactics, seemed to be a slap in the face of those careful engineers dedicated to

the use of zinc chloride.

Samuel Rowe, who had been in the business since the 1880's, was appalled at Lowry's success. On April 30, 1905 Rowe wrote a letter to A. A. Robinson:

[Lowry] goes to Germany about three years ago and talks with the timber treaters there, returns and immediately enters the field as an expert in the business and also immediately concludes that the chloride of zinc treatment was a failure in this country.

One of the hardest things to understand is that he, through government backing, impliedly, if not actually succeeded in holding up the whole business in this country in a measure, and not only this, to throw discredit, both on the many workers and upon results obtained. Not only this, but the schemes of various promoters have been taken up, and exploited some nonsensical and some that when properly proven by time, may be of value, but that any one with so short an experience should set himself up as an authority is almost incredible and shows but little conception of the broadness of the whole question.

...I must beg your pardon for this long dissertation but you must understand that is done under severe provocation and in a case where a man feels like sharing the stress with another.⁷³

Lowry tried to play down the conflict. On January 15, 1907, in his opening remarks at the AWPA meeting, he said:

A question occurred to me in a talk with one of the gentlemen now present. There are two elements of wood preservation represented in this association and throughout the world: the creosoting method and the zinc chloride method. Some people are short-sighted enough to believe that there is serious conflict in the two forms of treatment. In my judgement, this is not true; they are distinct in their uses and in the conditions under which they are to be used, and the only conflict that can occur is the unwise attempt of an advocate of the one insisting on using it under conditions to which the other method is peculiarly adapted. They each have their uses, and they have come to stay.

...This country is so vast, its climate so varied and the conditions so widely separate, and yet contiguous to each other, that, in the language of Admirable Schley, "there is enough glory for all."⁷⁴

It did not work. Octave Chanute himself expressed distrust of empty cell creosoting in 1907. He brought up the experience of the Western Ry of France to show that when less creosote is used, the life of the tie is shorter.⁷⁵ His example tells us that he did not believe that the Lowry or the Rueping process does what its promoters claimed.

The 1908 AWPA meeting must have been volatile. The *Proceedings* were never published. This explanation was given at the 1909 meeting by President Walter Buehler: "There is really very little to explain. The minutes consisted of about eighty pages; everything was in there from remarks as to the purchase of postage stamps, to side remarks by Mr. Berry. We had a stenographer work on them about two weeks, gathering together what each man said, the resultant piece of literature we thought rather dangerous to print."⁷⁶ I am trying to acquire these *dangerous* minutes from the

⁷³ [Rowe, 271-276]

⁷⁴ ['07, 4]

⁷⁵ [AREA '07, 489]

⁷⁶ ['09, 7]

AWPA now.

A reaction was taking place. In all likelihood Lowry had directed the AWPAs in its first four years in a very partisan way. He had declared zinc chloride a failure, and was stealing the business of many treating companies. It is not surprising to see a man like Rowe provoked under stress at the beginning of Lowry's rise. And once Lowry was personally removed from the scene by his unexpected death, we can understand the reaction of men who had for the past twenty years successfully built up the Burnett and Wellhouse processes.

17. Others fail at replicating empty-cell creosoting

Then there were the engineers who failed to reproduce the results of Lowry and Rueping. This caused many to conclude that empty cell creosoting simply does not work, and consequently that companies promoting these processes were committing fraud.

Joseph B. Card, son of Chanute's partner J. P. Card, attempted both the Lowry and Rueping processes at the Terre Haute plant of the Chicago Tie Preserving Co. in 1906. In his try at Lowry's method, he could not extract enough creosote. With Rueping, he could not inject enough creosote into the ties in the first place.⁷⁷

In 1908 or 1909 F. J. Angier tried to treat ties by the Lowry process at the CB&Q plant at Galesburg. He failed to extract much creosote with the final vacuum.⁷⁸

In a 1911 paper published in the *Proceedings* of the AWPAs, Charles D. Chanute, Octave's son, reported his failure at treating ties by the Lowry process in an experimental retort. He gave a thorough explanation of his procedure, and I find that his problem was that his vacuum was anything but quick. After the pressure was released and the creosote drained, Chanute removed the ties from the retort and let them drip for some time. Then he placed them back in the retort and applied the vacuum. He extracted from 5.4% up to 15.6% of the creosote injected, depending on the species.⁷⁹

F. H. Weiss of the Forest Product Laboratory conducted a preliminary experiment of the Rueping process which he reported to the AWPAs in 1912. He was unable to extract much of the preservative. Evidently he was not convinced by his experiment because in 1913 he wrote an article tacitly supporting empty cell creosoting.⁸⁰

It was Angier's failure which had the most impact on wood preservers. The Galesburg plant

⁷⁷ [Rowe, 279]

⁷⁸ [10, 115]

⁷⁹ [11, 163-165]

⁸⁰ [Goltra I, 52-54][13, 71-83]

was state-of-the-art and Angier was experienced and respected. At the 1910 AWWA meeting the result of his experiment spurred a short discussion on the topic. J. B. Card, Walter Buehler (Kettle River Co.), and D. Burkhalter (Santa Fe) were lead by C. W. Berry (Union Pacific) in expressing very serious doubts about the effectiveness of Lowry's process. Octave Chanute restrained from criticism.⁸¹

At the same meeting Angier compared the new empty cell methods with the Seeley method. The latter was the small dose open-tank creosoting method which proved a complete failure on the CB&Q in 1868. A year later Angier's firm belief in the impossibility of empty cell methods is evident in this statement:

...is it not possible that we are making a mistake in treating with what we call "empty cell processes"? We know that thousands of ties are being treated with small doses of creosote, in many instances ranging from twelve to twenty pounds per tie, with only a superficial penetration. With many of our inferior woods now being used for crossties, the heartwood remains practically untreated, and with the more refractory woods, even the sapwood is not entirely impregnated.⁸²

18. Later criticism: William Goltra

After 1910 the invective against Lowry and Rueping intensified. John T. Logan, of the National Lumber & Creosoting Co. in Texarkana, spoke at the 1911 AWWA meeting against railroads who do not use treated ties, and especially against empty cell methods:

The most demoralizing and dangerous elements to meritorious wood preserving in existence today are such make-shift concerns as those bearing to our worthy institutions the same relationship which the notorious quacks bear to the medical profession. The public is afforded means of detecting the quack and shunning him, and this Association's mark of condemnation it seems should be placed on "coffee pot" and "paint brush" methods, being exploited by concerns posing under the dignified name of "Creosoting" and "Wood Preserving" companies. One carload of the meretricious bogus product of these "get rich quick" concerns, by its early proven worthlessness can influence hundreds adversely to their own interest, and to that of the legitimate wood preserving industry. Such concerns should be branded as things apart from our profession, and this association I am convinced should go on record accordingly, and in its practices, and by the roster of its membership live up to such principles."⁸³

At that meeting Logan was elected President of the AWWA. No one defended Lowry or Rueping.

The most vocal and ill-mannered opponent of empty cell methods was William F. Goltra. I will spend some time discussing him and his book not just because he had a colorful, foot-stomping, fist-shaking personality, but because he was very influential in the wood preserving world in these years. Goltra's voice was heard in almost every discussion at AWWA meetings. He edited the wood

⁸¹ [10, 115]

⁸² [11, 125]

⁸³ [11, 146]

preservation statistics for the AWP from 1913 to 1915, and he published several accounts attacking empty cell creosoting on a number of points. These he collected into a book which was published in 1912-1913 titled *Some Facts About Treating Railroad Ties*.

Goltra was General Tie Agent for the Big Four Route from November 1, 1907 to November 1, 1910. In that capacity he observed the workings of Lowry's Shirley/Indianapolis plant which treated the railroad's ties. After leaving the Big Four he established the Goltra Tie Company in Cleveland.⁸⁴

He wrote in the preface of his book

The most demoralizing and dangerous elements to meritorious wood preserving in existence today are concerns which have foisted their worthless processes for treating railroad ties on some of the railroads of this country. I cannot patiently accept the present situation or allow their unwarranted assumptions to go unchallenged.⁸⁵

We will see just what types of dishonesty this man committed besides plagiarizing. He, like Rowe, was offended at the rapid success of Lowry's and Rueping's methods: "The sum of acquired knowledge and the experience of many years is thrown aside scornfully and has been replaced by untried methods having absolutely no record as to their value as preservative treatment."⁸⁶

Goltra's argument against empty-cell treating had several sides. He maintained that sorting timbers by species, time of year cut, or by seasoning is entirely useless. Even in a completely homogeneous lot of ties, some ties will absorb much more preservative than others. For this reason it is impossible to treat the ties in any lot with only 2 1/2 gallons per tie, as Lowry's company claims it did. In reality many ties will have practically no creosote while others will be saturated. Goltra maintained that only treatment to refusal will ensure that all ties are thoroughly treated.⁸⁷

On this point he was going against the standard practice of possibly every timber preserving plant in the U.S., including those run by people opposed to empty-cell treating like Angier, Berry, and Chanute. It was standard practice for ties to be sorted, even if they were to receive a full cell dose of zinc chloride.⁸⁸ Octave Chanute even questioned Goltra's statistics on this point at the 1910 AWP meeting.⁸⁹

Goltra also denounced the Lowry process because it omits the preliminary steaming which is common for ties treated by the Burnett process.⁹⁰ Rowe also complained of this in his letter

⁸⁴ [Goltra I, 70]

⁸⁵ [Goltra I, 5]

⁸⁶ [Goltra I, 5]

⁸⁷ [Goltra III, 22]

⁸⁸ [I, 105]

⁸⁹ [I, 115-116]

⁹⁰ [Goltra I, 75ff]

to Robinson. Steaming was performed just prior to treatment to loosen the remaining sap in the wood, and to accelerate seasoning. Goltra did not even hint in his book that steaming was a highly controversial topic. The problem is that it weakens ties. The debate of its effects would continue for years: by the 1920's the negative effect of steaming on the strength of Douglas fir was known, but the damage done to pine was only fully recognized in 1960.⁹¹

In France full cell creosoted oak and beech ties last at least 25 to 30 years in main line service. This fact is stated in many reports, including Chanute's 1900 address to the ASCE: "...the creosoted oak lasting 25 years, and the creosoted beech being estimated to last 30 years in the track, as evidenced by data for 27 years..."⁹²

Now listen to Goltra: "It is currently reported that in France and England creosoted ties have been known to last thirty years. This is true, but it must be borne in mind that this is not the mean or average life; in fact, we are reliably informed that only two or three ties in one hundred last that long. The average life of oak or beech ties, treated in France and England, with creosote oil, to refusal, adzed and bored and warmed in ovens, prior to impregnation, as near as we can judge from available data, is about fifteen years."⁹³

Goltra was lying. He was twisting the words which echo in engineers' minds about the durability of French ties. Naturally he did not name his supposedly reliable source. The reason he wanted to discredit the record of full cell treating is that if it is believed that the France ties last only fifteen years, then empty-cell creosoted ties cannot last longer.

He attacked the Lowry and Rueping processes directly:

It has been clearly demonstrated time and again that the promoters of the Lowry process cannot do what they claim. The claim is that they can withdraw from the wood any desired amount of oil by means of a "quick high vacuum," applied at the end of the treating operation. The proposition is most absurd, yet many people believe it. The oil is not drawn out by means of a vacuum, but it is forced out by the expansion of the air, which is compressed in the cells of the wood simultaneously with the injection of the fluid.⁹⁴

Of course it is the air which forces out the oil. The quick vacuum ensures that *enough* oil is expelled.

It is a well established fact that the amount of fluid expelled by the expansion of the air, which is compressed simultaneously with the fluid, is directly proportional to the amount of fluid injected in the wood, and neither an initial pressure, as in the Rueping process, or a final vacuum, as in the Lowry process, can materially change the natural phenomenon which always takes place when timber is treated under pressure. The application of a final vacuum to dry ties after treatment while still dripping in the impregnation retort was practised in this country long before Mr. Lowry was in the treating business. It

⁹¹ See the discussions in the 1905 through 1909 AWP A *Proceedings*. [Graham, 19]

⁹² [ASCE 6-01, 505]

⁹³ [Goltra I, 65]

⁹⁴ [Goltra I, 40]

is common practise to apply a final vacuum at nearly all of the plants in this country. No matter how quickly the vacuum is applied or number of inches obtained, the vacuum can only assist the escape of the compressed air. . .⁹⁵

Against Rueping:

Experiments have clearly demonstrated that nothing of the sort is accomplished by an initial pressure and the burden of the proof of the claim is upon the patentee, and the sooner these people get the idea out of their heads that the application of an initial air pressure will diminish the quantity of antiseptic necessary to thoroughly impregnate the timber, the sooner we will have an age of reason in wood treating business.⁹⁶

To sum it up, Goltra claimed that

. . .the Lowry and Rueping processes are as much "full-cell" processes as the Bethell process. There cannot possibly be any distinction between these several processes, because the expulsion of the liquid by the expansion of the air in the wood when the fluid pressure is released occurs the same in all of them. The advocates of these two processes have invented a lot of awe-inspiring words and phrases, such as "full-cell," "empty-cell," "coated walls," "painted walls," "coated cells," "compressed air bubbles," "air plugs" "quick high vacuum," "heavy and long pressure," and other imaginary words, intended to mystify, hoodwink and bamboozle the uninitiated.⁹⁷

Now he must explain just how half the treating industry got hoodwinked and bamboozled. He did this by claiming that "The salesmen of coal tar creosote are more industrious than the zinc salesmen."⁹⁸ Additionally, he complained of the long term, exclusive contracts which Lowry made with railroads. Once signed, the railroad had no way to change treatments.⁹⁹ Goltra's book is full of accusations of conspiracy and concealment of facts by those who profit from empty-cell methods.¹⁰⁰

Here is another example of Goltra twisting facts to meet his needs. In an August 17, 1912 editorial in *Railway and Engineering Review* (reprinted in his book) he quoted old C&EI statistics which showed that of the zinc chloride treated ties laid in 1900, only 2% had been removed by 1910. But, as Goltra well knew, Angier had demonstrated these statistics to be completely inaccurate in January, 1911.¹⁰¹

In every volume of the *Proceedings* of the AWPA is a list of timber preserving plants in the U.S. Through 1912 the processes employed at these plants is part of the included information. We can tell if a plant was using the Bethell, Burnett, Lowry, or Rueping process because it is listed right there. Goltra was editor of the list from 1913 to 1915, and he changed this feature. Instead of

⁹⁵ [Goltra I, 40-41]

⁹⁶ [Goltra I, 52]

⁹⁷ [Goltra I, 56]

⁹⁸ [Goltra IV, 24]. This isn't his quote, but he agreed with it.

⁹⁹ [Goltra IV, 25]

¹⁰⁰ [Goltra I, 40, 42]

¹⁰¹ [Goltra I, 38-39]['11, 123]

providing a description of the processes in use, he included information which tells which processes the plant is *capable* of performing. Because no extra equipment is required for the Lowry process, he lumps under the same category plants which use the Lowry, Bethell, and Burnett methods. The Rueping process requires an extra tank and pump, so they have a separate designation, but they are listed as capable of the Bethell process also. Beginning 1916 no information is provided on method of treatment.

Naturally in his book Goltra included some statistics on the relative economies of the various methods to show that zinc chloride is best. These statistics rely on his estimate of the average life of treated ties, which he gave as follows:

Creosote full-cell to refusal (Bethell): 12 years
Lowry treatment: 10 years
Zinc-creosote: 12 years
Zinc chloride (Burnett): 11 years.¹⁰²

Perhaps he estimated full-cell creosoted ties at 12 years instead of his 15 year estimate for French ties because traffic in the U.S. is heavier than that in Europe.¹⁰² No matter: his estimate is wrong.

Goltra's 10-year estimate for Lowry treated ties is likewise absurd. In the preface of his book he even claimed that Lowry treated ties will decay faster than untreated ties!¹⁰³

His zinc-creosote figure is low also. Only the estimate for Burnett treated ties is accurate. It is no wonder, given these numbers, that he can conclude that the economically sound choice is zinc chloride.

Consider Goltra's language. He called the promoters of empty-cell methods "mountebanks," "impostors," "false teachers," "bogus reformers," "shell gamesters," "grafters"; that they are like the "idolatrous Athenians of old."¹⁰⁴ He wrote these words in the same volume as his statement "It is our desire to give a conservative view, and as we are searching for the truth, we can hardly afford to deceive ourselves or the interested public and those specially concerned."¹⁰⁵

William Goltra must have believed that empty cell treating does not work. He knew that in a very short time the record of Lowry and Rueping treated ties would reveal the truth or falsehood of his statements. Knowing the Truth, he felt that any tactic to discredit empty cell treating,

¹⁰² [11, 124]

¹⁰³ [Goltra I, 6]

¹⁰⁴ [Goltra IV, 6-7]

¹⁰⁵ [Goltra I, 62]

even lying and distorting the record, was legitimate. Unfortunately for him, the methods he was attacking *do* work, as we shall see shortly.

It is easy to poke fun at Goltra, but I do not want to imply that other engineers who opposed empty cell treating were like him. Angier, Chanute, Rowe, and others were, as far as the record shows, honest engineers who were steered the wrong way by improperly conducted experiments. I have seen no evidence that they ever resorted to the kind of back-handed antics characteristic of Goltra.

No railroad which had adopted either the Lowry or Rueping process backed off and returned to zinc chloride, but there were some railroads which delayed the introduction of creosote based on the arguments of men like Angier, Berry, and Goltra (see Table VIII, page 69). Some continued to use Burnett treated ties. Others, as we shall see soon, went first to the Card process, which is a mixture of zinc chloride and creosote injected full-cell. The CB&Q, Angier's road, used the Card and Burnett methods into the 1920's. In 1910 Angier went to work for the Baltimore & Ohio, devoting that railroad to Card's method. Berry's line, the Union Pacific, did not begin using creosoted ties until 1927. The Milwaukee Road, the Missouri Pacific, the Southern Pacific, and the Great Northern are the other railroads I have identified as not adopting creosote until the 1920's.

19. Zinc creosote methods

We have to back up now. Recall what Octave Chanute said in 1900: that zinc-creosote might be economical, but creosote was too hard to get, and the price of lumber was just not high enough. This was an invitation for treating engineers to at least begin thinking about zinc creosote methods.

The history of emulsion processes involving zinc chloride and creosote date back to 1874 when Julius Rütgers introduced his method in Germany. His process involves mixing an 80%-20% solution of zinc chloride and creosote and injecting it in one step into the ties. In the U.S. it was in 1882, just when some Western railroads were beginning to consider tie treating, that Joseph P. Card patented a two-step process in which zinc chloride, then tar oil is injected into wood.¹⁰⁶ Neither Card, nor his subsequent partner Chanute, could make the process work in a satisfactory way. A process similar to Card's which was tried in an 1894 test section on the Galveston, Harrisburg & San Antonio. No other American test involving zinc chloride and creosote is known until 1902.

About 1902 R. L. Allardyce, working at the International Creosoting & Construction plant in Texarkana, developed a zinc-creosote method in which ties are first injected with ZnCl_2 , then a

¹⁰⁶ [ASCE 6-01, 511] ([H&G, 210] claims that it is the creosote which is injected first, and that the date of the patent is 1885. Card was issued patents in both 1882 and 1885, so both sources might be right. [Weiss, 278])

second time with creosote. The process was tested by various railroads in the period 1902-1911, but it was abandoned as too expensive. In order to work properly the ties need to be seasoned between injections, which drove the cost up (see Table XIII, page 71).¹⁰⁷

By 1904 lumber prices had advanced enough to make one-step zinc-creosoting economically viable. That year the Chicago Tie Preserving Co. built and put into operation a plant at Paris, IL for treating ties by Rütgers' process. In 1904-05, and possibly later, they treated 693,324 gum and oak ties for the Big Four Route. This is the first commercial use of a ZnCl_2 -creosote method in the U.S.

Joseph P. Card, Chanute's partner, died before the turn of the century, and his son, Joseph B. Card, became an active tie preservation engineer. Working with the Chicago Tie Preserving Co., he was able to build on the decades of experience of his father and Octave Chanute. J. B. Card, who was involved with the treatment of the Big Four ties just mentioned, experimented vigorously with zinc-creosote methods. The fruit of these investigations was the Card process, which was patented in 1906. It is very similar to Rütgers' process, the biggest difference being the manner in which the two substances are kept mixed.¹⁰⁸

It was not until 1908 that Card's method came into common use, though the Cotton Belt may have been treating ties by Card's or Allardyce's method since 1905. In 1908 the C&NW, the CB&Q, and the Milwaukee Road initiated the use of Card treated ties, and the B&O followed sometime in the period 1908-1911. With high timber prices and the belief that empty cell treating was a fraud, these railroads were looking for a better method than Burnett's.

The CB&Q built their second plant at Galesburg, IL in 1908 specifically to treat ties for Eastern lines by the Card process. Western ties were still treated with zinc chloride at Sheridan, WY. The Milwaukee Road had a similar east-west policy beginning 1908. They purchased their Card treated ties from J. P. Card's newly-formed Chicago Tie & Timber Preserving Co., in Waukegan, IL. The C&NW converted their Escanaba, MI plant from the Wellhouse to the Card process in 1908. When Frank Angier left the CB&Q for the B&O in 1910 he made sure his new line used the Card process. The B&O may have already begun using it in 1908, however (see Table V, page 68).

20. Many railroads abandon the date nail for test sections

In 1905 the recommendation of the AREA to railroads for tie record keeping began as follows:

Section foremen are provided with daily record blanks having space for each day of the month to record the number of treated ties put into track that day, the latter being divided according to the cause

¹⁰⁷ [Weiss, 63]

¹⁰⁸ [Weiss, 61]

necessitating their removal, whether rotten, broken, burned or rail cut. The section foremen must make these records each day. They must also show the year in which these ties were treated as indicated by the stamp and by the dating nail. These records must be entered up each day, and at the end of each month the daily record must be forwarded to the proper superior officer. If no treated ties have been taken out or put into track during the month, section foremen must note so on report.¹⁰⁹

Does that sound like a lot of record keeping? It was, and some railroads experienced great difficulty in getting it completed. F. J. Angier was the first to bring up the inaccurate records provided by date nails, and to offer a solution to the problem. He presented a paper at the 1911 AWPA meeting titled "Some results obtained in this country in prolonging the life of railway cross-ties by preservative treatment as shown by the records that have been kept; and a better method of keeping these records."¹¹⁰

He described the failure of date nails on the Burlington:

After all the trouble and expense of keeping this record, the results show that only 102,000 ties out of a total of more than five and one-half million—less than 2 per cent—had been removed for all causes. On one division this record shows five ties removed in ten years, although 435,000 had been put in track. You say this is absurd: then of what use is this record? It is needless for me to say to you that it was discontinued and another method adopted to ascertain the life of treated ties.¹¹¹

On the C&EI the record was no better:

A statement taken from the Chicago & Eastern Illinois Company's records, made December 31st, 1909, shows only $9\frac{1}{2}$ per cent removed, account of decay, from a total of 111,816 ties treated in the year 1899. From a total of 1,647,605 ties laid during the years 1899 to 1909 inclusive, the records show only 1.1 per cent removed due to decay. This record was made by placing a dating nail in each tie as treated and laid, and depending upon the section foremen to hand in correct reports of ties put in and taken out of track. It has proven an unsatisfactory method of keeping a record and doubtless many inaccuracies occur.¹¹²

He further described the problems on the CB&Q:

From the foregoing it can be readily seen that, for a correct and complete record, everything depended absolutely upon 1,500 section foremen. The average section foreman is not a clerk, and not much dependence can be placed upon him to give in reliable data. Even were he able to make the finest kind of a report, he will be unable to decipher the figures on the heads of thousands of rusty and battered dating nails, and he either guesses at the correct date, or writes in his report "illegible." Then again, no matter how many letters of instruction are written, or how often you talk in person to these men, there will be thousands of ties placed in the track without dating nails in them, and other thousands of UNTREATED ties bearing dating nails which should not have been driven in them.¹¹³

¹⁰⁹ [AREA '05, 769]

¹¹⁰ ['11, 122-130]

¹¹¹ ['11, 122]

¹¹² ['11, 123]

¹¹³ ['11, 128]

But it was not only the inaccuracy of the record kept by date nails which prompted Angier to stop the practice in 1909. He needed a more detailed kind of record:

For the sake of argument, we will assume that every section foreman sends in reports absolutely correct; that whenever he removes a tie he puts in another, and in every case he shows the year treated correctly. Under such conditions, what kind of a record have you when every tie contains a dating nail? A tie is a tie, it matters not whether it is made of oak, pine, chestnut, maple, beech, or any one of the twenty other species of wood. Your record then cannot show you which kind of wood is giving the longest life. There may possibly be some particular wood that is giving only one third or one half the record of other treated wood, but how are you to know from the record? Your record shows that so many ties are taken out each year, some for decay, others for rail-cut, breakages, etc., but does your record say that gum ties are breaking in greater numbers than hickory, or that maple ties are being destroyed much more by rail cutting and spiking than beech or ash ties? These are questions you want answered, and they never can be answered by the present method of putting a dating nail in every tie, and depending on the nail and the section foreman to give you a report.¹¹⁴

Angier found a way out of this record keeping mess. He and A. W. Newton, General Inspector Permanent Way and Structure, devised a plan to institute nineteen special test sections on the CB&Q, one on each operating division, in which ties of various woods and treatments would be laid together. The tests were implemented beginning in the Spring of 1909, and the last was completed in 1910. Generally 1,000 ties were laid out of face¹¹⁵ on each division. Each tie bore date nails specifying the year of treatment, the species, and type of treatment. Twenty kinds of wood were used, and the different treatments employed were Burnett, Card, Creosote (full cell), and untreated. Believing that empty cell creosoting was a fraud, Angier included no Lowry or Rueping treated ties in his tests. Now only nineteen section foremen instead of 1,500 would be depended upon.

There are two features of this plan which make the Burlington test sections different from those which had been conducted before. First, a large variety of woods and treatments were placed in the same stretch of track. In test sections before 1909, railroads usually placed a single wood and treatment together in order to determine the viability of the treatment. Second, nearly identical tests were scattered around the system to find out which combinations of wood and treatment were best for each territory.

There was some precedent for the first feature. In 1897 the Norfolk Southern tested five treatments on five species, and In 1905 Herman von Schrenk established a test section on the CB&Q with two woods treated six different ways. The most important early test of different woods and treatment was the 1902 Pelican, TX test described earlier. But these were all isolated experiments,

¹¹⁴ [11, 128] Some railroads stamped this kind of information into ties beginning no later than the mid-teens, but only so ties could be sorted properly for treatment and sent to the right track. The stamps served no purpose after the ties were inserted. [W-P Apr-Jun '15, 27-28][W-P Oct-Dec '15, 69]

¹¹⁵ that is, they were laid in a continuous stretch of track at the same time

which held little influence on railroad tests in general. The second feature was new. No railroad had ever placed similar test sections on different parts of its system.

It was the price of timber, not the availability of new treatments, which was responsible, along with the failure of the date nail, for the introduction of the CB&Q tests. What Angier did was to open the door to quite a few inferior woods which had hitherto been ignored.

He finished his 1911 talk by stating the savings that such a specialized record would provide.

To put a dating nail in every tie treated on the Burlington (about 2,300,000 per year) would cost in round figures \$8,000.00 a year for labor and material. In ten years this would amount to \$80,000.00. To make the special tests, placing 5,000 ties on each division¹¹⁶ once during the ten years, would cost about \$5,000.00. The savings in ten years would be \$75,000.00, plus interest.¹¹⁷

Many railroads were swayed by Angier's statements and efforts. Very quickly one railroad after another abandoned the date nail in favor of specialized test sections. The Santa Fe was first to follow. In 1910 they stopped using date nails except on 26 section foreman's districts. The nature of the Santa Fe tests was different. Instead of laying ties of various woods and treatments out of face, they decided to maintain the same type of record which they had endeavored to keep on the entire system, only in miniature. They kept track of ties inserted and removed in the natural course of renewals in these 26 test sections. Special tests of treated and untreated ties were also made, but their record was kept separate.

Table XI (page 70) lists railroads I have found which stopped using nails and instituted CB&Q-style tests on the years following 1909. By 1914 at least twelve railroads were concentrating their attention on test sections. Some of these lines, like the C&EI and the Monon, established only one test, because their territory was small. Most railroads did not test such a wide variety of woods as the CB&Q.

This movement found its voice in 1911 in an official recommendation by the Wood Preservation Committee of the AREA. They advocated exactly what Angier did on the CB&Q. The use of nails in all ties should cease, and railroads should concentrate on test sections. In fact, every argument put forth by Angier, and every change he made on the Burlington, is contained in the recommendation. He may have written it.¹¹⁸

There were other problems with nails. Recall that the date nail was introduced because railroads had a difficult time with stamps in the ends of ties. They believed the date nail to be a more permanent mark. Now we hear Angier saying that the nails become rusty and defaced. F. S. Pooler

¹¹⁶ He is stating the extreme case here—most divisions received 1,000 ties.

¹¹⁷ [11, 130]

¹¹⁸ [AREA '11 III, 434]

of the Milwaukee Road said after Angier's talk "...roadmasters tell me the men cannot read these figures [on date nails], and in some cases probably do not take the pains to clean off the top of the nail."¹¹⁹

Some railroads disagreed with Kittredge's suggestion that the nails be driven by the section gang, because the nails would be driven into the wrong ties, or would not be driven at all. Mistakes of this kind were occurring on the Wabash by 1905,¹²⁰ and plagued both the C&EI and the L&N in their first years of dating ties with nails.¹²¹ C. W. Berry of the Union Pacific wrote in 1904 that nails should be placed in ties before they leave the treating plant.¹²² Angier had his men on the CB&Q drive nails at the track from 1899 to 1907, after which they switched to the UP practice.¹²³

While nearly every Western and Midwestern railroad was persuaded to quit using nails after 1909, several companies in the Northeast were satisfied with date nails. In 1914 the New York Central believed that 90% of the reports on the lives of their ties were correct, and they intended to continue using a date nail in every tie.¹²⁴ The Buffalo, Rochester & Pittsburgh kept a record of every tie on its system with date nails beginning 1910. Up to 1925 they had tracked the lives of over a million and a quarter ties. Their record, which was quite good, appeared in a 1926 issue of *Railway Age Gazette*.¹²⁵ The Delaware, Lackawanna & Western was also happy with its record from nails¹²⁶ (see Table XII, page 71). The only Western railroads I have identified which continued to use date nails in all treated ties are the Union Pacific and Southern Pacific.

As for Angier's complaint that nails only recorded the date, there were a few railroads before 1920 which used special nails to give more information. The CB&Q itself was using a second nail bearing the letter "H" in 1903 in ties treated by the Hasselmann process. Several companies used nails with different shaped heads to indicate treatment. The Santa Fe in 1904 began using nails with diamond shaped heads (and shanks) in untreated ties. In 1905 the Big Four began using diamond nails in ties treated by the Lowry process at the Shirley/Indianapolis plant, while round nails were used in other treated ties. The El Paso & Southwestern (1908), Oregon Short Line¹²⁷ (1910), New York Central (1911), and Chicago & Eastern Illinois (1912) established similar plans. On the Rock

¹¹⁹ ['11, 136]

¹²⁰ [AREA '07, 495]

¹²¹ [AREA '22, 1167]

¹²² [AREA '04, 70]

¹²³ ['11, 127]

¹²⁴ ['14, 402]

¹²⁵ [RAG 1-9-26, 175-180]

¹²⁶ [AREA '22, 1167][DNC, 33]

¹²⁷ or its subsidiary the Oregon RR & Navigation Co.

Island round, diamond, and square nails were used with different treatments beginning 1907/08. Nails on the Milwaukee Road carried an extra letter to indicate treatment from 1908 to 1910.

On the Great Northern an extra letter was used to specify the wood in the period 1904-1911, and the Pennsylvania did the same from 1909 to 1911. From 1910 to 1932 the Buffalo, Rochester & Pittsburgh used two nails, one bearing the date and the other with letters indicating the species of wood.

21. Vindication of empty cell methods

In 1912 Goltra wrote "The value of any treatment can be judged only by a careful record of conditions from year to year."¹²⁸ It was the compilation of such records which led to the general acceptance of empty cell methods. In 1915 the AWPAs published in its annual *Proceedings* a table of the results of test sections on various railroads. The list appears in a fold-out table. This single page covers ties from all over the U.S., with treatments ranging from creosote to zinc chloride to copper sulphate to mercuric chloride. Some Rueping and Lowry tests are included. On the Illinois Central, of 6,080 Rueping treated ties laid in 1907, two were reported to have been removed by 1914. The other empty cell tests also had a strong record.¹²⁹ The same year the AREA published a six page list of tests in fold-out tables, along with a two page summary organized by treatment. There the Rueping tests of the Galveston, Harrisburg & San Antonio, the Mexican Central, and the Frisco showed very promising results—only three out of 1,454 ties had been removed, and all had been in service at least seven years.¹³⁰

These pages attracted some attention, and for the 1916 AWPAs *Proceedings* the Committee on Service Tests of Cross Ties put together a comprehensive 72-page report on vast numbers of tie tests throughout North America, and they even included many foreign tests. The table is arranged by wood, then is broken down by treatment. Many Rueping tests are included, and a few Lowry tests. It had been a decade since the Big Four and the Santa Fe began using creosoted ties, and from the collected data the Committee wrote

Empty Cell Creosote Treatment.—This tabulation includes records on ties treated respectively by the Rueping and Lowry processes. It is of interest to note that of the total of 54 records of ties treated by the Rueping process none are yet completed.¹³¹ All of the records are covered by seven railroads, the I. C., and the A. T. & S. F. furnishing most of the records. The longest service so far reported is no removals of 146 pine ties after $9\frac{1}{2}$ years in the Mexican Central Railway. The remaining records are on ties which have been in place from one to 11 years. The removals vary from nothing up to about 9%.¹³²

¹²⁸ [Goltra I, 5]

¹²⁹ ['15, table]

¹³⁰ [AREA '15, table, 879-880]

¹³¹ i.e. not all ties have been removed from the track yet.

¹³² ['16, 259-60]

They continue by describing the Lowry records, which also showed a long life. Elsewhere in the 1916 volume we find "the empty cell treatments [are] suitable for all pine and other easily treated track ties used in moist climates, under service conditions which give a mechanical life in keeping with the anticipated life for decay..." But two paragraphs up they acknowledged that there were still people who were opposed to the treatments: "While definite deductions may be drawn from theoretical consideration of the two processes [Lowry & Rueping] and divergent opinions are held, it is not for the Committee to pass judgement, and the fact remains that both processes have received wide recognition."¹³³

No hint that anyone had ever questioned empty cell methods appeared after this in the literature. The AWPB buried its mistake in silence.

Extensive lists of test sections also appeared in the 1917 and 1920 AWPB *Proceedings*, as well as in subsequent AREA volumes. The record of Lowry treated ties on the Big Four, published in 1926, showed an average life of over twenty years, as calculated (ironically) by the Goltra method.¹³⁴

22. The wartime creosote shortage

If the vigorous arguments against Lowry's and Rueping's processes did not convince any railroad to stop using the methods, the creosote shortage caused by the First World War did. Even though domestic production was on the rise, much of the creosote used in the U.S. was still imported from Europe. Railroads could not afford to diminish the amount of the oil used in bridge piles and timbers, but ties could be treated with zinc chloride again, and that is exactly what happened on many roads.

I have information on only a few railroads which were forced to switch from creosote to zinc chloride. In mid-1914 the Fort Worth & Denver City (FW&DC) reverted to ZnCl_2 , and the Santa Fe readopted the Burnett process in 1915. The C&O, which had begun using Lowry treated ties in 1915, switched to zinc chloride in 1920. The Pennsylvania simply cut back on tie insertions in these years. Several other railroads either cut back or switched.¹³⁵ The rarity of date nails from the late teens on the Erie and on the New York, New Haven & Hartford could be due to a cutback in creosoted ties. Both these companies probably previously used ties treated by the Rueping process.

The Santa Fe continued to treat bridge timbers with creosote. In an effort to improve the Burnett process, they conducted large tests of ties injected with zinc chloride mixed with other

¹³³ [16, 179]

¹³⁴ [WPN 11-26, 148]

¹³⁵ Chicago & Northwestern; Illinois Central; Los Angeles & Salt Lake; Michigan Central; Pittsburgh & Lake Erie; Rock Island Lines.

substances: crude oil, petroleum, and a creosote-petroleum mixture.¹³⁶

Some companies using Lowry treated ties only cut back a little, if at all. From published statistics as well as nail finds it is clear that the New York Central, the Big Four, the Delaware, Lackawanna & Western, and the Lehigh Valley continued to use large numbers of creosoted ties throughout the late teens. The Buffalo, Rochester & Pittsburgh, which by about 1913 may have switched to an empty cell process, also used creosote in this period, though they did use about 200,000 zinc chloride treated ties at one time¹³⁷ (see Table XII, page 71).

23. 1920's: revival of creosote, with coal tar or petroleum

It was not until around 1923 that the creosote supply was restored. We know that that year the Santa Fe, the C&O, and the FW&DC returned to creosoted ties. Also in 1923 the Southern Pacific finally abandoned zinc chloride and began treating ties by the Rueping process. The Pennsylvania had begun again to use large numbers of creosoted ties in 1922.

Gradually during the 1920's those railroads which had shunned creosote began using empty cell treated ties. The SP was the first of these, and by the end of the decade the Baltimore & Ohio, the Burlington, the Great Northern, and Milwaukee Road all began to use creosoted ties. Some of these lines continued to treat large numbers of ties with zinc chloride, however.

In New England the New York, New Haven & Hartford and the Boston & Maine began using creosoted ties in large numbers in 1922. In this case it was not solely the availability of creosote. The reason given in an AWPAs report was this: "The shift in source of supply which follows changes in transportation costs is exemplified in recent developments in the New England States. Most of you probably know that the Boston and Maine Railroad and the New York, New Haven and Hartford Railroad have undertaken to give preservative treatment to their ties and timbers. They immediately turned to local sources of supply of woods they had not heretofore been using. They did not treat them before because the cost of pine ties shipped from the South Atlantic States had not been high enough to justify the use of local woods with the price of preservative added."¹³⁸

Another report attributes the construction of the New Haven plant to a blight of the chestnut tree, which had up to then been used untreated.¹³⁹ Whatever the reason, local conditions affected all New England roads. The Boston & Albany began using large numbers of treated ties in 1923/24, and the Barre & Chelsea/Montpelier & Wells River began about 1925.

¹³⁶ ['41, 196]

¹³⁷ [RAG 1-9-26, 177]

¹³⁸ ['23, 216-217]

¹³⁹ [NH]

The Canadian National was organized out of several smaller Canadian railroads in 1923, and they began the slow process of converting from untreated ties to creosoted ties the next year. In this case the shift to creosote came as much from corporate reorganization as it did from the new availability of the chemical.

George J. Ray of the Lackawanna stated the case for roads in the Southeast in 1928: "In many parts of the South, where yellow pine ties are extensively used, the normal life of the untreated tie is very much less than it is in our Northern climate. The cost of the tie is low compared with the price of ties delivered along Northern lines. ...there is no reason why a properly treated tie should not last just as long in our Southern climate as they do in our Northern climate, so far as the matter of decay is concerned. It is my belief that the saving to be accomplished by treating yellow pine ties in the South will be found to be greater than can be expected in the North."¹⁴⁰ Most railroads in the South were still using untreated ties when Ray spoke, though the N&W had switched to creosote treatment in 1921, and the Southern was evidently treating its ties by the early 1920's. The Atlantic Coast Line built a tie treating plant in 1912, but judging from date nail finds they may not have treated large numbers until 1930. By the same reasoning the use of creosoted ties on the Seaboard Air Line might not predate 1928.

From Histograms I and II (page 73) it is apparent that many, many railroads began using treated ties in the 1920's. Even short lines like the Fonda, Johnstown & Gloversville in New York and the Copper Range in Michigan went to the expense of treatment. This new found popularity came with a price: the creosote supply, though restored by 1923, was not enough to keep up with the new demand. This may be the reason several of the larger lines continued to use zinc chloride into the 1930's. As of 1935, for instance, the Great Northern was still treating the majority of its ties with zinc chloride.

By the 1920's railroads were mixing either coal tar or petroleum with their creosote. The empty cell processes enable treating engineers to obtain a thorough penetration of the wood using little creosote, and diluting the oil with another liquid helps stretch it even further. The earliest record I have found of the use of a creosote-coal tar solution is on the Rock Island in 1908. It seems from test sections that the railroad adopted the combination for general use when they switched to creosote in late 1907. By similar reasoning, the Northern Pacific began using a creosote-coal tar mixture at the same time.¹⁴¹ Such emulsions came into general use on the C&EI possibly as early

¹⁴⁰ [28, 121]

¹⁴¹ Later reviews of the use of coal tar give 1908 as the first year in which the mixture was used. See in particular Hermann von Schrenk's article "An Historical Statement on the Use of Straight Coal Tar for Tie

as 1912. We have definite information that a creosote-coal tar solution was the treatment used by the C&O, the Detroit & Mackinac, Lehigh Valley (beginning 1920), and the Toronto, Hamilton & Buffalo.

The Santa Fe had begun experiments with a mixture of creosote and petroleum as early as 1909. Different proportions were tested in the ensuing years, and when the railroad returned to the Rueping process in 1923 they used a 30%-70% creosote-petroleum mixture. Railroads which began using a solution of creosote and petroleum in the 1920's include the CB&Q, C&NW, Great Northern, Southern Pacific, and Union Pacific.

I lack information on other railroads, but it seems that in generalities treated at American Creosoting Co. plants (using the Lowry process) employed creosote-coal tar mixtures while ties treated by the Rueping process were more likely to be treated with creosote-petroleum.

24. Other treatments

An insignificant number of ties were treated with methods and chemicals other than empty-cell creosote and zinc chloride in the first decades of the century. I will mention some of them here for the sake of being complete.

In 1906 the Oregon RR & Navigation Co. began treating ties by the Bethell (full-cell) process. The process became somewhat popular in 1909-1912 with at least six more lines joining in (see Table VI, page 69). We can guess that these railroads did not believe empty-cell methods work, and that they wanted something better than the Card method. Probably all of these lines switched to the Lowry or Rueping method by the 1920's.

In the period 1910-1919 many ties were treated with water gas tar. The Public Service Railway Company of New Jersey used the substance from 1910 to at least 1914. The B&O, CB&Q, C&NW, Pennsylvania, Reading, and the Forest Products Lab used or tested water gas tar treated ties mainly in the period 1914 to 1919. Use of the chemical for treating ties seems to have died after 1914, however. In its peak year fewer than 7% of all treated ties received water gas tar.

Tests of ties treated with zinc-meta-arsenite (ZMA) were conducted by the Forest Products Lab (1928), CB&Q (1929), Illinois Central (1929), and Canadian National (1930). It was used regularly along with creosote and zinc chloride by the Great Northern beginning 1932. To 1936 ZMA treated ties never accounted for more than 2% of all treated ties in the U.S.

Carbolineum was tested by the Honolulu Rapid Transit (1900-1903), Mexican Central (1905), Oregon RR & Navigation Co. (1908), and Soo Line (1913-1914). Other 20th century preservatives

Treatment" in [AREA '49, 387-400].

include cresol-calcium, cresoil, sodium fluoride, and Penta, the latter being a pesticide tested in the 1940's (see Table XIII, page 71).

25. Boring & adzing machines

Along with all the attention paid to preventing decay came increased efforts to reduce the mechanical wear of ties. It is pointless to creosote a tie which will be badly rail cut after five years, or if the spikes will wear loose in a short time. More and more railroads were using tie plates, and beginning about 1911 some railroads installed boring and adzing machines in their treating plants. With these machines spike holes were pre-bored, and the seats for the ties plates were adzed to a level, flat surface.

One advantage of a boring and adzing machine is that with the ends of the ties cut flat, information can be stamped there. Goltra described machine stamping: "a pneumatic branding device, consisting of two opposite cylinders with pistons, provided with dies for stamping dates, or any other information, and controlled by automatic air valves, may be placed directly behind the boring spindles and so timed to the machine feed that when the tie moves to the proper position, the dies advance and leave their deep sunken impression in both ends of the tie."¹⁴²

Unlike the hand stamps of the 1800's, machine stamps are nearly permanent. Not only was the stamp deeper, but it was placed on a more even surface. Also, the use of mauls and picks in track work had basically stopped, making stamps last longer.¹⁴³

Not only the year of treatment, but other information, such as species, grade, weight of rail, and treatment specifications can be stamped into the ties. This answers to Angier's complaint about the limited information conveyed by nails, and it led to a decline in the creative use of odd date nails recording special information. The railroads which continued to use different head shapes and extra nails did so for convenience. All the necessary information could be found stamped in the ends of the ties.¹⁴⁴

In 1911 the Delaware, Lackawanna & Western, the Northern Pacific, and the Santa Fe became the first railroads to employ such machines. The DL&W was using screw spikes, which require pre-bored ties. In 1912 a boring and adzing machine was installed in the Port Reading, NJ plant, which treated ties for the Central RR of New Jersey and the Reading. Boring and adzing machines began working on ties for the C&O in 1925, and for the Illinois Central in 1923 (at Grenada, MS) and 1928 (at Carbondale, IL).

¹⁴² [Goltra II, 82]

¹⁴³ [P'14, 406-407]

¹⁴⁴ See CB&Q for a detailed explanation of the machine stamps on their ties in the 1950's.

In a questionnaire dated June 15, 1921 and answered by 82 railroads, only four were machine adzing their ties. These were the CRR of NJ, DL&W, NP, and Santa Fe.¹⁴⁵ In 1932 forty-one railroads responded to another questionnaire. Again four of these branded their ties by machine, while one was stamping information by hand.¹⁴⁶ Evidently two of the six railroads named above did not respond to this one. It seems, then, that as of 1932 no other railroads utilized the machines. Then Hunt and Garratt wrote in 1938 "Adzing and boring machines are a necessity in practically every fully equipped tie-treating plant..."¹⁴⁷ Tentatively, then, it appears that these machines came into common use during the 1930's.

26. 1920's: revival of the date nail

In 1921 the Santa Fe returned to using date nails in all treated ties. The reason for this can be seen in this short discussion at the 1923 AWP meeting initiated by William Steen: "Which is better, a dating nail or a stamp?" S. D. Cooper of the Santa Fe responded "I think they are both of great advantage, because in a dry country where you put in a pine tie the tie is liable to check and you are liable to lose the nail, but you never lose the mark on the end of the tie. Of course, the advantage of the nail on the top of the tie is that it makes the inspection so much quicker. If there is any doubt the stamping is as distinct as the date it was put in."¹⁴⁸

Another minor reason it was desired to resume the use of date nails on the Santa Fe is that sometimes ties would not be used until one or more years after being treated, so the date stamped in the end would not be the date the tie was inserted in the track.¹⁴⁹

The Santa Fe, as we saw, was a special case in that they were already stamping information in their ties at this time. For the majority of American railroads in the early 1920's, the lack of date nails meant no record at all for ties outside test sections. In 1922 the Tie Committee of the AREA voted to reinstate its recommendation that date nails be used in all treated ties:

The Committee is almost unanimous on the question of dating all treated ties that go into the track and we hope that there will be more of it done. Like all other programs of checks on railroad work there have been failures, but these failures are largely due to lack of initiative or lack of control. We have found railroads that have been successfully using dating nails for seventeen years, and who would not give them up. They figure that the moral risk that a section foreman wants to assume if he takes out treated ties before they have given their full service will be much greater if he knows that there are dating nails in those ties, and that they will be checked up by someone in authority to see why the ties did not stay their full life.¹⁵⁰

¹⁴⁵ [AREA '23, table]

¹⁴⁶ [AREA '32][DNC, 36-37]

¹⁴⁷ [H&G, 364]

¹⁴⁸ ['23, 331][DNC, 337]

¹⁴⁹ [SFe, 3]

¹⁵⁰ [AREA '22, 1164-65]

The one member who prevented unanimity on the subject was Frank Angier. He still maintained that test sections are the only way to get reliable records, and he vehemently defended his ideas. But the bad results of two railroads did not prevent other engineers from seeing the value in dating every treated tie.

The "moral risk" in the recommendation refers to the psychological effect of date nails on the section men. In response to an AREA questionnaire Hermann von Schrenk wrote in 1926 "I have had any number of experiences with the section men who feel that the dated ties will last for so many years that they will not remove them. The increase of interest of the men in dated ties brings about a method of handling which undated ties would hardly receive."¹⁵¹ In fact, twenty of the thirty-two engineers who responded in a definite way to this particular question agreed that the men responsible for determining tie removal will give more consideration to ties with date nails.¹⁵²

Just as those railroads which had embraced zinc chloride slowly switched to creosote in the 1920's, many lines which had abandoned the date nail reinstated their former policy. The C&NW took up the use of nails again in 1923. The Great Northern joined in about 1924, and in 1927 the Milwaukee Road returned to nails. In 1928 the CB&Q also reverted to their former policy, but judging by nail finds, they returned to the practice of using nails only in test sections in 1931.

Even with automatic branding machines stamping all kinds of information into the ends of ties, the kind of record kept for the vast majority of ties was essentially the same as that of the late 1800's on the Southern Pacific, Santa Fe, and Rock Island. The dates on ties removed from track was recorded, along with information on the cause of removal and sometimes the species. This was enough, since few lines were using more than one treatment. The Big Four and the Buffalo, Rochester & Pittsburgh published their results from such a record in 1926.¹⁵³

27. The 1930's and after

The number of ties treated annually in the U.S. rose dramatically during the 1920's, but suffered a severe plunge after 1929. The depression hit the railroads as hard as any industry, and its effect can be seen clearly in Histograms III and V (pages 74 & 75). Recovery began in 1934, and any decline after that can be attributed to two factors: (1) with the percentage of treated ties in track on the increase, renewals were fewer, and (2) the dwindling mileage of U.S. railroads after World War II. The use of untreated ties declined from nearly 50 million in 1921 to about 12 million in 1930. This decline was slowed during the depression. Untreated tie insertions were practically nil

¹⁵¹ [AREA '26, 708]

¹⁵² [AREA '26, 705-709]

¹⁵³ [WPN 11-26, 148][RAG 1-9-26, 175-180]

after 1950.¹⁵⁴ One reason some major lines like the Santa Fe continued to use small numbers of untreated ties into the 1950's is that on some tight main line curves, where ties are often removed due to mechanical wear before they have a chance to decay, treatment would be a waste.

Into the mid-1930's the use of date nails mirrored tie preservation. There was a great rise in the use of nails in the 1920's, and a drop during the early depression. There was another drop coinciding with World War II. After 1950 nail use went through a long, steady decline terminating in 1971. After that practically no railroad has used date nails in North America. My guess is that two factors contributed to this decline: the perfection of treatment methods, and the reliance on stamps for records.

To this day the AWPA still recommends empty-cell creosoting for crossties. Their specifications call for six to eight pounds per cubic foot, which is really no different from the treatment received by Big Four ties in 1905. Other preservatives continue to be tested, and in some cases adopted under special circumstances, but the Lowry or Rueping creosoted tie has remained the standard for over seven decades.¹⁵⁵

The average tie in 1900 lasted 12 years. By 1969 this life had increased to about 35 years, despite a great increase in both the speed and the weight of traffic.¹⁵⁶ It took over fifty years, beginning in 1880, for U.S. railroads to fully realize the necessity and value of treating ties with creosote. Certainly if railroads had conducted long-term price planning in the late 1800's they would have found that treating ties early would lead to savings in the long run. Even when untreated ties were the most economical choice, such a policy of using and discarding large amounts of wood necessarily leads to a bad shortage and high prices later on. As with any natural resource, proper management only becomes an issue for serious consideration when there is little left to manage. There were railroad officials who saw this crisis approaching, and who warned that this reckless stripping away of our natural resources would lead to problems, but for any railroad under financial constraints, the short-term solution was almost always the most attractive.

¹⁵⁴ [RA 5-86, 44]

¹⁵⁵ AREA 1997 *Manual for Railway Engineering*, 3-6-10, 3-9-4

¹⁵⁶ [Graham, 10]

Table I. Early tie treating experiments

<u>Railroad</u>	<u>Date</u>	<u>Chemical</u>	<u>Process</u>
South Carolina	1830-33	Tar & Turpentine	
South Carolina	1838-41	HgCl ₂	Kyan
South Carolina	ca. 1838-42	CuSO ₄ & FeSO ₄	Earl
Northern Central	1838	HgCl ₂	Kyan
Louisa	1840	HgCl ₂	Kyan
Philadelphia & Columbia	1840	Lime	
Baltimore & Ohio	1842	HgCl ₂	Kyan
Boston & Providence	1844	HgCl ₂	Kyan
Old Colony	1845	HgCl ₂	Kyan
Eastern	1846	HgCl ₂	Pressure
Providence & Worcester	1847	HgCl ₂	Kyan
New York Central	1849	HgCl ₂	Kyan
Baltimore & Ohio	1850	Lime	Open tank
Belvedere Delaware	1850	Salt	
Reading	1851	HgCl ₂	Kyan
Reading	1852	Tar	
Reading	1854	Coal tar	No pressure
Union RR of Cambridge	1855	ZnCl ₂	Burnett
Boston & Providence	1856	HgCl ₂	Kyan
Vermont Central	1856-59	ZnCl ₂	Burnett
Boston & Albany	1860	ZnCl ₂	Burnett
Erie (mostly bridge timbers)	1861-69	ZnCl ₂	Burnett
Philadelphia, Wilmington & Baltimore	1863-?	ZnCl ₂	Burnett
Union Pacific	1865-66	ZnCl ₂	Burnett
Rock Island Lines	1866	ZnCl ₂	Burnett
Reading	1867	ZnCl ₂	Burnett
Lehigh & Susquehanna	1867-68	ZnCl ₂	Burnett
Lehigh & Susquehanna	1867-68	Semi-refined oil	
Chicago, Burlington & Quincy	1868-69	Creosote	Seeley
Hudson River	1869	FeSO ₄ & CuSO ₄	Hamar
<i>Cleveland, OH</i>	1870	CuSO ₄	Thilmany ['16, 328]
Memphis & Charleston	1871	Salt, arsenic, HgCl ₂	Foreman
Chicago & North Western	1871	Salt, arsenic, HgCl ₂	Foreman
Illinois Central	1871	Salt, arsenic, HgCl ₂	Foreman
Rock Island Lines	1872	Creosote	Seeley
Central RR of New Jersey	1875-76	Creosote	Hayford
Central RR of New Jersey	1875/76	Petroleum	
Central RR of New Jersey	1875/76	ZnCl ₂	Burnett
Houston & Texas Central	1877	Creosote	Bethell
Wabash	1877-78	CuSO ₄	Thilmany
Reading	1878	Creosote	Hayford
Boston & Providence	1878	Creosote	Hayford
Louisville & Nashville	1878	Creosote	Bethell
Louisville & Nashville	1879	Creosote	Bethell
Central RR of New Jersey	1879	Creosote	Bethell
Baltimore & Ohio	1879	CuSO ₄	Thilmany
Lake Shore & Michigan Southern	1879	CuSO ₄	Thilmany
New York, Pennsylvania & Ohio	1879	CuSO ₄	Thilmany
Pennsylvania	1879	CuSO ₄	Thilmany
St. Louis, Iron Mountain & Southern	1879	Zinc tannin	Wellhouse
Illinois & St. Louis	1880	Zinc tannin	Wellhouse

New York, New Haven & Hartford	1880	Creosote	Bethell
Indianapolis & St. Louis	1880	Zinc tannin	Wellhouse
Chicago & Alton	1880	Zinc tannin	Wellhouse
Houston & Texas Central	1880-82	Creosote	Bethell
Central RR of New Jersey	1880/82	Creosote	Bethell
New York, New Haven & Hartford	1881	CuSO ₄ & barium	
Santa Fe	1881-82	Zinc tannin	Wellhouse
Erie	1882	Zinc tannin	Wellhouse
Eastern	1881-91/2	HgCl ₂	Kyan
Manhattan Elevated (Metropolitan)	1883		Vulcan
New York Central	1884	Creosote	Bethell
Santa Fe	1885	ZnCl ₂	Burnett
Lehigh Valley	1886 (-90?)	Creosote	Bethell
Atlantic Coast Line	1887	Creosote	Bethell
Chicago & North Western	1888	Zinc tannin	Wellhouse
New York, New Haven & Hartford	1888	Creosote	Bethell
Pennsylvania	1889	Creosote	Bethell
Duluth & Iron Range	1890	Zinc tannin	Wellhouse
Pennsylvania	1891	Zinc tannin	Wellhouse
Central RR of New Jersey	1891-92	Creosote	Bethell
Illinois Central	1891-93	ZnCl ₂	Burnett
Delaware & Hudson	1892		Vulcan
Delaware & Hudson	1892	Zinc tannin	Wellhouse
Pennsylvania	1892	Creosote	Bethell
Pennsylvania	1892	ZnCl ₂	Burnett
Chicago, Burlington & Quincy	1894	ZnCl ₂	Burnett
New York, New Haven & Hartford	1894	Dead oil of coal tar	
Galveston, Harrisburg & San Antonio	1894	ZnCl ₂ & covered with creosote	
Galveston, Harrisburg & San Antonio	1894	ZnCl ₂ & creosote	
Galveston, Harrisburg & San Antonio	1894	Tar oil	
Pennsylvania	1894-98	Creosote	Bethell
Pennsylvania	1896-99	ZnCl ₂	Burnett
Unknown RR	1896	Carbolineum	[AREA '02, 116]
Boston Elevated	ca. 1897-1903	Carbolineum	
Pennsylvania	1897	Zinc tannin	Wellhouse
Norfolk & Southern	1897	Zinc tannin	Wellhouse
Norfolk & Southern	1897	ZnCl ₂	Burnett
Norfolk & Southern	1897	Creosote	Bethell
Norfolk & Southern	1897		Vulcan
St. Louis Bridge & Tunnel	1897	Carbolineum	dipped, painted
Pennsylvania	1899	Zinc tannin	Wellhouse
Oregon Short Line	1899	Salt	

There may be many other early uses of treated ties I have not yet found.

Table II. Wood preserving plants operating in North America in the period 1880-1904.

Year	Location	Company	Process	Primary Wood	No. of Retorts
1848	Lowell, MA	Locks & Canal Co.	Kyan	Spruce, etc.	2
<i>Switched to the Burnett process in 1850, and back to Kyanizing in 1862. Otis Allen & Son is the company named as owner beginning 1904. This plant treated mainly canal and bridge timbers.</i>					
1865	Somerset, MA	Old Colony RR	Bethell		1
<i>First creosoting works in the U.S. Built to treat bridge piles. Still in operation in 1885, but abandoned before 1901.</i>					

Year Built	Location	Company	Process	Primary Wood	No. of Retorts
ca. 1870	Defiance, OH	American Wood Preserving Works	Thilmany		
	<i>Treated paving blocks, bridge timbers, building timbers, and railroad ties. This plant treated ties in the Thilmany tests listed in Table I, and operated at least to 1885. It was gone by 1901.</i>				
*1880	Portsmouth, NH	Eastern RR	Kyan	Spruce, etc.	4
	<i>Kyanized ties from the opening of the plant in April, 1881 to 1891/92. Afterward no ties were treated. The plant was owned by Otis Allen & Son as of 1903.</i>				
1876	W. Pascagoula, MS	Louisville & Nashville	Creosote	Pine, etc.	2
	<i>Began creosoting bridge piles about March 1, 1876. Burned 1902, and rebuilt with three retorts.</i>				
*1876	Houston, TX	Houston & Texas Central	Creosote	Pine	
	<i>Possibly rebuilt or enlarged in 1883. Began treating ties by the Burnett process in 1887 for the Southern Pacific, moved to a different location near Houston in 1889, and rebuilt in 1890-91. The rebuilt plant is listed below under 1891.</i>				
1878	Long Island City, NY	Eppinger & Russell	Creosote	Pine, etc.	4
*1879	St. Louis, MO	St. Louis Wood Preserving Co.	Wellhouse		
	<i>This plant, run by Joseph P. Card, treated the Wellhouse experimental ties from 1879-1882 listed in Table I. The plant was probably closed at the time Card and Chanute started their Chicago plant in 1886.</i>				
1879	Slidell, LA	New Orleans & North Eastern	Creosote	Pine	1
	<i>Built for creosoting bridge timbers. Abandoned 1883, and revived in the latter part of 1902 by the Southern Creosoting Co.</i>				
1881	Portsmouth, VA	Wyckoff Pipe & Creosoting Co.	Creosote	Pine	1
<1883	St. Louis, MO	American Wood Preserving Co.	Gypsum		
	<i>"Our company has lately purchased the creosoting works of the former Western Wood Preserving Company, and having acquired the patent of E. Hagen for treating wood with tincture of zinc chloride and gypsum in one solution and charge, we now apply this process to railroad ties, car roofing and siding, etc..." (From a letter dated 11-3-83.)</i>				
1884	Seattle, WA	Colman Creosoting Co.	Creosote	Pine	2
*1885	Las Vegas, NV	Atchison, Topeka & Santa Fe	Wellhouse	Pine, etc.	2
	<i>Enlarged to three retorts before 1900.</i>				
*1886	Chicago, IL	Card & Chanute	Wellhouse	Hemlock	4
	<i>This plant, run by Octave Chanute and Joseph P. Card, was built to treat Rock Island ties. The company was also known as the Chicago Tie Preserving Co.</i>				
1886	Laramie, WY	Union Pacific	Wellhouse	Pine	2
	<i>Closed in 1887.</i>				
1886	Perth Amboy, NJ	Lehigh Valley	Creosote		
	<i>Built to treat piles and timbers, but they did treat a few experimental ties. They closed the plant in the latter part of 1898, and subsequently leased it to the Hasselmann Co., which probably began to treat wood by the Hasselmann process in 1901. After 1902 this plant does not appear in the lists.</i>				
1888	New Orleans, LA	New Orleans Wood Preserving Co.	Creosote	Pine	1
1889	Oakland, CA	Southern Pacific	Creosote	Pine, etc.	2
1890	Perth Amboy, NJ	U.S. Wood Preserving Co.	Creo-resinate	Pine, etc.	4
	<i>Treated mainly paving blocks.</i>				
*1891	Houston, TX	Southern Pacific	Burnett	Pine, etc.	5
1892	Galveston, TX	Galveston Creosoting Co.	Creosote	Pine	1
1893	Bay City, MI	Michigan Pipe Co.	Creosote?		1
*1894	California & Oregon	Southern Pacific	Burnett	Pine, etc.	2
	<i>Portable plant.</i>				
1895	Lowell, WA	Puget Sound Wood Preserving Co.	Creosote	Pine, fir	2
	<i>This plant also included a non-pressure open tank facility for boiling poles in creosote.</i>				
1896	Buell, VA	Norfolk Creosoting Co.	Creosote	Pine, etc.	4

Year Built	Location	Company	Process	Primary Wood	No. of Retorts
1896	Indianapolis, IN	Republic Creosoting Co.	Creosote		1
*1897	Somerville, TX	Texas Tie & Lumber Co.	Wellhouse	Pine, etc.	6
<i>Treated ties for the Santa Fe beginning late 1897 or early 1898. Treated Rock Island ties beginning 1900. In 1902 supplied 500 ties to the Milwaukee Road for a test section.</i>					
*1897	Beaumont, TX	International Creo. & Constr. Co.	Various	Pine, etc.	1
*1898	Bellemont, AZ	Atchison, Topeka & Santa Fe	Wellhouse	Pine, etc.	2
1898	Newark, NJ	American Creosoting Co.	Creosote	Pine	4
*1899	Mt. Vernon, IL	Chicago Tie Preserving Co.	Wellhouse	Black oak	1
<i>Portable plant. Treated Chicago & Eastern Illinois ties, as well as ties for other railroads.</i>					
*1899	Edgemont, SD	Chicago, Burlington & Quincy	Burnett	Pine, etc.	2
<i>Plant moved to Sheridan, WY in 1901. At least to 1903, one month was set aside each year for treating ties by the Hasselmann process.</i>					
*1901	Greenville, TX	Missouri, Kansas & Texas	Wellhouse	Pine, gum	3
*1901	Somers, MT	Great Northern	Wellhouse	Pine, etc.	4
<i>Plant opened early 1902. They switched to the Burnett process in 1903.</i>					
*1901	Aguas Calientes, Mex.	Mexican Central	Wellhouse		2
1901	Norfolk, VA	Atlantic Creo. & Wood Pres. Co.	Creosote	Pine	3
*1902	Texarkana, AR	International Creo. & Constr. Co.	Burnett	Pine	2
<i>About half the sources say Texarkana, TX and half Texarkana, AR. In 1904 & 1908 the process is listed as "various". In 1909 Allardyce, Burnett, and Bethell.</i>					
*1902	Alomogordo, NM	Alomogordo Lumber Co.	Wellhouse	Pine	2
<i>Probably opened 1903. Treated ties for the El Paso & Southwestern.</i>					
*1902	Rawlins, WY	Union Pacific	Wellhouse	Pine	2
<i>Portable plant.</i>					
1902	Southport, LA	American Creosote Works	Creosote	Pine	2
<i>Labrot process.</i>					
*1902	Texarkana, TX	Southern Tie & Timber Treating Co.	Burnett	Pine	1
<i>Another retort was added between 1904 and 1908. The Bethell process is also listed in 1910.</i>					
*1903	Carbondale, IL	Ayer & Lord	Creosote, Burnett	Oaks	6
<i>Another retort added 1904. Treated Illinois Central and Rock Island ties by the Burnett process. At least 1903 they supplied Burnett treated ties to the CB&Q, and possibly also to Grand Trunk.</i>					
*1903	Escanaba, MI	Chicago & North Western	Wellhouse	Pine	3
*1903	Laramie, WY	Union Pacific	Burnett	Pine	2
*1903	Wyeth, OR	Oregon RR & Navigation Co.	Burnett	Pine, fir	2
<i>Portable plant. The ORR&NCo. was owned by Oregon Short Line.</i>					
1903	Minneapolis, MN	Republic Creosoting Co.	Creosote		2
*1904	Grenada, MS	Ayer & Lord	Creosote, Burnett	Pine	2
<i>Treated Illinois Central ties.</i>					
*1904	Terre Haute, IN	Chicago Tie Preserving Co.	Wellhouse	Black oak	1
*1904	Paris, IL	Chicago Tie Preserving Co.	Wellhouse	Various	2
<i>Zinc-creosoted ties were treated here 1904-1905 (and possibly later) for the Big Four Route.</i>					
*1904?	Alamosa, CO	Denver & Rio Grande	Burnett or Wellhouse		3
1904	Eagle Harbor, WA	Pacific Creosoting Co.	Creosote	Fir	8
*1904	Chihuahua, Mexico	Chihuahua & Pacific	Burnett or Wellhouse		2

[ASCE 8-85, 247ff] [AREA '01, 107] [RG 3-21-02, 203] [AREA '04, 75] [AREA '08, 737] [AREA '10, 762] ['10, 138-140] ['11, 212-213] ['12, 284-286] ['13, 199, 448-460]

A * indicates a plant which treated ties regularly. Note that sometimes the year of construction is the year before the plant went into operation.

Table III. Railroads adopting zinc chloride

<u>Railroad</u>	<u>Year commenced</u>	<u>Process</u>	
Santa Fe	1885	Wellhouse	Four divisions
Rock Island Lines	1886	Wellhouse	
Southern Pacific	1887	Burnett	Atlantic System
Southern Pacific	1894	Burnett	Pacific System
Santa Fe	1898	Wellhouse	Majority of divisions
Chicago & Eastern Illinois	1899	Wellhouse	
Chicago, Burlington & Quincy	1899	Burnett	Western lines
Great Northern	1899	Wellhouse	Western lines (Maybe Burnett 1899-1901)
Chicago & Alton	1900	Burnett	
Big Four Route	1901	Wellhouse	
Missouri, Kansas & Texas	1901	Wellhouse	
Mexican Central	1901	Wellhouse	
Colorado & Southern	1902	?	
Milwaukee Road	1902	Burnett	Dakotas to Missouri
El Paso & Southwestern	1902/03	Wellhouse	
Chicago & North Western	1903	Wellhouse	
Illinois Central	1903	Burnett	
Oregon RR & Navigation Co.	1903	Burnett	
Union Pacific	1903	Burnett	
Denver & Rio Grande	1903/04	?	
Toledo, St. Louis & Western	1905	Burnett	
Wheeling & Lake Erie	1906	Burnett?	
Missouri Pacific	1911	Burnett	

The following switched to the Burnett process: Santa Fe (1901), GN (1903), MK&T (1903), Rock Island (1903?), and C&EI (1906). In 1906 the Mexican Central was considering switching.

Table IV. Railroads adopting empty-cell creosoting up to 1915

<u>Lowry process</u>		<u>Rueping process</u>	
Big Four Route	1905	Santa Fe	1906
Rock Island Lines	1907	El Paso & Southwestern	1906
Chicago & Eastern Illinois	1907	Illinois Central	1907
Frisco Lines	1907	Rock Island Lines	1908
Northern Pacific	1907	Missouri, Kansas & Texas	1909
Monon Route	1907/08	Pennsylvania	1909
Lake Shore & Michigan Southern,		Charlotte Harbor & Northern	1912
Michigan Central	1909	Central of Georgia	1915 or earlier
Kansas City Southern,		Pittsburgh & Lake Erie	1915 or earlier
International & Great Northern,			
Texas & Pacific	1910		
Delaware, Lackawanna & Western	1910	(Railroads grouped together acquired ties from the same plant.)	
Lehigh Valley	1910		
New York Central	1911		
New Orleans Great Northern	1912		
Chesapeake & Ohio	1915		

Table V. Railroads adopting zinc-creosote

Big Four Route	1904	Rütgers	Used to 1905, possibly to 1910
Cotton Belt Route	1905?		
Chicago & North Western	1908	Card	
Chicago, Burlington & Quincy	1908	Card	Eastern lines
Milwaukee Road	1908	Card	Eastern lines, possibly only to 1916
Baltimore & Ohio	1908/11	Card	

Table VI. Railroads adopting the Bethell process of creosoting

Oregon RR & Navigation Co.	1906	
New York, New Haven & Hartford	1906/07	
Indianapolis, Columbus & Southern Traction	1909	Low pressure
Buffalo, Rochester & Pittsburgh	1910	
Butte, Anaconda & Pacific	1910	
Rochester, Syracuse & Eastern	ca. 1911	
Central RR of New Jersey / Reading	1912	
Canadian Pacific	1912	

This list is possibly very incomplete. Perhaps many other electric railroads treated ties by the Bethell process.

Table VII. Railroads adopting creosote, process unknown

Fort Worth & Denver City	1907	Probably Rueping
Erie	1910	Probably Rueping
Louisville & Nashville	1910	Bethell?
Atlantic Coast Line	1912/13	Rueping or Bethell

Table VIII. Railroads which did not begin using creosote until the 1920's

<u>Railroad</u>	<u>Adopted creosote</u>	<u>Process used until then</u>
Baltimore & Ohio	1921/27	Card
Missouri Pacific	1922	Burnett
Southern Pacific	1923	Burnett
Great Northern	1924?	Burnett
Milwaukee Road	1924/27	Burnett & Card
Union Pacific	1927	Burnett
Chicago, Burlington & Quincy	?	Card & Burnett

Table IX. Methods of dating ties other than date nails

Central RR of New Jersey	1875-1876	Stamps	Test section
Santa Fe	1881-1882	Brass tags	Test sections
Allegheny Valley	1883-1887	Notches	All ties
Santa Fe	1885-1900	Stamps	All treated ties
Southern Pacific	1887-1909+	Stamps	All treated ties
Big Four Route	1892/3-ca. 1895/6	Stamps	All ties?
Lake Shore & Michigan Southern	1893-1900+	Stamps	All ties
Michigan Central	1893 up	Stamps	All ties?
Rock Island Lines	1895-1904+	Stamps	All treated ties
Peoria & Eastern	1898 (-1902?)	Stamps	All ties?
Chicago & Eastern Illinois	1899 up	Stamps*	All treated ties
Chicago, Burlington & Quincy	1899 up	Stamps*	All treated ties
New York Central	1901-1910	Notches	All treated ties?
Great Northern	1902-1903+	Stamps*	All ties?
Pere Marquette	1902-1911	Notches	All ties?
Milwaukee Road	1906-1908	Lead tags	All treated ties
Milwaukee Road	before 1913	Common nails	Test sections
Louisville & Nashville	1910-1920	Common nails	All (treated?) ties
New York Central	1912-1921	Notches	Untreated ties
Missouri, Kansas & Texas	±1914	Stamps*	All treated ties?

This table is probably very incomplete. Not included here are stamps made by automatic boring & adzing machines. "±" indicates that the marks were in use in the year indicated, and were probably used in years before and after. "+" indicates that the use of the marks could have persisted later. "*" indicates that the marks were used in conjunction with date nails.

Table X. The first railroads to use date nails

1897	Mississippi River & Bonne Terre	1906	St. Louis, Rocky Mountain & Pacific
1899	Great Northern	1907	New York, New Haven & Hartford
	Chicago & Eastern Illinois		Northern Pacific
	Chicago, Burlington & Quincy	1908	Frisco Lines
	Pittsburgh & Lake Erie		Milwaukee Road
1901	Big Four Route		Monon Route
	Missouri, Kansas & Texas		St. Louis, Iron Mountain & Southern
	Santa Fe	1909	Pennsylvania (had used nails also ca. 1904/05)
1902	Baltimore & Ohio		Tonopah & Goldfield
	Rio Grande, Sierra Madre & Pacific*	1910	Buffalo, Rochester & Pittsburgh
1903	Cotton Belt Route*		Delaware, Lackawanna & Western
	El Paso & Southwestern		Erie
	Long Island*		Kansas City Southern
	Southern Pacific		Lehigh & Hudson River
	Union Pacific		Lehigh Valley
	Wabash		New York Central
1904	Rock Island Lines		Texas & Pacific
1905	Chicago & North Western		
	Oregon Short Line		
	Salt Lake Route		

*may have begun nail use earlier

I have sketchy information on other railroads. The Michigan Central was using nails before 1912, and the Lake Shore & Michigan Southern about 1910/11. It is likely that the Wabash quit using nails after 1905. This table is very incomplete, but is reliable for the major railroads.

Table XI. Railroads which established CB&Q-style test sections

<u>Railroad</u>	<u>Stopped using nails</u>	<u>Test sections</u>	<u>Started using nails</u>
Chicago, Burlington & Quincy	1909	1909	1928
Santa Fe	1910	1910	1921
Union Pacific	—	1910?	—
Great Northern	1911	1911	1924?
Baltimore & Ohio	—	1911	—
Cotton Belt Route	?	1911	?
Chicago & Eastern Illinois	1910	1912	—
Illinois Central	1911?	1912?	1930, 1950
Atlantic Coast Line	—	1913	1930
Frisco Lines	1910	1914	—
Monon Route	1910	1914	—
Chicago & North Western	1913	1914	1923
Rock Island Lines	1913?	1914	—
Chicago & Alton	1913	1914/15	—
Pennsylvania	1911	1919	1924/25?
Northern Pacific	1918 or 1921	1919	—
Milwaukee Road	1910	—	1927
El Paso & Southwestern	1911	?	—
St. Louis, Iron Mountain & Southern	1911	?	—

"Stopped using nails" is the last year the railroad used nails in all treated ties. It was common for these railroads to continue to use date nails in test sections.

"Test sections" is the year the railroad instituted CB&Q-style test sections. Installations may have continued past the indicated year.

"Started using nails" is the year the railroad began again to use nails in all treated ties. A "—" indicates the railroad did not stop/start again using nails. A "?" indicates that I do not know if the event occurred.

The Illinois Central began using nails in switch ties in 1930, and in all crossties in 1950.

Table XII. Railroads which did not stop using nails in the teens.

Big Four Route	New York Central
Buffalo, Rochester & Pittsburgh	New York, New Haven & Hartford
Delaware, Lackawanna & Western	Oregon Short Line
Kansas City Southern	Salt Lake Route
Lehigh & Hudson River	Southern Pacific
Lehigh Valley	Union Pacific
Railroads which might not have stopped using nails:	
Colorado & Southern	Erie
Cotton Belt Route	Louisville & Nashville

This table is possibly very incomplete.

Table XIII. Twentieth century miscellaneous tests

(p) indicates a process, (c) indicates a chemical.

Carbolineum (c) (see also Table I, page 65, for other tests.)

ca. 1897-1903	Boston Elevated
1900-1903	Honolulu Rapid Transit
1905	Mexican Central
1905	Santa Fe (Pelican, TX test)
1908	Oregon-Washington Ry & Navigation Co.
1913-1914	Soo Line

Barshall salts (c) by the Hasselmann process

1902	Santa Fe (Pelican test)
1902-1903	Chicago, Burlington & Quincy

Allardyce (p)

1902	Santa Fe (Pelican test)
1902	Chicago & Eastern Illinois
1904	Kansas City Southern
1904	Chicago, Burlington & Quincy
1905	Chicago, Burlington & Quincy (U.S. Government test)
1905, 1911	Cotton Belt Route

(The Galveston, Harrisburg & San Antonio (SP) experimented with a similar process in 1894 and 1905-1907.)

Crude oil (c) [AREA '09, 472-474]

1902	Santa Fe (Pelican test)
1907	Mexican Central

Zinc chloride-crude oil emulsion (p) ['24, 160ff]

1902	Santa Fe (Pelican test)
1906	Southern Pacific
1914-1915	Houston East & West Texas
1915, 1917	Santa Fe

Diamond glue preservative (c)

1902	Santa Fe (Pelican test)
1907	Galveston, Harrisburg & San Antonio

Giussani (creosote) (p)

1905	Chicago, Burlington & Quincy (U.S. Government test)
1905	Frisco Lines
1905	Mexican Central

Cresol-calcium (c)

1910	Forest Products Lab (Tennessee Coal Iron & RR)
1910	Illinois Central

Water gas tar (c) [21, 118]

- 1910-1914+ Public Service Railway Company of New Jersey
- 1914-1919 Baltimore & Ohio
- ca. 1914+ Chicago, Burlington & Quincy
- ca. 1914-1920 Pennsylvania
- ca. 1914+ Reading
- ca. 1914 Chicago & North Western
- 1917 Forest Products Lab (Milwaukee Road)
- 1927-1928 Baltimore & Ohio

Sodium fluoride (c)

- 1906 Southern Pacific ("zinc-fluoride")
- 1914 Baltimore & Ohio
- 1917 Forest Products Lab (Milwaukee Road)
- 1924-1925 Forest Products Lab (Milwaukee Road)

Cresoil (c)

- 1915 Milwaukee Road
- 1915 Spokane, Portland & Seattle
- 1924 Great Northern

Zinc-meta-arsenite (c)

- 1928 Forest Products Lab (Milwaukee Road)
- 1929 Chicago, Burlington & Quincy
- 1929 Illinois Central
- 1930 Canadian National
- 1932+ Great Northern

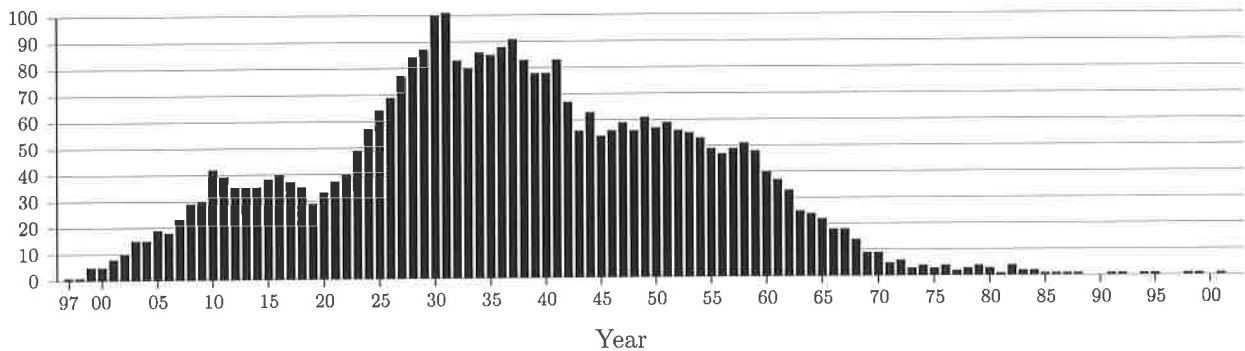
Penta (c)

- 1947 Union Pacific
- 1948 Illinois Central

Chemicals and processes recorded for only one railroad

- | | | |
|-----------------|---------------------------------------|--|
| 1901 | Creo-resinate (p) | Pennsylvania |
| 1902 | Spirittine (c) | Santa Fe (Pelican, TX test) |
| 1909 | Spaulding (p) | Oregon Ry & Navigation Co. |
| 1909 | Asphaltic crude oil (c) | Indianapolis, Columbus & Southern Traction |
| 1910 | J. M. Long's Liquid (c) | Illinois Central |
| 1911 | Timber asphalt (c) | Baltimore & Ohio |
| 1911 | Semi-refined oil (c) | Forest Products Lab (Milwaukee Road) |
| 1911 | Mercuric chloride (c) | Forest Products Lab (Milwaukee Road) |
| 1916 | Gas oil (c) | Forest Products Lab (Milwaukee Road) |
| 1917 | Cecil Williams (p) | Baltimore & Ohio |
| 1921 | Pintsch gas-tar (c) | Forest Products Lab (Milwaukee Road) |
| 1922 | Aczol (c) | Forest Products Lab (Milwaukee Road) |
| 1924-1925, 1927 | ZnCl ₂ -fuel oil, two-step | Union Pacific |
| 1925-1926 | Basilit (c) | Forest Products Lab (Milwaukee Road) |
| 1925-1926 | Triolith (c) | Forest Products Lab (Milwaukee Road) |
| 1927 | Borax (c) | Forest Products Lab (Milwaukee Road) |
| 1928 | Arsenious acid (c) | Forest Products Lab (Milwaukee Road) |
| 1928 | Sodium dichromate (c) | Forest Products Lab (Milwaukee Road) |
| 1929 | Natural brine (c) | Forest Products Lab (Milwaukee Road) |
| 1929 | Wolman salts (c) | Illinois Central |

Histogram I. Number of railroads using date nails, 1897-2001.

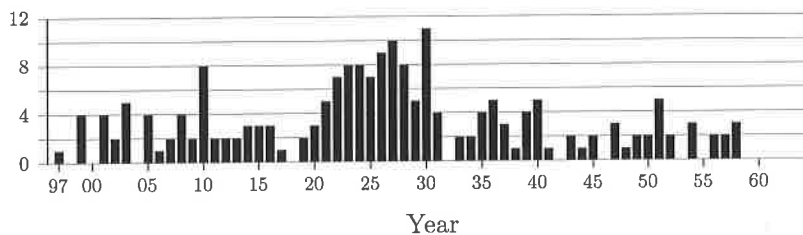


This histogram was generated by a computer program which took the railroad listings as input. If I know from documentation that a particular railroad used nails, say, in 1899, but none have been found, I added it to the data. If a railroad used several different nails in a particular year it still counts as one. Naturally nails from second hand ties and from other timbers are not included.

Several trends in tie preservation and record keeping can be seen in the histogram:

- The use of date nails follows pretty closely the rise in use of treated ties beginning 1899. This is consistent with the AREA recommendation that date nails be used.
- After 1910 there is a decline in nail use due to Angier's recommendation to concentrate records in test sections. The histogram includes even railroads which used nails only in test sections, making the drop remarkable.
- The creosote shortage due to World War I can be seen in the dip in nail use the late teens.
- After the war the rapid adoption of tie treating, along with the return to favor of date nails is seen in the steep rise in nail use.
- There is a decline after 1931 due to the depression.
- A further decline can be seen because of World War II. Metals were being used more for military purposes.
- The long decline in nail use after 1959 is probably due to a good knowledge by railroads of the best woods and treatments to use, and by the reliance on stamps in the ends of ties for record keeping.
- By the time the Texas Date Nail Collectors' Association was formed in 1970, nail use was at a minimum.

Histogram II. Number of railroads starting the use of date nails, 1897-1958.



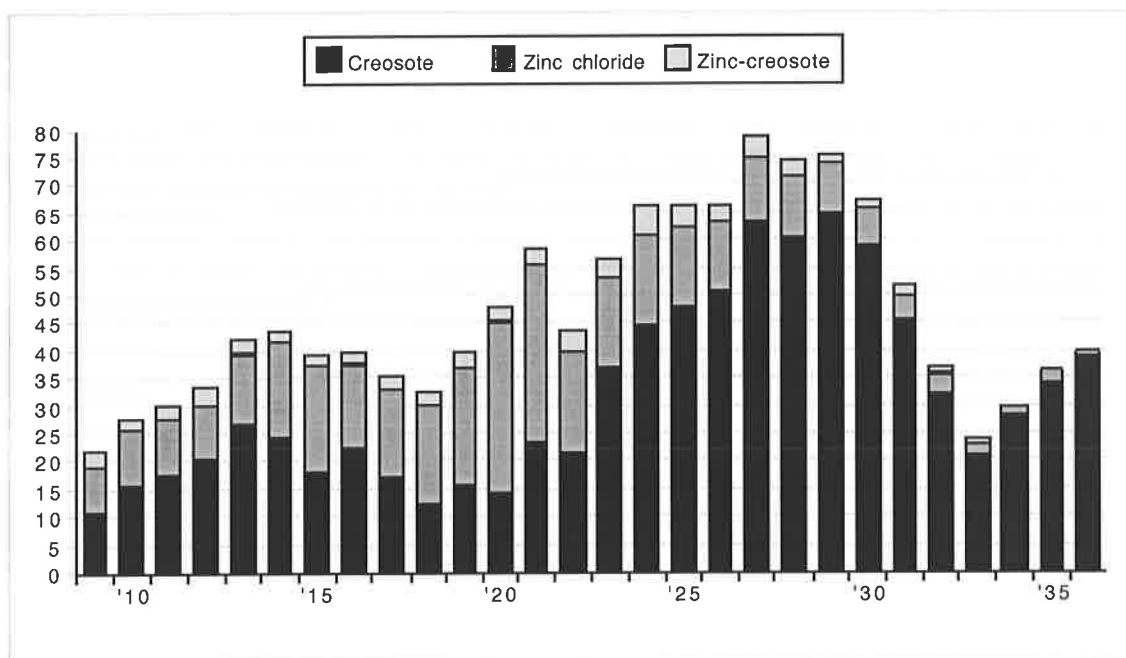
If a railroad stopped using nails, and started again a few years later, both dates are included. For example, the Lehigh Valley began using date nails in 1910, they stopped in 1921, and began again in 1940. The LV contributes to the 1910 and 1940 totals. The gap in LV nails for 1918 is not considered.

Again, I consider documentation, not just nail finds. The C&EI began using nails in 1899, though none have been found yet. I count the 1899 date.

The total for 1910 is high partly because several NY and PA lines began using nails that year.

Note: I only updated 1897-1910 with this printing. Its basic shape is reliable.

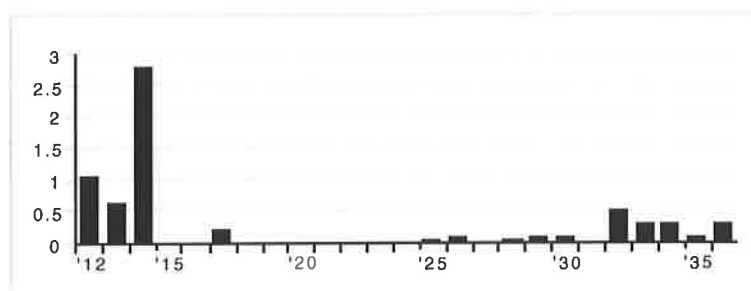
Histogram III. Treated ties installed in the U.S. by the three major processes, 1909-1936.



This histogram shows, in millions of ties, the numbers of crossties treated by the three major methods which were installed in the U.S. in the period 1909-1936. Zinc-creosoted ties were last used in 1934, and zinc chloride was on the way out by the mid-1930's.¹

The use of treated ties saw a new peak during World War II, but after that numbers declined so that by the 1960's annual installments were roughly 20,000,000.²

Histogram IV. Ties treated by miscellaneous processes, 1912-1936.



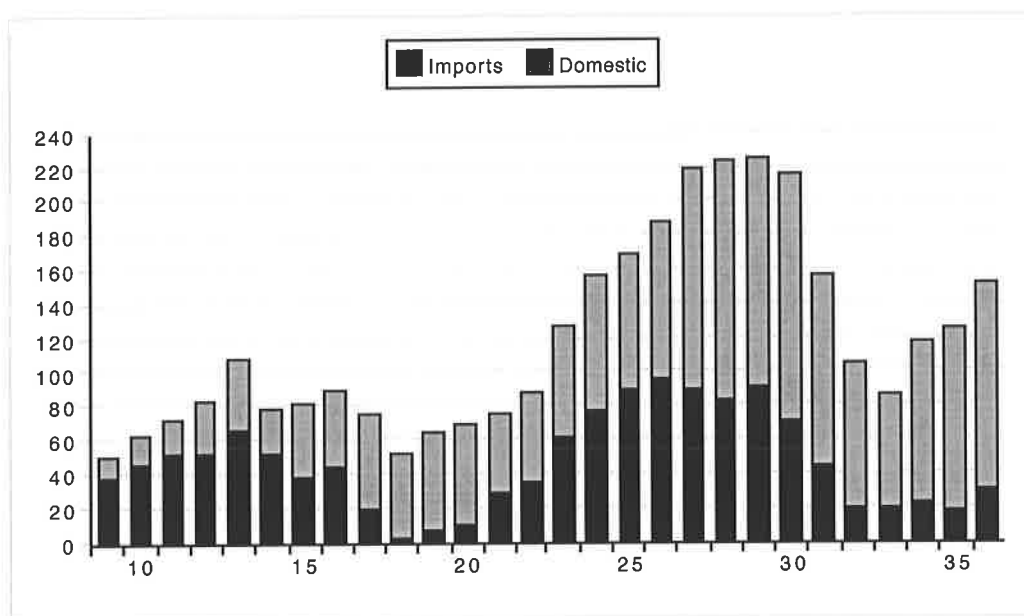
This histogram measures, in millions of ties, the number of ties treated by methods other than creosote, zinc chloride, and zinc-creosote. The 1914 peak represents the use of water gas tar. The higher figures beginning 1932 represent mainly installations of ties treated with zinc-meta-arsenite (ZMA).³

¹ [H&G, 434-436]

² [RA 5-86, 44]

³ [H&G, 436]

Histogram V. U.S. creosote consumption in millions of gallons, 1909-1936.



The dip in the late teens in creosote imports was caused by World War I. The dip in the early 1930's was caused by the depression.

Short biography of Octave Chanute

Chanute was the most important figure in the field of tie preservation from 1882 to the turn of the century. He was also instrumental in the development of the airplane, and it is because of his contributions in that area that he is most widely known. He was even featured on a U.S. air mail stamp! I have recently begun to collect information on Chanute, and this biography is the result. Naturally there is a lot of material covered both here and in the History of Railroad Tie Preservation. Generally, where they overlap, I include more details in the history than in the biography.

Octave was born in Paris on February 18, 1832, the first of three children born to Joseph Chanut and Élise Sophie de Bonnaire. Joseph was a professor and historian at one of the five Royal Colleges in Paris, and late in 1838 he left his post to take on responsibility as vice-president of Jefferson College in Louisiana. He and six-year-old Octave left for America that year, and the rest of the family followed later.¹

Chanut did not remain long at this post. The family moved again in 1844, to New York, so Joseph could engage in literary pursuits. In 1849, at the age of seventeen, Octave was eager to begin a career with the railroads. He approached John B. Jarvis, resident engineer of the Hudson River Railroad during its construction at Sing Sing, and asked for a position. After being told there was none available, he volunteered to work for free as a chainman. The proposition impressed Jarvis, and Chanute was taken on. Chainman was about the lowest job one could have on a railroad, but within two months Chanute was earning \$1.12½ a day. By 1853, when the railroad was completed to Albany, he was a Division Engineer in charge of maintenance-of-way from Hudson to Albany, and in addition he was responsible for the construction of terminal facilities at Albany.²

Railroad engineering in the Midwest

There were many railroads being built in the Midwest in the 1850's and 1860's due to massive emigration to that area, and Chanute had a hand in several of them. He and H. A. Gardner, former Chief Engineer of the Hudson River RR, went west to Illinois in September, 1853. To write Chanute's activities in these years in prose would result in an incomprehensible mess, so I present them as a list:³

¹ Crouch, *A Dream of Wings*, p. 22.

² *Civil Engineering*, December 1937, p. 871; *The Aeronautical Annual*, 1896, p. 56; *The Journal of the Western Society of Engineers*, May, 1911, p. 439.

³ The sources for the chronology of 1853-1873 are *The Aeronautical Annual*, 1896, pp. 56-57, and *The Journal of the Western Society of Engineers*, May, 1911, pp. 439-441.

- 1853-54** Track engineer for the construction of the (future) Chicago & Alton from Joliet to Bloomington, IL.
- 1854-61** Before he was quite finished with the C&A job, he took the position of Chief Engineer of the eastern portion of the (future) Toledo, Peoria & Western. He built the line from Peoria to the Indiana border (112 miles). After construction was finished in 1857 he was in charge of maintenance-of-way.
- 1857** Chanute married Anne "Annie" Reddell James of Peoria, and they began a family which was to include five children.
- 1861** With his former employer now in receivership, Chanute became the Division Engineer of the Pittsburgh, Fort Wayne & Chicago (later PRR) between Chicago and Fort Wayne, IN. He was given the job by his old superior Gardner.
- 1862** Chief Engineer of Maintenance of Way of the Western Division of the Ohio & Mississippi (later B&O), responsible for the section from St. Louis to Vincennes, IN. Gardner recommended him for this job, too. Chanute left the road after only six months because of a change in administration.
- 1863-67** Chief Engineer of Maintenance of Way and Construction of the Chicago & Alton. He was mainly in charge of reconstruction, since the road was built cheaply and needed lots of work. Also he built new track from Alton to St. Louis. His plan for the Union Stock Yards of Chicago was accepted among competitors, and he constructed the yards in 1867 while still working for the C&A.
- 1867-69** In 1867 his plan for the construction of a bridge over the Missouri River at St. Charles, MO (close to Kansas City) was accepted, so Chanute resigned from the C&A and moved to Kansas City to work on the project. Bridging the Missouri was a job of the highest difficulty, due to "Currents of eight miles an hour, ice jams, rapid rises of 30 ft or more in stage, and a shifting bottom that may scour or build 20 ft overnight".⁴ By July, 1869, when the job was completed, Octave Chanute had become a famous man. He and his assistant, George Morrison, wrote a book on the construction of the bridge in 1870.
- The bridge was the first over the Missouri River. It was later used by the CB&Q, and was demolished in 1917 to make way for a newer structure.
- 1868?-71** Railroads were now being built in Kansas, and Chanute, while still working on the bridge, became Chief Engineer of Construction for the Missouri River, Fort Scott & Gulf (later Frisco) from Kansas City north to Indian Territory (160 miles). After the line was constructed he built a parallel railroad for the Leavenworth, Lawrence & Galveston (later Santa Fe), from Lawrence, KS to Indian Territory. Then he built a connecting line between these two railroads called the Kansas City & Santa Fe.⁵ Finally he built the Atchison & Nebraska (later CB&Q) from Atchison north.
- While building these four lines Chanute also constructed the Union Stock Yards at Kansas City, a job which was finished in 1871.
- 1871-73** After the Stock Yards were finished, Chanute remained with the Leavenworth, Lawrence & Galveston as General Superintendent.

⁴ *Civil Engineering*, December, 1937, p. 871.

⁵ Presumably this road later became part of the Santa Fe also.

New York City rapid transit, 1873-1875

In 1873 Chanute was drawn back east, to New York, to become Chief Engineer of the recently reorganized Erie RR. In his first years there he was involved not only with the Erie, but he served on two committees of the American Society of Civil Engineers (ASCE). One of these produced a report which was adopted June 10, 1874 and was titled "On the form, weight, manufacture and life of rails."⁶

Chanute was chair of the other committee, whose task was to solve New York City's transit problem. When he arrived in New York in 1873, he found that politicians had been arguing about rapid transit possibilities for nearly twenty years with no result. In five months of intensive work the committee compiled about 4,000 pages of information. They accepted opinions and advice. They held public hearings, and they consulted with landowners and tenants along the proposed routes. In 1875 the report was published. Four lines of elevated railroad, operated by steam locomotives, were to be built. The report was immediately assaulted by people with interests in other plans, but the committee's proposal was accepted by the public and was quickly put into law. Construction soon followed.⁷

At this point Chanute was verging on nervous collapse. Because he worked for the Erie during the day, the only time he could find for the transit problem was at night. Also, the political pressure of vested interests in the city took its toll on Chanute, and after the report came out he needed some rest. To recover, he took his family on a four month vacation to France in 1875.⁸ It was his first visit to Europe since he left for America as a boy.

With the Erie RR, 1873-1883

Chanute was hired by the Erie to improve and extend the right-of-way. The railroad was planning on spending fifty million dollars, to be procured in England, for the purpose. The gauge was to be reduced from six feet to standard, the main line was to become double track, and the railroad was to build new track to Boston and Chicago.

The financial panic of 1873 reduced the available funds by a factor of ten. With the little money he had Chanute did well to at least change the gauge by adding a third rail, and to double track the main line. Even this was made difficult by a financial scandal within the railroad.⁹

⁶ *Transactions of the American Society of Civil Engineers*, Vol. 3 (1875), 87-105.

⁷ *The Journal of the Western Society of Engineers*, May, 1911, p. 441.

⁸ Crouch, *The Bishop's Boys*, p. 149.

⁹ *The Aeronautical Annual*, 1896, pp. 57-58; *The Journal of the Western Society of Engineers*, May, 1911, p. 441.

Chanute was made Assistant General Superintendent in 1875 and the next year he was temporarily placed in charge of motive power and rolling stock. All the while he was still Chief Engineer in charge of track. By the time he left the Erie in 1883 the average freight train had increased from 18 to 35 cars.¹⁰

Chairman of the Tie Committee, 1882-1885

Before his time was up with the Erie, Chanute was appointed chair of another ASCE committee. This one, formed in 1880, was charged with investigating methods of treating railroad ties with chemical preservatives. Lumber was becoming scarce and expensive, and U.S. lines had done little to extend the lives of their ties. Because progress of the committee was insignificant in the first two years, the ASCE chose Chanute to replace the original chairman in 1882. This time Chanute's committee work lasted three years. At first there was little interest on the part of railroads to help them out, and only slowly was the committee able to produce a report. This Chanute delivered on June 25, 1885.

The report consists of an organized description of every known American use of treated wood, along with an evaluation of its failure or success. Here Octave's organizational skills become evident. He was able to make comprehensible a massive amount of information, much of it bad, much of it merely hearsay, and none of it standardized in any way. The conclusion of the committee was that those railroads which ran through territory in which untreated ties had short lives *would* find it economically advantageous to use treated ties.

Several chemicals and methods had been tried on ties since the 1830's. Mercuric chloride was too toxic, and it could not be used practically under pressure. Iron sulphate, copper sulphate, and other chemicals were not effective enough. Creosote was the best substance for preventing decay, but it was too expensive, and the supply was not reliable. What came out of Chanute's report was that zinc chloride is the best tie preservative.¹¹

There were two methods of treating ties with zinc chloride. One was to inject the solution in one step (the Burnett process), but because the preservative is water soluble, it would leach out of the ties over time, especially in areas of great rainfall. A more elaborate method, patented by Wellhouse and Hagen in 1879, was to treat the ties in two steps. First a mixture of zinc chloride and gelatin (or glue) was introduced, followed by tannin. The glue and tannin would combine to seal off the pores of the wood, preventing the zinc chloride from washing out. The Wellhouse method

¹⁰ *The Aeronautical Annual*, 1896, p. 58.

¹¹ *Transactions of the ASCE*, July 1885 to September 1885.

was more expensive than straight zinc chloride, but the ties would last longer in wet locations.

The first permanent tie treating plants

Octave Chanute was hired by the Santa Fe to construct the first permanent North American tie preserving plant. It went into operation in July, 1885 at Las Vegas, treating ties by the Wellhouse process. The next year Chanute went into business with Joseph P. Card. Card had been treating ties by the Wellhouse process in St. Louis since 1879, and he got together with Chanute to form the Chicago Tie Preserving Co. Chanute built two plants in 1886: one for Union Pacific at Laramie, WY, and one for the Chicago Tie Preserving Co. in Chicago. After construction the UP operated the Laramie plant, while Card relocated to Chicago to treat ties for the Rock Island under contract.¹²

Some people have supposed that Chanute was not involved in the tie treating business until his move to Chicago in 1889, but that is not what I understand from the following quotes. An 1886 article described the new Laramie plant of the UP. Chanute himself quoted an Omaha newspaper:

The works, as also those at Las Vegas for the Atchison, Topeka & Santa Fe, have been erected under the supervision of Mr. O. Chanute, of Kansas City, Mo., by a company styled the 'Chicago Tie-Preserving Co.,' which have also this season built works on the grounds of the Rock Island Co. in Chicago. . ."¹³

Chanute spoke of himself in April, 1900:

He had been engaged in the designing and building of the plants at Las Vegas and at Laramie, and when the Chicago plant was decided upon he went into partnership with Mr. J. P. Card, who had been operating a plant at St. Louis for some years.¹⁴

From a few moments earlier:

In 1886 the Chicago, Rock Island & Pacific Railway contracted with Card & Chanute, (since organized as the Chicago Tie Preserving Company,) to erect works at Chicago and to treat 100,000 to 200,000 ties annually for five years.¹⁵

There should be no question now that Card and Chanute were partners beginning 1885 or 1886, though after the construction of the plants Chanute acted chiefly as an advisor.¹⁶

Both men favored the Wellhouse process. The Santa Fe, Union Pacific, and Rock Island all used ties treated by this method, while the Southern Pacific began using Burnett (straight zinc

¹² It is not clear to me if the Santa Fe plant was built under the name of the Chicago Tie Preserving Co. also.

¹³ *Railroad Gazette*, October 29, 1886, p. 737.

¹⁴ *The Journal of the Western Society of Engineers*, April, 1900, p. 102.

¹⁵ *ibid.*

¹⁶ *ibid.*

chloride) treated ties in 1887. The UP abandoned its plant in 1887, and the remaining three railroads were alone in pursuing tie treatment until the end of the century.

After the founding of the company, Card worked in Chicago running the plant which was treating Rock Island ties. Chanute had moved from New York back to Kansas City in 1883 "in order to look after his personal interests, and to open an office as Consulting Engineer."¹⁷

Private consulting, 1883-1889

In 1885 Octave began the job of supervising construction of iron bridges for the Chicago, Burlington & Northern (later CB&Q) from Chicago to St. Paul. In 1887 and 1888 he held similar responsibilities for the Santa Fe railroad from Kansas City to Chicago. The big jobs for the Santa Fe were the construction of the bridge over the Missouri River at Sibley, MO, completed in 1888, and the bridge over the Mississippi at Ft. Madison, IA.¹⁸

It is not easy to determine when—if ever—Chanute's trip to China took place, but it might have occurred sometime between 1883 and 1889. J. P. Morgan wanted to build railroads there, and he sent Octave to look into the matter. The deal was cancelled when the dowager Empress Tz'u Hsi was warned by a dragon in a dream to beware of foreigners.¹⁹ The political climate in China was not conducive to foreign business or technology, so the dream, whether it occurred or not, was in agreement with the policies of at least some people in power at the time.

Chanute travelled to Europe in 1889, and there he studied wood preservation and made contacts for his continuing interest in aviation.²⁰

In Chicago with the Chicago Tie Preserving Company, 1889-1899

In 1889, upon his return from Europe, Octave moved from Kansas City to Chicago.²¹ Though he remained merely an advisor to his tie-treating partner Card, his interest in the subject was on the rise. In 1891 he placed this ad in *Railroad Gazette*:

Having under my recent visits to Europe gathered further data concerning the methods and results of preparing wood chemically to resist decay, I am confirmed in the opinion that the time has now fully arrived when large economies may be realized by adoption of these methods on American railroads, in many parts of this country. I propose to make this a specialty, and I am prepared, in connection with the Chicago Tie Preserving Co., to design, erect and operate works for preserving wood, either on commission or at our own expense, upon adequate contracts.²²

¹⁷ *The Aeronautical Annual*, 1896, p. 58.

¹⁸ *ibid.*

¹⁹ *Civil Engineering*, December 1937, p. 873.

²⁰ Crouch, *A Dream of Wings*, p. 73.

²¹ *The Aeronautical Annual*, 1896, p. 58.

²² *Railroad Gazette* July 31, 1891, p. 536.

Since the word “visits” is plural, he must have taken a trip to Europe in the period 1885-1891 apart from the 1889 voyage.

Unfortunately, despite the imminent shortage of timber, ties were still too cheap to be treated in most territories. Also, many railroads which could have benefitted from zinc chloride treated ties were run by people with little faith in the effectiveness of treatment. So Chanute and Card continued to treat ties only for the Rock Island.

On September 25, 1893 Chanute wrote to a fellow aviator “...my partner in the wood-preserving plant is seriously sick of an incurable disease...”²³ Chanute became president of the company that year.²⁴ But Chanute said this in 1900: “Mr. Card ran the Chicago works for 9 years, and died in the latter part of 1894, since which time the writer, who had previously acted chiefly in an advisory capacity, has taken active charge of the work.”²⁵ It is impossible for me now to determine which date is right. Chanute took over the company in either 1893 or 1894.

In 1896 he improved the Wellhouse process by increasing the number of injections to three. Originally the zinc chloride and gelatin were applied as one mixture. Because the gelatin makes the zinc solution gummy, it was difficult to gain a deep penetration of the preservative. Under Chanute’s modification, a watery zinc chloride solution is first injected, followed by gelatin, and finally tannin. This way two and a half times as much zinc chloride is forced into the ties.²⁶

The Southern Pacific was not interested in the new method because they were not even using the Wellhouse process. The Santa Fe continued to use the two-step method. Only the Rock Island received three-step treated ties, though other lines would later use his process²⁷

Aviation in Chicago in the 1890’s

Chanute’s interest in flight dates back at least to 1874, though it was not until he moved to Chicago that he was able to devote any attention to the subject. The study of aviation prior to this time was classed “with such absurdities as the finding of perpetual motion and the squaring of the circle”.²⁸ Anyone who professed to be exploring the possibility of human flight was at best not

²³ *The Chanute – Mouillard Correspondence April 16, 1890 to May 20, 1897: Being the letters exchanged between Octave Chanute, American Engineer, and Louis-Pierre Mouillard, French author and student of bird flight, mainly on the subject of aeronautics, to be found at* http://hawaii.cogsci.uiuc.edu/invent/i/Chanute/library/Chanute_Mouillard/Chanute-Mouillard.html.

²⁴ *Octave Chanute: A Register of his Papers in the Library of Congress, to be found at* [gopher://marvel.loc.gov/00/.ftppub/mss/msspub/fa/c/chanute.txt](http://marvel.loc.gov/00/.ftppub/mss/msspub/fa/c/chanute.txt).

²⁵ *The Journal of the Western Society of Engineers*, April, 1900, p. 102.

²⁶ *The Journal of the Western Society of Engineers*, April, 1900, pp. 102, 122.

²⁷ *Chicago & Eastern Illinois (1899), Mexican Central (1901), Great Northern (1902)*.

²⁸ *The Journal of the Western Society of Engineers*, May, 1911, p. 443.

taken seriously. Chanute saw that flight was not as far-fetched as most people believed, though he balked at making his interest known for some time. This can be seen in a little story published in 1937:

One Evening in 1891 Octave Chanute was dining with friends in Kansas City. The talk turned to hobbies, and Chanute remarked that every man should have one.

"What is yours?" inquired his host.

Chanute smiled. "Wait until the children are not present," he said, "for they would laugh at me."

After the children had gone to bed the question was repeated, and Chanute replied:

"My hobby is flying-machines—and I guess I would spend twenty-four hours a day working on them if my family would let me."²⁹

Chanute had, since the 1870's, been building a portfolio of past flight experiments. He was in contact with people all over the world who shared his interest, and he had researched experiments dating back 200 years. In his first years in Chicago he was able continue his investigation more vigorously, and he compiled his findings just as he had done with tie experiments for the 1880 ASCE committee. Including all relevant details, he described every known experiment, and offered comments on the causes of failure and on possible solutions. His work, titled *Progress in Flying Machines*, was published in serial form in *The American Engineer and Railroad Journal* beginning October 1, 1891. The whole collection was later published in book form in 1894. The influence of *Progress in Flying Machines* was immense, for it gave experimenters the opportunity to avoid simple mistakes which had hampered many of their predecessors, and because it presented the topic of flight as a viable engineering problem to those who would not have otherwise been interested.

Chanute conducted his own experiments, also. Modifying Otto Lilienthal's crude glider, he began a series of flights at Dune Park in Northern Indiana in 1896. Chanute, now in his sixties, thought himself too old to fly. That was done by assistants, who made close to 200 flights with no accidents! Lilienthal himself was killed in a crash in 1896. By 1897, when the experiments ceased, the design of the glider had evolved into a biplane. This Chanute glider was the prototype of the Wright Brothers' plane.³⁰

The second timber crisis, 1898-1900

In 1898 lumber prices began a rapid rise which forced many railroads to take up tie preservation. The Santa Fe expanded the territory on which Wellhouse treated ties were used, and in 1899 lines like the Great Northern, the Chicago & Eastern Illinois, and the Chicago, Burlington &

²⁹ *Civil Engineering*, December 1937, p. 871.

³⁰ *The Journal of the Western Society of Engineers*, May, 1911, pp. 442-443.

Quincy all joined in. The C&EI signed a contract with Chanute's firm, which built a new treating plant in Mt. Vernon, IL. It went into operation July 17, 1899, treating ties by Chanute's modification of the Wellhouse process. Charles D. Chanute, Octave's son, was put in charge of the plant while Octave remained in Chicago.

Again the ASCE appointed Octave as chair of a committee to investigate timber preservation. This time the focus was on Europe, where tie treating had been commonplace for many decades. Chanute left for Europe in October, 1899 and visited England, France and Germany, and he was back by the end of the year. His goal was to study zinc-cresote methods, which use a balance of zinc chloride and creosote. Julius Rütgers had been using such a method in Germany since 1874, and it seemed to be the promising next step above straight zinc chloride for American ties.

The report prepared by Chanute stated that 1) creosote is still too expensive to be used alone, 2) zinc-cresote methods are likewise a bit too expensive, though they show promise, and 3) that zinc chloride alone (Burnett or Wellhouse process) is still the most cost-effective treatment. Of course he advocated his three-step Wellhouse process.³¹

Record keeping and the introduction of date nails

In order to keep a record of the longevity of treated ties, the Santa Fe and Southern Pacific had been stamping the year of treatment into their ties at the treating plant since 1885 and 1887 respectively. The Rock Island began the practice in 1895. Despite this, record keeping on the Rock Island was a mess. In the summer of 1898 "the report went out among the men that our ties were giving out in three or four years, and, at the maximum, in seven years." To settle the problem, they had the men count twelve million ties in the track to get an accurate calculation of their average life. It turned out that they were really lasting nine or ten years.³² Later Chanute revised this figure at $10\frac{2}{3}$ years east of the Missouri River, and $11\frac{2}{3}$ years west of the Missouri River.³³

Because of the record keeping fiasco on the Rock Island, Chanute saw to it that the ties treated at Mt. Vernon for the C&EI were all dated with nails. Date nails had been in common use in Europe for at least three decades, and good records were obtained from them. He even brought back some European nails in 1899 to show other engineers.³⁴

It is due to the efforts of Chanute, E. E. Russell Tratman, and George Kittredge that most railroads initiating the use of treated ties at this time also began keeping records using date nails.

³¹ *Transactions of the ASCE*, June 1901.

³² *Railroad Gazette*, July 27, 1900, p. 507.

³³ *AREA* 1907, p. 488.

³⁴ *The Journal of the Western Society of Engineers*, April, 1900, p. 126.

In 1899 the CB&Q, Great Northern, and others also began nail use. By the end of 1901 at least eight railroads were dating ties this way.

The decline of the Wellhouse process

From the data I have collected, in 1899 there were four railroads using the Wellhouse process vs. two using Burnett's. Despite Chanute's backing of zinc tannin, the Burnett process became dominant in the early years of the century. By the end of 1903 there were five railroads using the Wellhouse process vs. eleven for Burnett. Even roads associated with the Chicago Tie Preserving Co. switched. In 1903 the Rock Island went to Burnett treated ties from another company, and the Chicago & Eastern Illinois did the same in 1906. The reason for the shift is probably one of economy. The Burnett process is cheaper than the Wellhouse process.

In the meantime zinc creosote methods were being developed. In 1904 the Chicago Tie Preserving Co. built a new plant at Paris, IL for treating ties for the Big Four Route by the Rütgers process. The work continued through at least 1905. Joseph B. Card, son of Chanute's deceased partner, was working on zinc creosote methods, and it was probably he who initiated the Rütgers process at Paris. In 1906 he patented his own zinc-creosote variation, called the Card process. Now this was the direction Octave had foreseen, but before I delve into the matter, I must first describe the rise of creosote.

The rise of empty-cell creosoting processes

It was about 1901-1902 that Cuthbert B. Lowry travelled to Germany to investigate tie treating. Lowry had been in the lumber and wood preservation business for some years, creosoting bridge piles on the Gulf Coast. After his return from Europe he conducted experiments on a new method of creosoting. What is important with treating ties with creosote is not so much the amount of preservative absorbed, but the depth of penetration. Lowry devised a way to gain sufficient penetration using little creosote. He accomplished this by extracting excess oil after first treating the ties with a liberal amount of preservative. At about the same time Max Rueping of Germany invented a similar method. Lowry's and Rueping's methods are called empty-cell methods, because the space between the wood cells is left empty, while the cell walls remain coated with creosote.

In 1904 Lowry declared that his process was more cost effective than the Burnett or Wellhouse methods.³⁵ George Kittredge of the Big Four was suitably impressed, and made a contract with Lowry's new company in February, 1904 for the treatment of 550,000 ties annually. Lowry built a

³⁵ Rowe, p. 271.

plant at Shirley, IN for the purpose, which began operating in the Spring of 1905.

Also in 1904 the Santa Fe began experimenting with Rueping treated ties, and in 1906 they too converted to empty-cell creosoting. By the end of 1909 fifteen major railroads were using either Lowry or Rueping treated ties. These include many lines which had previously used zinc chloride. The Rock Island and the Chicago & Eastern Illinois switched to creosote in 1907. The El Paso & Southwestern, the Illinois Central, and the Missouri, Kansas & Texas, also abandoned zinc chloride for creosote.

The empty-cell controversy

Of course there was a reaction. Many engineers were skeptical about the new methods, and Chanute was among them. One reason was that empty-cell treated ties had not yet proven themselves in long-term track tests. Chanute spoke in 1900 "Chemists have so many times been disappointed by the results obtained with antiseptics or methods which they recommended that it is now recognized that a process should be tested 10 to 15 years in track before it is adopted fully."³⁶ Having seen so many wood preservation methods prove to be completely worthless in the 19th century, it was a shock to Chanute and others that small-dose creosoting by the Lowry and Rueping methods were embraced so quickly and exclusively by so many railroads. At best the new processes should have been thoroughly tested first!

The principle behind the new processes was dubious to many, including Chanute. To him a small dose of creosote meant a short-lived tie. He wrote in 1907 "Other railroads contemplate building plants, and incline to go over to straight creosoting. It is believed that some of them are figuring on insufficient doses of this costly antiseptic, and as an instance of what may be the result the writer hereto appends the relation of the experience of the Western Railway of France, which has just been received." Chanute then read his translation of the report, which stated that when the railroad dropped its dosage of creosote from 18-22 kilos per tie down to 12-15 kilos per tie, "...at the end of 3 years decay began in ties insufficiently injected, and after 5 years' service a considerable number had to be renewed." They then reinstated their former dosage.³⁷

Various people outside the two empty-cell treating companies attempted to replicate the results of Lowry and Rueping, and all failed. This, together with the aggressive business tactics of the creosoters, led many to believe that these new methods were frauds. The controversy became intense both because of this accusation, and because of the vast amounts of money made or lost

³⁶ *The Journal of the Western Society of Engineers*, April, 1900, p. 111.

³⁷ AREA 1907, pp. 489-490.

with new contracts. This must have been disconcerting for Chanute, who had all his life promoted progress through cooperation and sharing of information. He was not one who believed in rapid advances by recluse experts, or worse, of an industry divided between squabbling parties hurling insults and accusations.³⁸

The price of lumber kept creeping up in the first years of the century, and most tie men realized that zinc chloride alone, either with the Burnett or Wellhouse process, was no longer the most economical choice. For those railroads suspicious of the new creosoting companies, the Card method was the best alternative. In 1908 the Chicago & North Western, the Chicago, Burlington & Quincy, and the Milwaukee Road switched to the Card process, and the Baltimore & Ohio committed itself no later than 1911. The Union Pacific and Southern Pacific continued to use Burnett treated ties. Railroads were divided into two camps: those using straight creosote vs. those using Card's or Burnett's method.

Through all these changes Chanute kept promoting his 1896 three-step variation of the Wellhouse process. Engineers must have listened with patience as one of their most important figures continued to advocate an out-dated process which was not even well received when it was developed. Chanute was still explaining the merits of his process at the 1910 Wood-Preservers' Association meeting.³⁹

Records of empty-cell creosoted ties emerged in the second decade of the century. They showed that in fact there was no fraud involved. The ties held up as Lowry and Rueping had promised. After a creosote shortage during the First World War, railroads which had formerly used Card's or Burnett's process switched to creosoting their ties. Over 60% of the treated ties used in 1923 were treated by an empty-cell method, and by the early 1930's installations of Burnett and Card treated ties were insignificant. To this day the AREA recommendation is that wood ties be treated with creosote by either the Lowry or Rueping process.⁴⁰

The date nail in trouble

If it wasn't enough for Chanute to see not only his favorite process, but also his whole approach to wood preservation swept aside in the first decade of the century, his method of record keeping also fell under attack. He had advocated the use of date nails in all treated ties so that a record could be kept of ties removed from track. Only that way could an accurate calculation of the life

³⁸ Lowry, with the upper hand, downplayed the controversy. The zinc chloride men were very polemical.

³⁹ *Proceedings of the Wood-Preservers' Association*, 1910, p. 119.

⁴⁰ AREA, *1997 Manual for Railway Engineering*, vol. 1, p. 3-9-4.

of ties be procured.

But this turned out to be a fiasco on two railroads. Early in 1909 it came to light that the Chicago, Burlington & Quincy and the Chicago & Eastern Illinois obtained a very bad record from nails, which they had used since 1899. The problem was clerical. The section foremen could not maintain a record from the nails, and they severely underreported the number of ties removed. Frank J. Angier of the CB&Q quit using date nails in 1909 in favor of special test sections, and in his speeches and articles he advocated the same for other railroads. At the time of Chanute's death in November, 1910 the movement toward test sections for record keeping was in full swing: by then the CB&Q the Santa Fe, the Chicago & Eastern Illinois, the Frisco, the Monon, and the Milwaukee Road had quit using date nails in all treated ties, and many others followed in the next couple years. There were quite a few railroads which continued to use date nails, like the Delaware, Lackawanna & Western, the Southern Pacific, and the New York Central, but they were out-voiced. Angier's heated speeches almost turned record-keeping into an debate on par with the creosote controversy. Supposedly it was a difference in the class of labor which made date nails practical in Europe and on some U.S. lines, and not on the CB&Q or the C&EI.

Unlike the case of the switch to creosote, the new nail policy was eventually reversed. Beginning in the early 1920's, railroads which had stopped using nails began again, and lines which were new to tie treating established nails as their method of record keeping. The use of date nails peaked in 1931, and after a couple dips caused by the depression and World War II, they began a long decline which ended about 1970. Since then date nails have been rarely used in North America. In Europe, when wood ties are used, nails are still the norm. See Histogram I, page 73.

The Wright Brothers

I will describe briefly Chanute's relationship with the Wright brothers. For a detailed examination see Tom D. Crouch's biography *The Bishop's Boys: A Life of Orville and Wilbur Wright*.

On May 13, 1900 Wilbur Wright first wrote to Octave Chanute. At that time the Wrights were enthusiastic and very talented potential aviators, and Chanute was the established expert and clearinghouse for ideas. The Wrights had read *Progress in Flying Machines* and they wanted solid information on building gliders. By May 14, 1910, when Chanute last wrote to the Wrights, 435 letters had passed between them. What emerges from the correspondence are the following points:

(1) Chanute was quickly eclipsed in aviation engineering by the Wrights. By 1901 the brothers had surpassed Chanute in their understanding of the fundamental problems, and Chanute would

never catch up.⁴¹

(2) There was a basic incompatibility in their attitudes toward competitors. Like with tie preservation, Chanute believed that progress can be made only if the various people engaging in experimentation communicate freely. Patents would guarantee that credit landed fairly. This attitude may be linked to Chanute's distaste for politics, which he saw as a major hindrance to progress. Remember his bad experience with political trouble during his work on the New York transit proposal.

The Wrights were quiet, patient, and suspicious of their competitors. They had good reason to hide their ideas, at least at first. There was a lot of jealousy, and in the case of the French, national pride amongst aviators which easily got in the way of open communication. Even after the Wrights demonstrated their plane in Paris there were French pilots who claimed that the ideas for the airplane were theirs. By the end of the decade Orville and Wilbur had spent a fair amount of time in court over patent rights, some of it against former colleagues.

In the balance the Wrights were too skeptical about the motives of others. They kept all details of their inventions secret almost to the point of losing precedence to later experimenters. Only when forced by circumstances did they demonstrate their airplane before the public.

In the early years Chanute kept badgering the Wrights to take on apprentices, and to host other aviators during experimentation. The Wrights gave in a little, but this was always a sore point.

(3) After the Wrights' first successful flight at Kitty Hawk on December 17, 1903, Chanute held the view that they had merely adapted the ideas of their predecessors in clever ways. The Wrights knew that they had made several entirely new breakthroughs in the understanding of flight.⁴² This misunderstanding led Chanute to think of himself as the Wrights' mentor. Even before the flight, at a Paris, France lecture delivered April 2, 1903, Chanute implied that the Wrights were his pupils!⁴³ This eventually got back to the brothers, who did not take it lightly.

By 1904 relations between Chanute and the Wrights were strained, and by 1909 they were downright bad.⁴⁴ Crouch raises the question of why the Wrights found their correspondence with Chanute so important. His idea is that by writing to Chanute of their experiments, they made clear to themselves what they were doing. By putting their ideas down on paper, in terms which

⁴¹ Crouch., p. 201.

⁴² Crouch, p. 277.

⁴³ Crouch, p. 251.

⁴⁴ Crouch, pp. 420-421.

Chanute could understand, they refined and organized their thoughts. The letters were as necessary as attaching the fabric to the wings and tightening the bolts.⁴⁵ Also, in 1901, after a bad season at Kitty Hawk, it was Chanute who encouraged them to continue.⁴⁶

Chanute visited Kitty Hawk in August, 1901, October, 1902 and again in November, 1903. He missed witnessing the first flight in history by little more than a month.

Death and the fate of the company

Octave Chanute died in Chicago on November 23, 1910 at the age of 78. He had been ill for some time, and had to abort a trip to Europe that year because of his health. He was survived by three daughters, two of which were Elizabeth and Octavia, and a son, Charles. Annie, his wife, had died in 1902.

His tie preserving Company did not long outlast him. Charles ran the Mt. Vernon plant of the Chicago Tie Preserving Co. The Chicago plant was abandoned after the loss of the Rock Island contract in 1903. Two new plants were built in 1904: one at Paris, IL and one at Terre Haute, IN. In 1907 Joseph P. Card began a new company, the Chicago Tie & Timber Preserving Co., and opened a plant in Waukegan, IL to treat Milwaukee Road ties by the Card process.

In late 1909 or early 1910 the Chicago Tie Preserving Co. was dissolved. Card split with the Chanutes, taking the Terre Haute plant. The Paris plant was abandoned. Charles continued to run the Mt. Vernon plant, with his father as partner. The name of their firm was now O. Chanute & Co.

Charles was Third Vice President of the AWP in 1910, and about 1911 O. Chanute & Co. ceased to exist. The Mt. Vernon plant was taken over by the T. J. Moss Tie Co. Charles died sometime before 1922, possibly in 1911.

Octave Chanute reached the halfway point in his professional career in 1880, when he was still a railroad maintenance-of-way engineer. He had not yet begun work on the Tie Committee, and aviation was still only a hobby to which he had little time to devote. He was President of the American Society of Civil Engineers in 1891, and of the Western Society of Engineers in 1901.

⁴⁵ Crouch, pp. 210-202.

⁴⁶ Crouch, p. 218.

Railroad listings

Adirondack

This railroad, composed of two former branches of the NYC and D&H, was formed in 1979 as a passenger line to the Lake Placid Olympic Games. It was abandoned in 1980. The railroad placed a galvanized roofing nail with a 3/4" washer in the renewal ties inserted in 1979. The nails come in two shank lengths: 3/4" and 1 1/4".

Akron & Barberton Belt

Probably from second hand ties

2 1/2 × 1/4	rnd R	stl (07)	27:b,28
2 1/2 × 1/4	sqr R	stl (07)	29-31

The A&BB is a 20 mile long Ohio switching line. The sqr R nails are from second hand Nickel Plate ties.

Akron, Canton & Youngstown

From second hand ties

2 1/2 × 1/4	rnd R	stl (07)	25,26,27:b,28-32,34-41, ^{NL} 36,43,44,44:b,45,49-52
2 1/2 × 1/4	rnd R	stl (18B)	26
2 1/2 × 1/4	rnd R	stl (01)	27:b
2 1/2 × 1/4	rnd I	stl (07)	30,31,33,34,42-51,53,54
2 1/2 × 1/4	rnd I	stl (05)	31,35,36
2 1/2 × 1/4	rnd I	stl (10)	33
2 1/2 × 1/4	rnd R	stl (09)	38
1 1/2 × 1/5	rnd R	stl (06)	42,46,47,51-57
1 1/2 × 1/5	rnd R	stl (09)	45

Code nails from second hand ties

1	× 1	rnd I	stl (CL)	8
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The AC&Y was bought by the N&W on October 16, 1964, and became part of the N&W system in January, 1982.

See [Shaw, 67] for a photo of some nails pulled here. They are also from second hand ties, and the first 26 shown is really a Western Union nail. Many of the nails listed above come from the DNC list.

The (CL) 8 was pulled by Russ Hallock in the diamond crossing where the AC&Y crossed the PRR in Chatfield, OH. The tie may have been inserted by the PRR, the N&W, or even by the treatment company. This is a chair-leg, or bottle cap nail, stamped out of sheet metal with three shanks protruding down from the edge of the head. It is the only (CL) nail known from a tie in North America. In Europe, Belgium in particular, they are common.

Sources for second hand nails

Chicago North Shore & Milwaukee

2 1/2 × 1/4	rnd I	stl (05)	31,35
1 1/2 × 1/5	rnd R	stl (06)	42,46,47,51-57
1 1/2 × 1/5	rnd R	stl (09)	45

Erie

2 1/2 × 1/4	rnd R	stl (01)	27:b
2 1/2 × 1/4	rnd I	stl (07)	30,31,33,34,42-51,53,54
2 1/2 × 1/4	rnd I	stl (10)	33
2 1/2 × 1/4	rnd I	stl (05)	36

...Akron, Canton & Youngstown

Wabash

2 1/2 × 1/4 rnd R stl (09) 38
(and possibly the rnd R (07) 29, 30)

Algoma Central & Hudson Bay

1 1/2 × 1/4	rnd R os cp	stl (38)	47-49
1 1/2 × 1/4	rnd R cp	stl (38)	50-57
1 1/2 × 1/5	rnd R ts	stl (37)	58-61
1 1/2 × 1/4	rnd R ts	stl (37)	61-80,82

On June 30, 1965 the AC&HB changed its name to the Algoma Central.

Jason Draper reports that all nails were placed outside the rail. See [June '76, 7] for a nail hunt. Both Ed Biedenharn and Terry Hill confirm that 80's were ordered, but never used. Terry reported the rare (37) 61. He also tells me they used the 1 1/2 × 1/4 aluminum 50 (page 73, Volume III). This nail, and the others in the series, are common in poles in Canada. [Winter 2001, 11][Winter 2002, 12].

Aliquippa & Southern

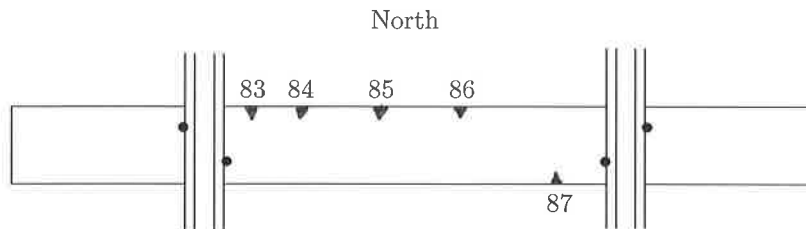
2 1/2 × 1/4 sqr I stl (05) 64

This 45 mile Pennsylvania line connects with the P&LE. An A&S track worker was selling these unused 64's at a flea market, and claimed that they are the only date used by the A&S. Has anyone walked this line?

Allegheny Valley

This line became part of the Pennsylvania RR in August, 1900. It was owned by PRR before.

In 1881 they began careful tie records, and in 1883 began notching ties. "On the Allegheny Valley Railway the system of marking is by cutting a small V notch with an axe or adze in the edge of the tie at the time of placing it in the track, the position of the notch indicating the year." [Trat II, 222] The scheme is reproduced here:



1883 notches were placed 4" on the north side inside the River (west) rail. 1884, 1885, and 1886 notches were placed on the north side 1 foot, 2 feet, and 3 feet respectively inside the River rail. 1887 notches were located 9" inside the Hill (east) rail on the south side of the tie. Because the article in [RG] was written four years after 1887, they may have notched their ties for only five years.

Though they were aware that petroleum may increase the life of ties, they were not, in the 1880's, ready to experiment with treated ties. [RG 12-18-91, 895-896][DNC, 9-10]

Almanor

2	× 1/4	rnd R	stl (18C)	48-53
2 1/2	× 1/4	rnd R	stl (18C)	51,58-62
2 1/2	× 1/4	rnd I	stl (06)	54,56
2 1/2	× 1/4	rnd R	stl (06)	53,56,58,61
2	× 1/4	rnd R	stl (06)	48,59,61

Almanor

The Almanor, a 13 mile California short line, was incorporated September 15, 1941 and began operating in May, 1942. It connects with the Western Pacific.

Wayne Gregory has walked the whole line. He found one each 1 1/2" (18C) 48,49,53. These were probably cut short at the nail factory.

Dave Parmalee wrote in [J-F '78, 1] that they used no 55 or 57. Wayne Gregory agrees.

Alton

See Chicago & Alton.

American Car & Foundry

2	× 1/4	rnd R	stl (07)	39,41
2 1/2	× 1/4	sqr I	stl (08)	46
2 1/2	× 1/4	rnd R	stl ()	⁷⁹⁷ 1947
1 3/4	× 3/16	rnd I gm	cop (60)	52,54,56/4

The 56/4 is an overstrike: 6 over 4. The 1947 in the ⁷⁹⁷₁₉₄₇ probably refers to the date.

This company built freight cars and operated a private track in Berwick, PA which connects the DL&W with the factory. Another company owns the property now.

See Dave Parmalee's article in [N-D '81, 1-2].

Ann Arbor

2 1/2	× 1/4	rnd R	stl (07)	26,29:b,30,31
2	× 1/4	rnd R	stl (07)	30
2 1/2	× 1/4	rnd R	stl (06)	31-37,39,41,48,48:b
2 1/2	× 1/4	rnd R	stl (09)	38,40
2 1/2	× 1/4	rnd R	stl (17)	42,47,49
2 1/2	× 1/4	rnd R	stl (05)	43,44,44:b,45,45:b,46

The DT&I controlled the Ann Arbor from 1905 until the Wabash took over in 1925. The DT&I retook the AA on December 31, 1962.

Nails are located 8 inches inside the west or south rail, sometimes on the opposite side.

This set, really a regional variation on the Wabash set, is hard to pin down. Wiswell, in [Dec '74, 6], listed no 2 1/2" (07) 26, 30, 31, (05) 44:b, and nothing before 29. His nails were pulled by C. L. Fisher. Dave Parmalee, in [J-F '78, 1], wrote that the 29 is short (he meant the 30), and all other nails are identical to Wabash. Bill Bunch suspects that nails before 30 may not have been used on the AA. Iacovino found 29, 32-49. [(2nd) Fall 2001, 11]

Apache

1 1/2	× 1/4	rnd R	stl (25)	50
2 1/2	× 3/16	rnd R	stl (10)	79-88,90,91
<i>From second hand ties</i>				
2 1/2	× 1/4	rnd I	stl (07)	24
2 1/2	× 1/4	rnd R	stl (06)	35
2 1/2	× 1/4	rnd R	stl (18C)	45,50,54,55

The Apache is a 74 mile line in Arizona which connects with the AT&SF.

The 50's were put in by the former owners when the Southwest Forest Industries saw mills were operating. The current owner, Stone Container Corp., used the newer nails.

Most nails are found outside the rail.

The second hand 24 is from the SP and the others are from ex-Santa Fe ties.

Max Jones, who supplied all this information, also found some Southern Pacific (Texas and Louisiana Lines) and other Santa Fe nails on the spur to Snowflake.

Arcade & Attica

From second hand ties

1 3/4 × 5/16	rnd I	stl (01)	3,11-15
2 1/2 × 1/4	rnd I	stl (07)	12-14,15:b,15:c,16,22-26,26:b,26:c,27-29,31,33,37,39,42,44,47,48,49:b,50,51,62
2 1/2 × 1/4	rnd R	mi (11)	14
1 3/4 × 5/16	rnd I	stl (05)	16,17
2 1/2 × 1/4	sqr I	stl (07)	18-20,22,23,26:b,27-30
2 1/2 × 1/4	rnd R	stl (07)	19,22-25,25:b,26:b,26:d,27:b,28,28:b,29,29:b,30-36,38-40,42,43,44:b,45-47,52,53
2 1/2 × 1/4	sqr I	stl (05)	24,26:b,31,31:d
2 × 1/4	rnd I	stl (07)	24
2 1/2 × 1/4	sqr R	stl (07)	26
2 × 3/16	rnd R	mi (11)	26,27,30,31
2 1/2 × 1/4	rnd R	stl (01)	28:b
2 1/2 × 1/4	rnd I	stl (01)	30
2 1/2 × 1/4	rnd I	stl (05)	31,35
2 × 1/5	rnd R	stl (04)	33,34,42
2 1/2 × 1/4	cut R	stl (03)	35
1 1/4 × 3/16	rnd R gm	cop (60)	37
1 1/2 × 1/5	rnd R	stl (06)	43
1 1/2 × 1/5	rnd R	stl (09)	45
2 1/2 × 1/4	rnd R	stl (06)	48
2 1/2 × 1/4	rnd I	stl (06)	55

This western NY short line never used its own nails. They always inserted second hand ties face-down. For this reason it is rare to find a nail in the track. The effort of searching the rotting ties on the embankments and in the bushes pays off, as the list suggests. See [M-A '91, 5].

Sources for second hand nails

Chicago North Shore & Milwaukee

2 1/2 × 1/4	rnd I	stl (05)	31,35
1 1/4 × 3/16	rnd R gm	cop (60)	37
1 1/2 × 1/5	rnd R	stl (06)	43
1 1/2 × 1/5	rnd R	stl (09)	45

Nashville, Chattanooga & St. Louis

2 × 3/16	rnd R	mi (11)	26,27,30,31
2 × 1/5	rnd R	stl (04)	33,34,42

These nails were found in the proper positions in the tie. See NC&StL.

New York Central

2 1/2 × 1/4	sqr I	stl (07)	19,20,22,23,27-30
2 1/2 × 1/4	sqr I	stl (05)	24,26:b,31,31:d

Nickel Plate Road

2 1/2 × 1/4	sqr I	stl (07)	26:b
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Arcade & Attica

Pennsylvania

2 1/2 × 1/4	rnd I	stl (07)	23,50,62
2 1/2 × 1/4	rnd I	stl (06)	55

The rnd I (07) 62's have been found only in Arcade, which is the location of the A&A's interchange with the PRR. In New York state the PRR inserted ties which already had a date nail, and paid no attention if the nail landed face down in the ballast. The only nails found in the track on the A&A are the rnd I (07) 23, 50 and rnd I (06) 55. Because these are PRR nails, they support the fact that the A&A inserted all second hand ties face down. See also Stewartstown RR.

Rutland

2 1/2 × 1/4	rnd R	stl (01)	28:b
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Schenectady

2 1/2 × 1/4	rnd I	stl (07)	12-14,15:b,15:c,16
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Shadow sets

Stubby shadow set

1 3/4 × 5/16	rnd I	stl (01)	11-15
1 3/4 × 5/16	rnd I	stl (05)	16,17
2 1/2 × 1/4	sqr I	stl (07)	18

and possibly

2 1/2 × 1/4	rnd R	stl (07)	19
2 1/2 × 1/4	rnd I	stl (07)	25,26:b

Arcadia & Betsey River

1 1/2 × 1/4	rnd I	stl (07)	27
1 1/4 × 3/16	rnd I gm	cop (60)	28-30

The A&BR was abandoned in December, 1936. It was a 17.3 mile short line in Michigan, and connected with the Pere Marquette.

These nails might be from second hand ties.

Arizona Eastern

The AE was owned by the SP, and was incorporated into the SP system in November, 1924. The following SP nails have been found here:

2 1/2 × 1/4	rnd I	stl (07)	08,09,12-14,18,22
2 1/2 × 7/40	rnd R gm	stl (07)	15

Arkansas & Louisiana Missouri

2 1/2 × 1/4	rnd R	stl (17)	30:c,31-62
2 1/2 × 1/4	sqr R rs	stl (17)	45

This 84 mile long railroad connected with IC, MoPac, and the Ashley, Drew & Northern. Their nail set seems to be the same as the AD&N's, judging from what has been pulled. Maybe track maintenance for the two railroads was centralized, like it was for B&C/M&WR and StJ&LC.

Ashley, Drew & Northern

2 1/2 × 1/4	rnd R	stl (17)	40-43,45,45:b,46-52,55-62
2 1/2 × 1/4	sqr R rs	stl (17)	45
2 1/2 × 1/4	rnd R	stl (06)	52-54

This 41 mile Arkansas short line connected with MoPac, Rock Island, and the A&LM. See Arkansas & Louisiana Missouri above for a comment on the sets.

Atchison, Topeka & Santa Fe

See Santa Fe.

Atlanta & Saint Andrews Bay

2 × 1/4 rnd R stl (19) 38,42,43,49-53

Atlantic Coast Line

2 1/2 × 1/4 rnd R stl (07) 30-32

2 1/2 × 1/4 rnd R stl (04) 33,34,37

1 1/2 × 1/4 rnd R stl (19) 43,67

1 1/2 × 1/4 rnd R stl (09) 63,64,66

1 1/2 × 1/4 rnd R stl (07) 65

Code nails

2 × 3/16 rnd R stl (18C) 0-6.,7-9. (Set #30)

The Atlanta, Birmingham & Coast, already owned by ACL, was merged into the ACL January 1, 1946. Seaboard Coast Line was formed from the ACL and SAL July 1, 1967.

Treating ties

In 1887 the ACL experimented with some creosoted ties in North Carolina, but it was not until 1912 that they built their first tie treating plant, in Gainesville, FL. The plant creosoted ties and other timbers by the full cell (Bethell) process. ['12, 284]['13, 450]

In 1913 they began a system of test sections which continued to receive ties at least until 1915. Both full cell and Rueping treated ties were laid, and it is not known if these experiments convinced the ACL to switch to the Rueping process in the teens.

The early test section

Goldsboro and Halifax, NC, 1887.

252 full-cell creosoted longleaf pine ties were laid. They were treated in the Spring of 1887 by the Wilmington Creosoting Co. 112 ties were placed near Goldsboro, NC, and 140 near Halifax. 60% were still in service in 1913. ['11, 131]['13, 99]['16, 321]['17, 198]['20, 122]

The 1913-1915 tests

In these years the ACL followed the lead of several Western railroads in instituting a system of test sections. The date was hammer stamped in the ties. "Test sections will contain 500 to 1,000 ties each. One or more to a division and will include all combinations of ties and treatments that road is likely to be interested in." [DNC, 289]['14, table]

Listed below are the three known sites with the ties known to have been inserted. There may have been other ties at these sites, but there were probably no other test sections.

- Gainesville, FL.

1913 50 untreated cypress ties. ['20, 98]

10 untreated loblolly pine ties. ['20, 121]

20 untreated longleaf pine ties. ['20, 122]

199 full cell creosoted longleaf pine ties, 8.5 lb/ft³. ['20, 122]

50 full cell creosoted longleaf pine ties, 13.23 lb/ft³. ['20, 122]

51 Rueping creosoted longleaf pine ties, 7.36 lb/ft³. ['20, 122]

50 Rueping creosoted longleaf pine ties, 4.94 lb/ft³. ['20, 122]

1914 2 Rueping creosoted red gum ties, 1.5 lb/ft³. ['20, 103]

2 Rueping creosoted tupelo gum ties, 2.8 lb/ft³. ['20, 104]

2 Rueping creosoted maple ties. ['20, 108]

2 Rueping creosoted hard maple ties, 3.5 lb/ft³. ['20, 109]

10 Rueping creosoted loblolly pine ties, 4.6 lb/ft³. ['20, 121]

Atlantic Coast Line

- Clearwater, FL.
 - 1914 50 untreated cypress. ['20, 98]
 - 50 untreated longleaf pine ties. ['20, 122]
 - 100 full cell creosoted longleaf pine ties, 8.89 lb/ft³. ['20, 122]
 - 150 Rueping creosoted longleaf pine ties, 4.21 lb/ft³. ['20, 122]
 - 100 Rueping creosoted shortleaf pine ties, 4.6 lb/ft³. ['20, 124]
 - 1915 50 untreated longleaf pine ties. ['20, 122]
- Waycross, GA.
 - 1915 50 untreated cypress. ['20, 98]
 - 150 untreated longleaf pine ties. ['20, 122]['22, 113]['23, 162]
 - 100 full cell creosoted longleaf pine ties, 8.89 lb/ft³. ['20, 122]
 - 100 Rueping creosoted longleaf pine ties, 4.51 lb/ft³. ['20, 122]
 - 100 Rueping creosoted longleaf pine ties, 4.72 lb/ft³. ['20, 122]

Date nails

In 1925 the ACL did not think nails were worth the cost. [AREA '26, 709][DNC, 329]

A rnd R (19) 70 has been found here in the end of the tie. It is a Southern Wood Piedmont nail. Maybe the (19) 67 listed above is also a SWP nail. Was it found in the end of the tie?

Baltimore & Ohio

Test section nails

2 1/2 × 1/4	rnd I	stl () 2
2 1/2 × 1/4	rnd I	stl (01) 2,3
2 1/2 × 1/4	rnd I	stl (07) 8,12
2 1/2 × 1/4	rnd I GM	stl (07) 9,09,10,10:b,10:c
2 1/2 × 1/4	rnd I	stl () 11,11:b

Code nails

2 1/2 × 1/4	rnd R	stl (07) CS #9,SC #4,ST #5,TS #2
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Code nails from test sections

2 1/2 × 1/4	rnd R	mi (11) 0-6.,7-9.	(Set #18)
2 1/2 × 1/4	cut R	stl (07) 0-9	(Set #19)
2 1/2 × 1/4	rnd R	stl (07) 0-5	(Set # 44)
2 1/2 × 1/4	rnd R	mi (11) W	

Code nails from bridge timbers

2 1/2 × 3/16	sqr R	stl (07) 0-9	(Set # 45)
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Treatment company nails?

2 1/2 × 1/4	rnd R	stl (07) 57,58
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Questionable nails

2 1/2 × 1/4	rnd I	stl (07) 53,54
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F. J. Angier and tie treating, beginning 1910

The B&O experimented sporadically with treated ties beginning with their 1842 test of mercuric chloride. It was only in 1908 that they began, on a small scale, to use treated ties on a regular basis. In the Spring of 1910 they hired Frank J. Angier as Superintendent of Timber Preservation. Angier, formerly with the CB&Q, had supervised the establishment of the Burlington's two treatment works, and was responsible for the CB&Q's series of test sections in 1909-1910. He was also opposed to empty cell creosoting. Naturally he set about doing for the B&O what he had done for the CB&Q.

He first established a test section between Blanchester and Windsor, OH in 1911, and in the next eight years added at least nine more.

In 1912 the B&O constructed their first tie treating plant at Green Spring, WV. It was still under construction at the end of 1912, and was certainly finished in time to treat 1913 ties. The plant treated cross and switch ties by the Card process. In 1914 they began also using water gas tar. The Card process remained in use at least through the teens, and by 1927 (perhaps 1924?) the railroad had switched to a creosote-petroleum mixture. ['13, 448-449][B&O, 71]

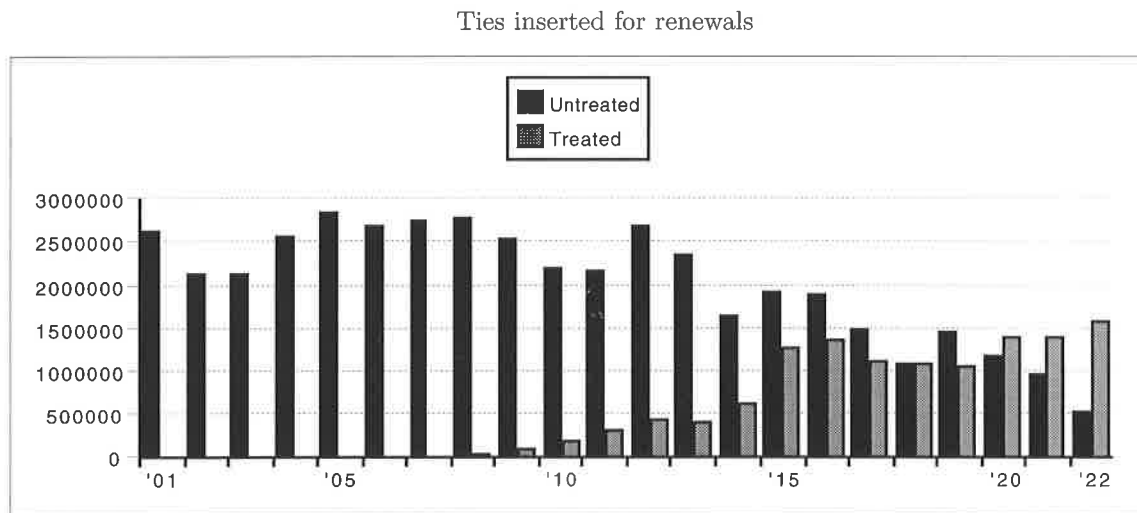
...Baltimore & Ohio

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The plant was expanded in 1924. Sometime between 1930 and 1934 they sold the plant to Century Wood Preserving Co. Century was taken over by Wood Preserving Corp. (Koppers) about 1939. Even after the railroad sold the plant it continued to provide them with ties. In fact, in 1940 R. N. Angier, probably F. J.'s son, was assistant superintendent of the Green Spring works. ['34, 491]['40, 412, 453]

An incidental comment in ['22, 41] reveals that the B&O was acquiring ties from at least two treating plants. The B&O owned only the Green Springs plant in 1922, so the other might be a commercial plant. Probably the 1917 test ties which received the Cecil Williams process were treated by the Indiana Tie Co. ['22, 482] (See test sections below.)

The following histogram is drawn from the data in [WPN Jul '24, 110].



1908 was the first year treated ties were used for renewals. 24,828 were inserted that year. 88,258 were used in 1909, after which the numbers rose rapidly.

The marking of ties

When they used them at all, the B&O placed date nails only in test section ties at least through 1922, the year of Angier's death. Two letters of Octave Chanute, from December 17, 1902 and September 12, 1903, list the B&O as currently using date nails. So the 2's and 3's from the Windsor-Blanchester test section are probably dates. [Spring 2002, 1-4][Fall 2002, 18-19]

Al Byers traded for several rnd R (05) 30's and (03) 36's years ago. They may not belong to the set. Only one each of the rnd I (07) 53 and 54 were found, by Steve Worboys at Blues Beach, near Romney, WV. They could be from second hand ties, and could have been inserted after the B&O ceased to operate the line. The 57's and 58's can be found in many locations. Because these nails are found also on the Erie and DL&W and do not seem to belong to either set, it may be that they are treatment company nails.

Code sets #18 and #19 and the rnd R (07) 1-3 were found in ties in a "test section in Washington, DC on the line going towards Baltimore" "to number ties from 1 to about 2500. Probably laid in the 1920's." [DNC, 180][Wiswell 77]

...Baltimore & Ohio

Two TS's have been found in New York in different locations on the former BR&P. (For these two nails, the letters are closer together than those in the nail pictured in Volume III, page 86.) [J-A '80, 2] If they are not from second hand ties, this dates the use of these nails between 1932, when the B&O took over the BR&P, and 1943, the last year the (07) diamond appears on AS&W Co. nails. The codes can also be found stamped into modern aluminum straps which are nailed to ties.

The 3, 8, and 9 have been found in Maryland and Pennsylvania, and the 9 has been found in West Virginia. See Test sections below for the locations of other finds.

Here are some quotes:

The B&O stated in January, 1914 "Expect to install record soon by special sections" using "Dating nail." [DNC, 289]['14, table]

Angier wrote in 1922 "I believe in putting dating nails in test track where we can keep a record..." He was opposed to the use of nails in every tie. [DNC, 31][AREA '22, 1165]

From 1925: "The branding method of marking ties may be accomplished at but a small percentage of the cost of dating nails..." [AREA '26, 709][DNC, 329] An illustration of the brands (stamps) used by the B&O is shown in [W-P Oct-Dec '15, 56]. The grade and species of wood are indicated, along with whether the tie is treated or not.

Test sections

All test sections from 1911 through 1919 were established by Angier, and can be seen as a continuation of his experiments on the CB&Q. From large tests of many woods and treatments there is a trend to smaller tests with specific goals. The tests from the 1920's on were initiated by Angier's successor.

- 1842.
In this year the B&O tested some Kyanized ties. [ASCE 7-85, 253]['16, 328]
- 1850.
Some ties soaked in Lime were installed. The test was a failure. [ASCE 7-85, 282]
- 1862.
The Ohio & Mississippi Railroad, later part of the B&O, used some Burnettized bridge timbers this year. [ASCE 7-85, 258]
- 1879.
Some ties treated with copper sulfate by the Thilmany process were installed. [ASCE 7-85, 279]
- Ohio, 1899-1900.
201,600 untreated oak ties were placed under observation. ['16, 305]
- Medora, IN, 1904.
424 untreated chestnut oak ties were installed. All were removed by 1916. ['16, 306]['17, 166] ['20, 111]['22, 111]['23, 163] (The latter two sources say pin oak.)
- Washington Terminal, 1904.
137,000 untreated white oak. All had been removed by 1918. ['22, 112]['23, 164]
- Washington, DC, 1909.
Many 09's were found on a spur by Steve Worboys.
- Hockessin, DE, 1909.
9's have been found here. At least two collectors have found them. [Winter 2001, 11]
- Windsor-Blanchester, OH, 1902-1912.
About one mile west of Blanchester, OH. Despite the extensive reports in [AWPA] and [WPN] of the 1911 experimental ties, I have no references to the earlier or later test ties.
A railroad man in Washington Courthouse, OH (ca. 35 miles from Blanchester) had (01) 2, 3, (07) 8, 9, 12, and several unused 09-11 B&O nails which Bill Bunch acquired from Jeff Irvin. Bill then drove to the Blanchester test track and pulled () 2, (01) 2, 3, (07) 8, 09, 10, and () 11 from tie fenceposts.
5,230 ties were inserted in the westward main track in March, 1911, from mileposts 155-909 to 157-000. Red oak and other species were treated with coal tar creosote, zinc-creosote (Card) process, and timber asphalt (open tank), and were laid together with untreated white oak. The following table gives the numbers:

...Baltimore & Ohio

	Creosote	Card	Timber asphalt	Untreated
Red oak	873	1,125	1,001	
Beech	27	568		
Hard maple	70	463	2	
Gum	113	126	3	
Elm	35	58	12	
Honey locust	2			
Ash	2	1		
Hickory	1	1		
Pine	1			
Black walnut	1	1		
White oak		1		760

"Purpose of test: (1) To determine the value of various kinds of preservative treatments compared with the untreated white oak tie.

"(2) To determine the value of red oak treated ties compared with treated ties of other woods (gum, beech, maple, elm, etc.)." ['37, 173]

The creosoted and Card ties were treated by the Kettle River Co. of Madison, IL in January, 1911, and the timber asphalt work was done at the Cincinnati Wood Preserving Co. in March, 1911. [AREA '12, Appendix B] [WPN Mar '23, 33-37][WPN Mar '24, 36-38]['21, 165-166]['25, 161] ['26, 212]['27, 165]['30, 294]['37, 173-174]

- Green Spring, WV, 1914.

60 red oak ties were treated. 10 ties each were treated with the following:

Zinc chloride & coal tar creosote

Coal-tar creosote—10 lb.

Coal-tar creosote—6 lb.

Zinc chloride & water gas tar & coal tar creosote

Zinc chloride & water gas tar

Untreated. ['21, 167]

- Herring Run, MD, 1914-15.

On the eastward main track seven miles east of Baltimore, 3,300 red oak ties were laid. All were installed in November, 1914 except the last lot of 300, which was placed in cooperation with the Forest Service in August, 1915.

<u>Ties placed</u>	<u>Tie numbers</u>	<u>Treatment</u>
298	3-300	Untreated
300	301-600	Burnettized, .35 lb. ZnCl ₂
300	601-900	Burnettized, .63 lb. ZnCl ₂
300	901-1200	Straight coal tar creosote, 4.02 lb.
300	1201-1500	Straight coal tar creosote, 9.78 lb.
150	1501-1650	Water gas tar creosote, 5.16 lb.
150	1651-1800	Water gas tar creosote, 6.12 lb.
150	1801-1950	Water gas tar creosote, 7.09 lb.
150	1951-2100	Water gas tar creosote, 10.90 lb.
212	0-212-Cull	Water gas tar creosote, 11.00 lb.
300	2101-2400	Sodium fluoride, .41 lb.
300	2401-2700	Card: coal tar creosote .76 lb., ZnCl ₂ .63 lb.
300	2701-3000	Card: creosote .37 lb., water gas tar creosote 1.35 lb., ZnCl ₂ .59 lb.
300	3001-3300	Card: coal tar creosote 2.0 lb., ZnCl ₂ .5 lb.

The purpose of this test "is to determine the economic value of various kinds of preservative treatments, and incidentally, to note the life of red oak treated ties compared with red oak ties untreated." ['37, 171]

I scoured the area in 1992 and turned up no ties old enough to be from this test. ['21, 167] ['25, 161]['26, 212]['27, 165]['30, 295]['37, 171-173]

...Baltimore & Ohio

- Staten Island, NY, 1915.

519 ties. ['21, 166-167]

Wood	ZnCl ₂ & coal tar creosote	Untreated
Black oak	105	25
Chestnut	105	25
Red oak	105	25
White oak	104	25

- Boyds, MD, 1915, 1919.

In 1915 the following ties were inserted:

2 gum, 6 hard maple, and 451 red oak ties treated with ZnCl₂ & water gas tar

2 gum, 6 hard maple, and 133 red oak ties treated with ZnCl₂ & water gas tar & coal tar creosote.

4 untreated white oak ties. ['21, 165-167]

In 1919, 118 beech ties were inserted. 64 were treated with ZnCl₂ & water gas tar and 54 with ZnCl₂ & water gas tar & coal tar creosote. ['21, 165]

The (01) 3 and (11) W were found here.

Also, the nails TS, SC, CS, and ST were found here, but in straight track. They might be from second hand ties. [Wiswell 79]

- Hamden, OH, 1917.

375 ties. 25 each untreated red oak, white oak, and water oak. 100 each ZnCl₂ & water gas tar, same three woods. ['21, 166-168]

- La Paz Jct., IN, 1917.

981 red oak ties were inserted, all treated with zinc chloride and coal tar creosote by the Cecil Williams process. The Indiana Tie Co., with plants at Joppa, IL and Evansville, IN treated ties by this method. ['20, 117]['21, 166]['22, ix] ['20] says 988 ties.

- North of Dayton, OH, 1919.

1,632 ties were laid, of which 1,178 were treated with zinc chloride and water gas tar (presumably by the Card method) and 454 were untreated. ['21, 165-168]

Wood	ZnCl ₂ & water gas tar	Untreated
Beech	571	50
Cherry	32	27
Chestnut	95	50
Elm	34	25
Douglas fir	155	105
Red oak	103	48
White oak	96	99
Heart pine		50
Sap pine	92	

- Barnesville, MD, 1919.

520 ties.

<u>ZnCl₂ & water gas tar</u>		<u>Untreated</u>	
4	Hickory	50	Heart pine
49	Hard maple	105	Douglas fir
55	Soft maple		
52	Sap pine		
50	Sycamore		
5	Beech		
45	Red birch		
105	Douglas fir	['21, 165, 166, 168]	

...Baltimore & Ohio

- Germantown, MD to Barnsville, MD, 1927-1928.
24,570 ties were laid.

<u>Treatment chemicals</u>	<u>Red oak</u>	<u>White oak</u>	<u>Mixed hardwoods</u>
Creosote	900 @ 6 lb.	300 @ 6 lb.	300 @ 6 lb.
Creosote	900 @ 8 lb.	300 @ 8 lb.	300 @ 8 lb.
50-50 creosote-petroleum	300 @ 8 lb.	300 @ 7 lb.	300 @ 8 lb.
50-50 creosote-petroleum	900 @ 9 lb.		
40-60 creosote-petroleum	900 @ 9 lb.	300 @ 7 lb.	300 @ 9 lb.
80-20 creosote-coal tar	900 @ 10 lb.	300 @ 7 lb.	300 @ 9 lb.
70-30 creosote-coal tar	900 @ 9 lb.	300 @ 8 lb.	300 @ 8 lb.
60-40 creosote-coal tar	900 @ 10 lb.	300 @ 7 lb.	300 @ 8 lb.
50-50 creosote-coal tar	900 @ 9 lb.	300 @ 5lb.	300 @ 9 lb.
Water gas tar	900 @ 8 lb.	300 @ 7 lb.	300 @ 9 lb.
50-50 creosote-water gas tar	900 @ 8 lb.	300 @ 8 lb.	294 @ 8 lb.
40-60 creosote-water gas tar	900 @ 9 lb.	300 @ 7 lb.	300 @ 10 lb.
30-70 creosote-water gas tar	900 @ 10 lb.	300 @ 8 lb.	300 @ 10 lb.
40-30-30 creo-petro-w.g. tar	900 @ 10 lb.	300 @ 7 lb.	300 @ 10 lb.
30-50-20 creo-petro-w.g. tar	900 @ 8 lb.	300 @ 5 lb.	300 @ 9 lb.
30-30-40 creo-petro-w.g. tar	900 @ 9 lb.	300 @ 7 lb.	300 @ 10 lb.
.47 lb. ZnCl ₂ -3.75 lb. petro	600		
.32 lb. ZnCl ₂ -4.7 lb. petro	600		
.41 lb. ZnCl ₂ -2.82 lb. petro		300	

In addition, 210 red oak and 66 white oak ties, treated by various treatments in experimental retorts, were laid. Mixed hardwoods consisted of beech, maple, ash, hickory, and others. The ZnCl₂-petroleum treatment was two-movement. [AREA '51, 315]['30, 293]

- Near Washington, DC, 1920's?

Code sets #18 and #19 were used to number ties from 1 to about 2,500. [DNC, 180]

- Between Hills, OH and Loveland, OH, 1930.

In January, 1930 1,800 straight creosote treated red oak and 3,857 60-40 creosote-petroleum treated ties of various species were laid. Probably all ties were treated by an empty cell method. [AREA '51, 314]

Straight creosote		
Wood	Absorption per cf	No. of ties
Red oak	4.78	600
Red oak	6.25	600
Red oak	8.17	600

60-40 creosote-petroleum treatment		
Wood	Absorption per cf	No. of ties
Chestnut	8.97	400
Gum	8.97	400
Hickory	8.48	400
Sap beech	8.97	200
Heart beech	10.47	200
White oak	5.47	600
Red oak	8.15	1,200
Red oak (damaged)	8.15	457

Bangor & Aroostook

2 1/2 × 1/4	rnd R	stl (07)	49-59,61,62:b
2 1/2 × 1/4	rnd R	stl (06)	60

Interestingly, all these nails were used also by the Maine Central. They were pulled by Russ Hallock, Steve Worboys, John Iacovino, and me. All are common on this railroad.

Barre & Chelsea / Montpelier & Wells River

2 1/2 × 1/4	rnd R	stl (07)	25,30-33,44,45
1 1/2 × 1/4	rnd R	stl (24)	34-36,36:b,37-40
1 1/2 × 1/4	rnd R	stl (23)	41-43
<i>From second hand ties</i>			
1 3/4 × 5/16	rnd I	stl (01)	3
2 1/2 × 1/4	rnd I	stl (07)	23,24,27-29
2 × 1/4	rnd I	stl (07)	24
2 1/2 × 1/4	rnd R	mi (11)	26,28,30
2 1/2 × 1/4	rnd R	stl (07)	26,27:b,28-35,40-42,45-50
2 1/2 × 1/4	cut R	stl (03)	35,36
1 1/2 × 1/4	rnd R	stl (07)	37,38
1 1/2 × 1/4	rnd R	stl (05)	39,41,42
1 1/2 × 1/4	rnd R	stl (19)	39
1 1/2 × 1/5	rnd R	stl (07)	43-45
1 1/2 × 1/5	rnd R	stl (06)	46-48
1 1/2 × 1/4	rnd R	stl (06)	47
2 1/2 × 1/4	rnd R	stl (17)	47,49
<i>Code nails from second hand ties</i>			
2 1/2 × 1/4	rnd R	stl (07)	R,Y

The B&M had controlling interest in the Barre & Chelsea and the Montpelier & Wells River from 1911 until 1925, when their interest dropped below 50%. On November 30, 1944 the B&M relinquished all control of the two railroads, and on January 1, 1945 the B&C bought the M&WR. On September 19, 1956 the B&C was given permission to abandon, and the rails from Montpelier to Wells River were removed by March 18, 1957.

The remaining trackage was bought and reorganized as the Montpelier & Barre, which began operating January 15, 1957. On March 17, 1958 the Central Vermont sold its Barre branch to the M&B. In 1979 the railroad was again abandoned, to be rescued this time by the state of Vermont. In April, 1980 it became the Washington County Railroad.

In 1925 the offices of the B&C, the M&WR, and the St. Johnsbury & Lake Champlain were consolidated. It seems also that the three railroads used the same nails. All three short lines had common tie replacement policies, so their nail sets are the same. The set is listed here, and also under StJ&LC. The 25 and 30-33 which I list are believed by Russ Hallock to belong to the set, but we are still uncertain. John Iacovino pulled rnd R (07) 25-34 here, from ties that seemed second hand. Maybe they are not.

The railroad re-dated second hand ties. Here are some combinations.

- stubby (01) 3 with rnd R (07) 30
About 50 ties were found with this combination by Dave Parmalee in a Barre yard track.
- rnd R (07) 30 with rnd R (24) 39
One tie found by John Iacovino on the StJ&LC.
- rnd R (24) 39 with rnd R (07) 44
Several ties found by Iacovino on the M&WR.

Even apart from Hallock's claim, it is clearly likely that the 30 is a B&C / M&WR / StJ&LC nail.

Barre & Chelsea / Montpelier & Wells River

The majority of ties from which the second hand nails were pulled probably arrived after 1945, and their re-use can be attributed to the consolidated B&C or to the M&B. The following subset of the second hand list were definitely pulled from the original B&C (not M&WR).

2 1/2 × 1/4	rnd R	stl (07)	25,26,27:b,28-34,40,41,46,48-50
2 1/2 × 1/4	rnd I	stl (07)	27
1 1/2 × 1/4	rnd R	stl (07)	37,38
1 1/2 × 1/4	rnd R	stl (05)	39,41
1 1/2 × 1/5	rnd R	stl (07)	43-45
1 1/2 × 1/4	rnd R	stl (06)	47
2 1/2 × 1/4	rnd R	stl (17)	47

See [M-J '86, 25-26] for a nail hunt by John and Sue Sherrod. They found (23) 41-43 and a copper indent 28.

Sources for second hand nails

Boston & Albany or Rutland

2 1/4 × 1/4	cut I	stl (03)	26
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Boston & Maine or Central Vermont

2 1/2 × 1/4	rnd R	stl (07)	25,26,27:b,28-35
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Boston & Maine

2 1/2 × 1/4	rnd R	mi (11)	26,28,30
2 1/2 × 1/4	rnd R	stl (07)	40,41,46-50
1 1/2 × 1/5	rnd R	stl (07)	43-45

Central Vermont

1 1/2 × 1/4	rnd R	stl (07)	37,38
1 1/2 × 1/4	rnd R	stl (05)	39,41,42
1 1/2 × 1/4	rnd R	stl (06)	47

Chicago North Shore & Milwaukee

1 1/2 × 1/5	rnd R	stl (06)	46-48
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New York, New Haven & Hartford

2 1/2 × 1/4	rnd I	stl (07)	23
2 × 1/4	rnd I	stl (07)	24 (probably)
2 1/2 × 1/4	cut R	stl (03)	35,36

and possibly some rnd R (07) nails.

Unattributed

2 1/2 × 1/4	rnd I	stl (07)	24,27-29
2 1/2 × 1/4	rnd R	stl (07)	26,27:b,28-35,42,45

The 26-33 may be B&C / M&WR / StJ&LC nails.

1 1/2 × 1/4	rnd R	stl (19)	39
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Possibly Birmingham Southern, which also used rnd R (07) 27-29, 32, 33.

Bath & Hammondsport

From second hand ties

2 1/2 × 1/4	rnd I	stl (07)	20,24,26-28,28:b,29,31-35,37-41,43-48,50,51,53
1 1/4 × 3/16	rnd I gm	cop (60)	23:b,24
2 × 1/4	rnd I	stl (07)	24
2 1/2 × 1/4	rnd R	stl (07)	25:b,26:b,30-32,39,45,47,52
1 1/2 × 1/4	rnd I	stl (03)	30
2 × 1/4	cut R	stl (03)	34,36,37
2 1/2 × 1/4	rnd I	stl (05)	36:b
2 1/2 × 1/4	rnd I	stl (06)	52

Bath & Hammondsport

The B&H is an upstate New York short line which was controlled by the Erie from 1903 until May 28, 1936. See [J-A '89, 4-5].

Sources for second hand nails

Erie

2 1/2 × 1/4	rnd I	stl (07)	20,24,26-28,28:b,29,31-35,37-39,41,43-48,50,51,53
2 1/2 × 1/4	rnd I	stl (05)	36:b
2 1/2 × 1/4	rnd I	stl (06)	52

And possibly some rnd R (07) nails.

Shadow sets

M&NJ shadow set

1 1/4 × 3/16	rnd I gm	cop (60)	23:b,24
1 1/2 × 1/4	rnd I	stl (03)	30
2 × 1/4	cut R	stl (03)	34,36,37

Belfast & Moosehead Lake

From second hand ties

2 1/2 × 1/4	rnd R	mi (11)	30
2 1/2 × 1/4	rnd R	stl (07)	40,48,55

The B&ML was created out of part of the B&M in 1926. All nails are from second hand B&M ties.

Berwick Foundry

See American Car & Foundry.

Bessemer & Lake Erie

2 1/2 × 1/4	rnd R	stl (07)	29-41,50-60
2 1/2 × 1/4	sqr R	stl (07)	35,37,39

Rnd R (07) 45, 46, and 48 have been reported, but probably do not belong. See Bill Kight's article in [N-D '89, 2-3]. Russ Hallock pulled the 50.

Big Four Route (Cleveland, Cincinnati, Chicago & St. Louis)

2 1/2 × 1/4	rnd I	stl ()	1-3
2 1/2 × 1/4	rnd I	stl (01)	4,5
2 1/2 × 1/4-	dia I	stl (07)	5,5:b,6,06:b,7,07,8,08,09:b,09:c,10
2 1/2 × 1/4	rnd I	stl (07)	6,7,08,09:b,10:c,17,18
2 1/2 × 1/4-	sqr I	stl (07)	10,10:b
2 1/2 × 1/4	sqr I	stl (07)	11-13,16,18-22,24-26,26:b,27,28,28:b,31
2 1/2 × 1/4	sqr I rs	stl (01)	13
2 1/2 × 1/4	rnd I	stl (01)	13
2 1/2 × 1/4	sqr R	stl (07)	14-18,24,25
2 1/2 × 1/4	sqr R rs	stl (07)	15
2 1/2 × 1/4	rnd I	stl (05)	21
2 1/2 × 1/4	sqr I	stl (05)	21-23,23:b,27-31,31:b,32:b,32:c
2 1/2 × 1/4	rnd R	stl (05)	23,24,25:b,26:b,27

From second hand Boston & Albany ties

2 1/2 × 1/4	rnd I	stl (07)	28,29
2 1/2 × 1/4	sqr R	stl (24)	31

.. Big Four Route

The CCC&StL (Big Four) was owned by the New York Central before 1900, and was formally merged into the NYC in February, 1930. Like the Michigan Central and the Boston & Albany, the Big Four's nails remained distinct even after their formal incorporation into the NYC. See NYC for general comments on the New York Central System.

For a description of the various branches, complete with a 1923 system map, see Merle Denney's articles in [J-F '85, 2-3] and [M-A '85, 3-5].

Hammer stamps, 1892/3 up

In 1880, nine years before being absorbed into the CCC&StL, the Indianapolis & St. Louis installed some zinc tannin treated ties. They were treated by J. P. Card in St. Louis ['16, 329]

In 1894 Tratman wrote "...On the Cleveland division of the Cleveland, Cincinnati, Chicago and St. Louis Railway it has been the practice to mark the ties when they are put in the track. . .For this purpose a stamp is used with letters about 1 1/2 inches long giving the year. . .the marking is done by a blow with a hammer, the mark being made on the top and south end of the tie." [Trat II, 222]

George W. Kittredge of the Big Four wrote in 1900 "In regard to the marking of ties, that was started on one of our divisions in 1892 or 1893. We had a steel hammer made with the letters or figures "92" on it, and that was driven into the end of the tie and into the top of the tie on the line side. We did not find that it worked very well, because at the end of a few years, a great many of the marks were effaced and the practice was discontinued, having been kept up only about three years. . ." [AREA '00, 76] [DNC, 9] That Peoria & Eastern (subsidiary of the Big Four) ties were stamped in 1898 indicates that they kept up this practice at least to that time. [AREA '04, 86]

The Wellhouse process, 1901-1903

In a table of the life record of ties, a note at the bottom reads "Ties not marked previous to 1901." [AREA '04, 88] These marks were certainly the date nails listed above. The ties which were dated were probably treated by the Wellhouse process by the Chicago Tie Preserving Co.'s portable plant.

The Rütgers process, 1904-05

In 1904 the Chicago Tie Preserving Co. opened a treating plant at Paris, IL to treat Big Four ties by the Rütgers process (zinc chloride-creosote). As of January 1906 it was still treating Big Four ties by this process, but by 1909 Chanute's three-step Wellhouse process was in use. The plant closed in 1910, having supplied a total of 693,324 gum and oak ties to the Big Four. ['06, 26][AREA '09, 619]['10, 48, 138] [Rowe, 295][Goltra I, 60]['16, 298]['20, 103]

The Big Four was the first U.S. railroad to use zinc-creosoted ties on a large scale, and J. B. Card, of the Chicago Tie Preserving Co., was soon to patent his improvements on the method. The Card process was to become common on many railroads beginning 1908.

The treatment company drove date nails into all ties. The Big Four, Chicago & Eastern Illinois, Chicago & Western Indiana, and possibly the Munising, Marquette & Southeastern all received Chicago Tie Preserving Co. ties in these years, and all have the same (01) 4 and 5 in their sets. So really these nails are treatment company nails, but the Big Four did take note of them in their statistics. [RG 8-18-99, 581]

Lowry creosote treatment, beginning 1905

Besides being the first to use zinc-creosote, the Big Four was also the first railroad in this country to commit itself to treating large numbers of ties solely with creosote. The railroad signed a five year contract in February, 1904 with C. B. Lowry's Columbia Creosoting Co. for the treatment of 400,000 ties annually. In November the contract was extended to January 1, 1914, and the number of ties was increased to 550,000 per annum. The treatment company built the creosoting plant just north of Shirley, IN, along the Big Four's Michigan division. It began operating May 1, 1905 and treated a variety of woods by the Lowry process. [RG 3-16-06, 282-284]['15, 172][Goltra I, 31, 43, 49]

The plant had two retorts and a yearly capacity of 1,340,000 ties. I do not know if they creosoted ties for other railroads, or just produced the 550,000 for the Big Four. ['13, 454]

Sometime before 1913 the Columbia Creosoting Co. merged into the American Creosoting Co. In 1913 the Shirley works were moved to Indianapolis, where they were still in operation in 1952. ['13, 454] ['15, 466]['52, 394][M-J '85, 10]

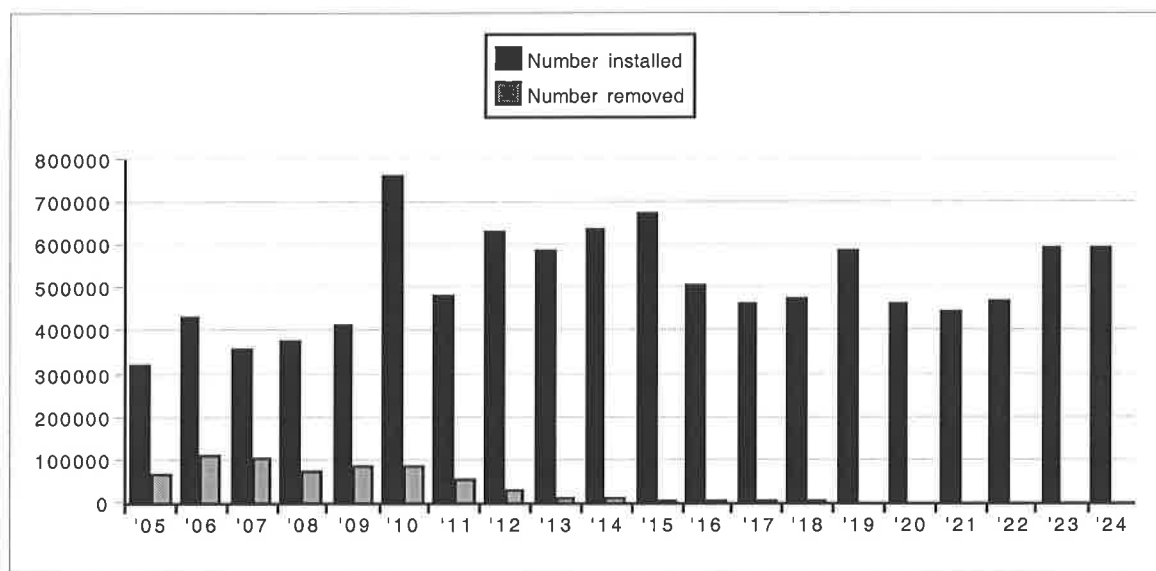
...Big Four Route

To distinguish Lowry treated ties from zinc-cresoted ties, or maybe to distinguish ties treated by different companies, the Big Four used diamond (and later square) nails in ties treated by the Lowry process at the Shirley/Indianapolis plant. The nails were driven at the treating plant. Track crews which inserted the ties often placed ties in the track with the date nail down. Many of these nails can be found in the bottoms of ties, or in tie fenceposts which were never used in the track. Judging from this practice and the statistics shown below, the Big Four may have been concerned about knowing the date of a tie only after it was removed.

The Shirley plant was Lowry's first, and by 1910 his company had constructed at least six more creosoting works for other railroads. But empty-cell creosoting aroused some controversy. Some people believed the process could not work the way its patentees, Lowry and Rueping, claimed. One of Lowry's most vocal opponents was G. F. Goltra, general tie agent for the Big Four from November 1, 1907 to November 1, 1910. In his 1912 book *Some Facts about Treating Railroad Ties*, he calls Lowry's and Rueping's companies "demoralizing and dangerous." Naturally he ascribes Lowry's success to aggressive marketing and exclusive contracts, and not to the value of his process. Goltra gives a very slanted view to the subject, claiming on the one hand that empty- and full-cell creosoting are really the same process, and on the other estimating the life of a Lowry-treated tie at only ten years! In fact, the average life of these ties exceeded twenty years. [Goltra I, 70][Goltra III, 13][Goltra IV, 6]

Goltra was interested in experimenting with other treatments, like zinc-cresote and crude oil, so the round nails after 1905 might have been driven into ties treated at another plant by some other method. These nails are generally scarce. Merle Denney pulled several rnd I 10's in Illinois, Indiana, and Ohio. In particular, he pulled two in Fortville, IN mixed with other Big Four nails [M-J '85, 11]. I do not know which rnd I 10 this is. It could be any one of the 10's shown on page 20 in Volume III, and it seems to be a true Big Four nail. ['13, 87ff]

Here is a table of the "number of [date] nailed ties removed" through April 23, 1925 from [WPN Nov '26, 149]. A good portion had been removed on account of wrecks and derailments. All were creosoted at the Shirley/Indianapolis plant.



These numbers do not include ties treated for the Peoria & Eastern, which was owned by the Big Four. Another tie report, from 1921, combines the Big Four and P&E statistics, showing that the P&E received between 35,000 and 100,000 ties per year, usually about 80,000 to 90,000. P&E nails, being driven into ties at the same treating plant, are the same as Big Four nails. ['21, 155-156]

...Big Four Route

Comments on the nails

The early dates through dia 10 and rnd 10 were driven about 10-14" inside the base of the rail. Nails from sqr 10 through 32 were driven in the center of the tie. [M-J '85, 10-20]

Dave Parmalee has the 1 and 3, which are somewhat like the Santa Fe early dates. Earl Carey and his brother, two early collectors in Mansfield OH, found 1's, 2's, and 3's, though very few of each. These are very rare nails, which were probably used in ZnCl_2 treated ties.

Russ Olsen and Dick Kyras once found a dia 5 and rnd 5 side by side in the same tie. [M-J '80, 1]

Many 1 3/4" sqr I rs (01) 13's have been found. They were probably cut too short at the nail factory.

On the line into Benton Harbor, MI Russ Olsen found many sqr I (05) 26's. They might be from second hand NYC ties.

Near Nortonsburg, IN Merle Denney found the second hand nails: four 28's, two 29's, and a 31. These were found in the bottom of the ties. Later another 31 was found near there. He described the 31 as "...a round raised 37, which later turned out to be a 31 with the cap turned backwards." "...I had pulled a bucket full of this type nail off the Boston and Albany railroad at Worcester, Massachusetts..." He probably meant to write square, but I do not know what "the cap turned backwards" means. All of these nails are from Boston & Albany ties.

Here is a provisional list of the standard Big Four nails after 1910 which the diligent nailer can expect to find: sqr I (07) 11-13, 18-21, 24-26, 31, sqr R (07) 14-17, and the sqr I (05) 22, 23, 27-30, 32:b. The other post-1910 nails may not be common.

William Kepka discovered that many Big Four nails, as well as nails from other railroads, were driven by someone into utility poles in the rural area just east of Muncie, IN. Near the towns of Pleasant Hill and Parker City he found that some poles had about five nails, others as many as 40. While pulling them he encountered a local person, and something like the following dialogue took place:

Local man: "So, you're pulling railroad nails!"

William: "No, I'm pulling pole nails."

Local man: "Actually, those are railroad nails." The man then explained how they got there.

It was probably about the 1940's or early 1950's that a nail collector was forced by his wife to dispose of his collection. Rather than throw them away, he drove his nails into utility poles. Most of the nails were from the Big Four, but there were also Chesapeake & Ohio and Louisville & Nashville nails. Bill Bunch wrote "He had a penchant for driving them close to the ground and into knot holes. I even found one Big Four diamond 09 driven through the edge of an I.G.S. 1934 Hubbard!"

For other nail articles, see [M-A '86, 3], [N-D '86, 13-14], [Jan '87, 10], [J-F '89, 6-7], and [M-A '89, 8].

Bingham & Garfield

2 1/2 × 1/4	rnd R	stl (18A) 22
2 1/2 × 1/4	rnd R	stl (07) 31
2 1/2 × 1/8+	rnd R	stl (18B) 31
2 1/2 × 1/4	rnd R	cop (07) 32
2 1/2 × 1/4	rnd R	cop (06) 33,34,37
2 1/2 × 1/4	sqr R	stl (18) 36
2 1/2 × 1/4	rnd R	stl (06) 48:b

Possibly from second hand Utah ties

2 1/2 × 1/4	rnd R	stl (18A) 24,25
2 1/2 × 1/4	rnd R	stl (18B) 26-30,33-35
2 1/2 × 1/4	rnd R	stl (18B) 36
2 1/2 × 1/4	rnd R	stl (18C) 37-47

From second hand Union Pacific ties

2	× 1/4	rnd R	stl (18B) 29
2	× 1/4	rnd R	stl (17) 30,32

...Bingham & Garfield

The B&G, a 36 mile long Utah railroad, was owned by the Kennecott copper mining company. The line connected with the UP, WP, and D&RGW, and was abandoned in August, 1948. These nails were pulled by Max Worthington and by Alan and Tamara Nielsen. The Nielsen's articles appear in [M-A '93, 1] and [M-J '93, 1]. In [S-O '93, 8] is a photo of their set. In [J-A '87, 7-9] is a history of the line.

From Al and Tamara: "From 22-25 the nails were placed in the tops of the ties near the ends (as on the UP nails). The 26-31's were placed in the center of the ties. The 32-48's were placed about 6 to 8" in from the south or west rail between the tracks."

The 8 penny 31 might be from an ex-Nevada Northern tie.

Birmingham Southern

2 1/2 × 1/4	rnd R	stl (07)	27-29,32,33
2 1/2 × 1/4	rnd R	stl (06)	31
2 1/2 × 1/4	rnd R	stl (19)	34-36,51-53,55,57,60-63,65,70
1 1/2 × 1/4	rnd R	stl (19)	37,37:b,38-48,48:b,67
1 3/4 × 1/4	rnd R	stl (19)	54

This list is almost identical to that in DNC. The 54 is rare.

Boston & Albany

2 1/2 × 1/4	sqr I	stl (07)	11
2 1/2 × 1/4	rnd I	stl ()	12:b
2 1/2 × 1/4	rnd I	stl (07)	13,25,27-29
1 × 3/16	rnd R	mi (11)	23
2 1/2 × 1/4	rnd R	mi (11)	24
2 1/4 × 1/4	cut I	stl (03)	26,26:b,26:c
2 1/2 × 1/4	sqr I	stl (05)	30
2 1/2 × 1/4	rnd R ss	stl (24)	30
2 1/2 × 1/4	sqr R	stl (24)	31
<i>From second hand ties</i>			
2 1/2 × 1/4	sqr R	stl (05)	25

The B&A came under the control of the NYC in 1894, and became part of the NYC in July, 1900. See NYC for general comments on the New York Central System.

In 1860 the B&A tested ZnCl₂-treated green spruce ties in a bridge over North Beacon St. in Brighton, now part of Boston. The ties were treated at the railroad's works by the Burnett process, and remained sound to 1882. [ASCE 7-85, 258, 259][ASCE 8-85, 303][Weiss, 12]

On the NYC square nails indicate ties treated at the Rome, NY treating plant, while round nails indicate ties treated elsewhere. Because nails were driven at the treatment plant, and the NYC used the sqr I (07) 11, it may be that the Rome plant supplied ties to the B&A that year. Also, the NYC used a rnd I (07) 13, and no NYC rnd 12 has been found yet, so there may be a NYC/B&A connection through 1913.

I do not know where B&A ties were treated, but some information can be gleaned from the section foreman's form titled "crossties taken out of the track" from 1915. These required the foreman to note the treatment of the tie as follows:

U = untreated,
Z Cl = zinc chloride,
C = creosote, and
RP = Rueping.

Zinc chloride was rarely used in the northeast, and "creosote" either stands for full cell treatment or the Lowry method. My guess is that ties treated with "creosote" and "zinc chloride" were tested, but were never used in large quantities after 1910.

...Boston & Albany

The foreman could determine the treatment of a tie, either by information stamped in the end of the tie, or by the position or shape of the date nail. Also on the report is a space for "Year put in as marked." The "mark" was probably a date nail, but could also have been a stamp in the end of the tie. [RAG 5-21-15, 1075]

The New Haven and the Boston & Maine began operating their newly built treating works in 1923-24, the same time that the B&A again took up the use of date nails. These two plants remained for some years the only treatment works in New England, so it may be that one of them treated ties for the B&A.

All nails are found between the rails, positioned closer to one rail or in the middle of the tie.

The 12 has a cup head, and two are known. The second hand 25 is from the NYC or the Rutland.

Boston & Maine

2	× 3/16	rnd R	mi (11)	24	
2 1/2	× 1/4	rnd R	mi (11)	25-29,29:b,30,32	
2 1/2	× 1/4	sqr R	stl (07)	25,25:b,26	
2 1/2	× 1/4	rnd R	stl (07)	25,26,27:b,28,28:b,29,29:b,30,30:b,31-34,34:b,35-37,37:b,38-41,46-59	
1 1/2	× 1/5	rnd R	stl (07)	42,43:c,44,45	
<i>Code nails</i>					
2 1/2	× 1/4	rnd R	mi (11)	0-6.,7-9.	(Set #18)
2	× 3/16	rnd R	mi (11)	0-6.,7-9.	(Set #18)
2 1/2	× 1/4	rnd R	stl (07)	0-9	(Set #10)
<i>From poles</i>					
2 1/2	× 1/4	rnd R	mi (11)	29,30	
1 1/2	× 1/5	rnd R	stl (07)	43:c	
<i>From second hand ties</i>					
2	× 1/4	rnd I	stl (07)	24	
2 1/2	× 1/4	rnd I	stl (07)	27	
2 1/2	× 1/4	rnd R ss	stl (24)	30	
2 1/2	× 1/4	cut R	stl (03)	35	
1 1/2	× 1/4	rnd R os cp	stl (38)	38	
1 1/2	× 1/4	rnd R ts	stl (37)	64	

Mercuric chloride on the Eastern RR

In 1846 the Eastern RR, a Massachusetts predecessor of the B&M, tested spruce and oak ties treated under pressure with mercuric chloride. [ASCE 7-85, 253][ASCE 8-85, 301]['16, 328]

"In 1879-80 works were erected at Portsmouth with the intention of using the Bethell process of creosoting. . . The works were burned in April, 1880, when ready for starting. Owing to the scarcity and very high price of creosote oil, it was decided not to rebuild works for creosoting, but to try Kyanizing instead." [ASCE 8-85, 301]

Kyanizing began at the new plant in April, 1881, and by 1891/92, when they stopped treating, about 800,000 hemlock and tamarack ties had been steeped in mercuric chloride. This was the only extensive use of treated ties in the U.S. before 1899 apart from the ZnCl₂-treated ties on the Santa Fe, Rock Island, and Southern Pacific. [ASCE 8-85, 302][Trat I, 32][Summer 2000, 18-19]

In the 1914 AWP report, compiled in late 1913, the B&M stated that for 10 years they had been "Keeping record only of treated ties of which there are comparatively few in track." Surely these treated ties were the 1881-1891/92 Kyanized ties mentioned above. [DNC, 289]['14, table]

Creosote

In May, 1923 "The Boston and Maine Railroad for years has been known to use only untreated ties. . ." That year the Pittsburgh Wood Preserving Co., which already operated a plant built in 1911 for treating Pittsburgh & Lake Erie ties, constructed a treatment plant at Nashua, NH for creosoting B&M ties by the Rueping process. The plant began operating in late 1923 or early 1924. [WPN 5-23, 77] [WPN 7-24, 103]

...Boston & Maine

The reason the B&M and the New Haven began treatment at this time is found in [’23, 216-217]: “The shift in source of supply which follows changes in transportation costs is exemplified in recent developments in the New England States. Most of you probably know that the Boston and Maine Railroad and the New York, New Haven and Hartford Railroad have undertaken to give preservative treatment to their ties and timbers. They immediately turned to local sources of supply of woods they had not heretofore been using. They did not treat them before because the cost of pine ties shipped from the South Atlantic States had not been high enough to justify the use of local woods with the price of preservative added.”

The Nashua plant was expanded in 1929, and by 1930 it was owned by the New England Wood Preserving Co., with headquarters still in Pittsburgh. By 1934 the plant was run by the Century Wood Preserving Co., which was taken over by Koppers sometime before 1940. [’30, 422][’34, 471][’40, 453]

The nails

Nails were placed between the rails, closer to the north or west rail. 24’s are found closer to the opposite rail.

All three sets of code nails were used to number ties in a test section in North Conway, NH. They were used between 1924 and 1932. [DNC, 179][Wiswell 77]

The second hand square shank 30 is from the Boston & Albany.

The second hand 38 and 64 come from ex-Canadian National ties. They were pulled from a siding in Bennington, VT. The second hand 24, 27 and 35 were found by John Iacovino in Portsmouth, NH in the proper B&M position. The NYNH&H placed nails in the middle of the tie, so the 24 and 35 cannot be attributed to that railroad. Possibly they are borrowed nails.

John also found one each of rnd R (07) 42, 46 in Wells River, VT. The 46 was found in the proper position for B&M. These are probably not B&M nails.

Only one (11) 32 has been found, again in the proper B&M position. It came from the Northampton, MA yard. This nail is unlikely to have come from the DL&W, which usually placed nails in the center of the tie.

John Iacovino has found a few $2\frac{1}{4} \times 9/32$ sq R (07) 25’s on the B&M. These are identical to N&W 25’s. They may have been ordered by the B&M, or they are the result of a nail factory mix-up.

Other odd nails turn up. In South Deerfield, MA Russ Hallock pulled a cut R (07) 32, and on the line from Ipswich, MA to Newburyport, MA he found several of the cut R (05?) 35’s similar to those found on the Chicago & Western Indiana. This 35 has also been found in second hand ties on the Middletown & New Jersey. Iacovino pulled a rnd R (07) 42 and a rnd I (07) 46 in Wells River, VT. Their source is unknown.

Probably many other nails can be found in poles. See [M-J ’86, 26] for a nail hunt.

Boston Elevated

All info on this line comes from the article “Timber Preservation Saves Money on Boston Elevated System” in [ERJ 2-19-27, 320-323], which I wrote about in [Fall 2000, 12-13].

The BER’s first experience with treated ties was with Woodiline (Avenarius Carbolineum) “some 25 or 30 years ago.” Subsequently they began using full cell creosoted oak and chestnut ties in November, 1912. The work was done by a commercial company. The railroad opened its own creosoting plant at South Boston in early August, 1916.

“Treated ties are now used in all track, whether paved or in open construction, and also in subways, tunnels and on elevated structures. No untreated ties have been used since 1916.” “Dating nails are installed on all ties sent direct to the job from the treating plant. Nails are furnished to division officers which supply ties from other storage points.”

Buffalo Creek

From second hand ties

$2\frac{1}{2} \times \frac{1}{4}$	sqr I	stl (07)	11
$2\frac{1}{2} \times \frac{1}{4}$	rnd I	stl (07)	53

In April, 1978 the BC, a switching line in Buffalo, NY, became part of Conrail. The 11 is from an ex-Lehigh Valley tie, and the 53 is from the Erie. They were pulled by Russ Hallock.

Buffalo, Rochester & Pittsburgh

2 1/2 × 1/4	rnd I	stl (07)	10,11,11:b,12-14,16,18,19,19:b,20,22-24,26,27,29,31:b,32
2 1/2 × 1/4	rnd I	stl (14)	15
2 1/2 × 1/4	rnd I	stl (05)	17,21,25,25:b,26,26:b,28,30,30:b
2 1/2 × 1/4	rnd R	stl (07)	18
<i>Code nails</i>			
2 1/2 × 1/4	rnd I		
A	Ash	stl (05)	#1,#2
		stl (07)	#3
B	Beech	stl (05)	#1,#6
		stl (07)	#2,#3
		stl (14)	#4,#5
BO	Black Oak	stl (05)	#14
		stl (07)	#12,#13
BR	Birch	stl (05)	#15
		stl (07)	#16
C	Chestnut	stl (07)	#2,#3
CY	Cherry	stl (05)	#10
		stl (07)	#11,#12
E	Elm	stl (07)	#3
G	Gum	stl (07)	#8
H	Hickory	stl (05)	#1,#2
		stl (07)	#3,#4
M	Maple	stl (05)	#1,#2
		stl (07)	#3,#4,#5
		stl (14)	#5,#6
P	Pine	stl (05)	#1,#2
		stl (07)	#3
		stl (14)	#4
PO	Pin Oak	stl (07)	#7,#8
RO	Red Oak	stl (05)	#3
		stl (07)	#4
		stl (14)	#5
S	Sycamore	stl (07)	#11
WO	White Oak	stl (07)	#3
X	Substandard tie	stl (05)	#1
		stl (07)	#2,#3
		stl (14)	#4

The BR&P came under the control of the B&O in 1930, and in January, 1932 became part of the B&O.

Tie treating and record keeping

In [RAG 1-9-26, 175-180] is a long and complete article by E. F. Robinson, Chief Engineer, on the BR&P's use of treated ties and date nails. Most of the quotes given below are from that article.

"Prior to 1910 no treated ties were used on the Buffalo, Rochester & Pittsburgh..." In the summer of 1910 the BR&P's Bradford, PA treatment plant began creosoting ties, bridge timbers, pilings, and other timbers. They treated the wood by the Bethell (full cell) process. [11, 212] After the B&O takeover, the plant was operated by Koppers. [44, 433]

By the end of 1925 about 2,000,000 treated ties had been inserted into BR&P track. About 200,000 of these ties were treated with ZnCl₂. I do not know where they were treated or where on the BR&P they were used. [RAG 1-9-26, 177]

...Buffalo, Rochester & Pittsburgh

The BR&P kept track of every treated tie on its main lines. "...it was determined to keep an accurate record of the life history of each individual [treated] tie...rather than to base conclusions upon results obtained in comparatively short stretches of test track." "All treated ties taken out of track...are immediately shipped to the timber preserving plant for inspection..." Here are the totals installed in main tracks only through 1925:

Creosoted ties placed in main tracks, 1910-1925

Tamarack	971
Elm	9,669
Red Oak.....	95,763
Black Oak.....	40,461
Pin Oak	10,740
Maple	219,528
Beech	240,634
Birch	9,086
Cherry.....	4,188
Gum	11,196
Chestnut	61,727
Hickory	29,583
Pine.....	523,460
Ash	574
Unclassified.....	1,219
White Oak	201
<hr/>	
Total	1,259,000

From this table we know that the nail "T" was used. It has not yet been found. The wood missing from this list is "S". This may be because the statistics only include ties from the main track. I found all my S's in yard tracks in Rochester, NY.

Test sections

Because the BR&P kept records of all treated ties inserted and removed, the following stretches of track were test sections only in that the railroad decided to pay closer attention to them. The nails used in these sub-tests were the same as the nails on all BR&P track.

- Backus, PA, 1910.

Between Mileposts 140 and 141, in November, 1910 2,371 ties creosoted with 10 lb/ft³ were laid. The species, with quantities, were: RO (72); BO (260); PO (316); M (543); B (824); BR (19); CY (9); G (12); C (170); H (146). [AREA '51, 314] Other sources (['27, 159, 166] and ['31, 25-27]) give slightly different numbers, with a total of 2,182 treated ties. In addition, they list 2,182 untreated white oak ties for this site. This stretch of track is a 3 degree curve. The purpose of the test was "to observe the relative service to be obtained from untreated white oak and creosoted hardwood ties." After 15 years of service, no treated ties had been removed because of decay. Date nails were used, and probably the wood nails too.

- South of Rochester, NY, 1913.

14,783 creosoted ties were laid between Rochester and Scottsville, NY between mileposts 4 and 11. The woods were E, RO, M, B, BR, G, C, H, and P. Date and wood nails were used here, as they were on all treated ties on the BR&P. ['27, 159, 166]

Date nails

"...a galvanized nail is applied to the ties at the timber-preserving plant, indicating the class of timber, and when the ties are placed in the track dating nails are applied, showing the year" [AREA '15, 553] Included with this AREA article is a fold-out drawing of the BR&P's date nail and tie marking policy from 1914. It was reprinted in [Dec '76, 4-5].

...Buffalo, Rochester & Pittsburgh

This drawing locates each date in a specific spot between the rails in the tie. 1910 nails were placed between the rails 8" from the inside base of the east rail, and the location for successive dates was 2" west of the previous year. By 1929 nails were close to the west rail, so in 1930 they began again in the 1910 position. Letter nails were driven outside the rail. This program was followed closely in practice.

Also on this diagram is a drawing of a BR&P inspection hammer. The hammer had raised letters and read "BR&P Ry" (in a circular fashion) around a single letter (inspector's letter). The hammer was used to stamp the information into the ends of ties, and I have seen these stamps in 1913 ties with inspector's letters B, M, and S.

Often the date nail and the letter nail are found on opposite sides (top vs. bottom) of the tie. In this case the tie was inserted upside down. Probably to avoid this problem, at least some 1911 and most 1913 BR&P ties have a letter nail in the top *and* bottom. I do not have enough information yet to make the same conclusion for other dates in the teens, and in later years only one letter nail was driven.

Sometimes two different letter nails are found in the same face, one driven on top of the other, so its head covers part of the first nail. Once I found a tie with RO over BR in the top and bottom. Another tie had an M on top and G over M on the bottom. The treatment workers didn't pull nails wrongly placed. Dave Parmalee mentions this practice in [J-A '79, 1].

Some BR&P letter nails have been found in the ties of other railroads (see Rahway Valley and Erie) without the BR&P date nail. These ties probably made their way to other railroads without first reaching BR&P track.

James W. Gibson pulled the two known 10's. They came from sidings along the Genesee River in Rochester, NY. [J-A '80, 2] Note that 1910 nails were also used in the first test section listed above.

There are many variations on the 12's, too many to separate into sub-varieties. They can be classified by the location, number, and spacing of the anchor markings. Similarly it is not useful here to differentiate the four minor variations of E.

The meanings of the letter nails, except for A, S, and WO, are found on the [AREA '15] drawing. A and WO are included in the 1926 table (given above). The letter S is not mentioned anywhere. Sycamore is included in a list of woods used in the first few years of operation of the Bradford plant, so the letter S can be identified with that wood. [RAG 1-9-26, 176]

In [Apr '71, 4] some collector, without naming any railroad, listed the meanings of letter nails from a Maintenance of Way Cyclopedia. The letters were A, E, P, C, CY, RO, BO, WO, S, M, H, B, BR, and G. The meanings given match the BR&P except for C (given as Cherry) and CY (given as Cypress). S, they said, was Sapling (cedar). If these were supposed to be BR&P nails, they got C and CY wrong, so S could just as easily be wrong.

All WO's Steve Worboys and I have pulled came from 1929 switch ties.

The (05) 26's and 26:b's were found in one stretch of track by Dave Parmalee. They have not been found elsewhere. Dave also found a rnd I (07) 21 with a letter nail. This 21 is probably a borrowed nail. [M-A '78, 1]

All dates are common, with 32 being the rarest. This is the year of the B&O takeover. The rnd R 18 is scarcer than the rnd I 18, and the 11:b and 25:b are rare.

With some hesitation certain letter nails can be identify as being particularly rare. These include the (07) A, (07) B #3, (05) BO, BR, (07) C #3, (07) CY's, (07) H #4, (07) M #4 (old—ca. 1911-1913), (14) P, (07) PO, (07) S, and (14) X. The (05) H is not easy to find, either.

Having kept an account on a few trips of which letter nails were found with each date, I have compiled the following lists. These are still very much incomplete, but already reveal some interesting facts.

...Buffalo, Rochester & Pittsburgh

Date and wood nails found together

(07) A #3.....20	11.....BO?, G, M, RO
(05) B #6.....31	12.....BO, M
(05) B #1.....28-31	13.....B, BR, E, G, H, M, P, RO, S
(07) B #2.....13,23,24	14.....P
(14) B #4.....18,20	15.....B, C
(14) B #5.....15,16	16.....B, M
(07) BO #12,#13 11?,12	17.....E, P
* (07) BR #16.....13	18.....B, P
(07) C #2.....15	19.....P
(05) CY #10.....30	20.....A, B, M, P
* (07) E #3.....13,17	21.....P
* (07) G #8.....11,13	22.....M, P
(07) H #3.....13,27	23.....B, M, P
(05) M #1 27,28,30,31	24.....B, P, RO
(05) M #2 28-31	25.....M, P
(07) M #3 11-13,16,20,22,23,25-28	26.....M, P
(14) M #5 16,26-29	27.....H, M, P
(14) M #6 16,27	28.....B, M, P, RO
(05) P #1.....21,30	29.....B, M, P, RO, WO
(05) P #2.....27-29	30.....B, CY, M, P, RO
(07) P #3.....13,14,17-27,29	31.....B, M, RO
(05) RO #3.....28-31	
(07) RO #4.....11,13,20,24	
* (07) S #11.....13	
* (07) WO #3.....29	
(05) X #1.....B #1, 30-CY #7, H #2, 30-M #2, RO #2, 30-RO #2, 31-RO #2	
(07) X #2.....M #7, 13-P #3, 19-P #3, 19:b-P #3, 20-P #3, E #3, 21-P #3	

* = our list of dates is fairly complete. WO was used sparingly before 1926.

This gives the following table for WESIS types:

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
(07)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
(14)					x	x		x		x						x	x	x	x			
(05)											x						x	x	x	x	x	

The WESIS numbers refer to letter nails. The only pre-1927 type (05) letter nail found is the P #1. This nail's style and early date suggest that it is not of the same series as the other (05) nails. The (14) nails came in two batches, with some nails common to both.

It seems that an order of letter nails lasted from 4 to 6 years. Thus, the (07) letter nails found in 1929 ties were probably bottom-of-the-barrel nails.

For nail hunts, see [M-J '79, 2], [M-A '89, 9], [J-A '89, 12], and [N-D '93, 1-2].

Burlington Route

See Chicago, Burlington & Quincy.

Butte, Anaconda & Pacific

From second hand ties

2 1/2 × 1/4	rnd I	stl (07)	07,08,09:b,10:c,13-15,15:b,16
2 1/2 × 1/4	rnd I	stl (14)	15
2 × 1/4	rnd R	stl (17)	29:b
2 1/2 × 1/4	rnd R	stl (18B)	34-36
2 1/2 × 1/4	rnd R	stl (18C)	36,37,51
2 × 1/4	rnd R	stl (07)	36
2 1/2 × 1/4	rnd R	stl (06)	49

From catenary poles

2 × 1/4	rnd I	stl (06)	53
2 1/2 × 1/4	rnd I	stl (06)	55,56,59,61

Unused nails

2 1/2 × 1/4	rnd I	stl (06)	44,61
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The BA&P, a 77 mile long line in Montana, was electric from 1914 to 1970. It was owned and operated by the Anaconda Copper Mining Co, though the Great Northern owned a large portion of its stock. See [J-A '87, 4] for a brief history of the railroad.

In 1910 the Anaconda Copper Mining Co. built a one retort treating plant at Rocker, MT near Butte, using "Creosote (Steam Pressure)." Yellow pine and Douglas fir ties and mine props were treated there. The plant was rebuilt in 1939 and was still operating in 1952. ['12, 284]['13, 456-457]['52, 394]

The company also operated a non-pressure creosoting plant at Rocker, with tanks dating from 1909, 1921, and 1926. These were used for telegraph poles and mine props. ['15, 470, 481]['52, 400]

Test section

• Butte, MT, 1910.

224 full cell creosoted Douglas fir ties. ['16, 293]['17, 228]['20, 101] The 1916 source names the line as "Anaconda Mine Co."

The second hand ties are from the Northern Pacific, Union Pacific, and Great Northern. The 51 is the exception, which may have made its way here from the Santa Fe.

The 34-36 and 49 were found between the rails, about 12-14" inside the west rail by John Iacovino and Charles & Cheryl Johnson. [e-NN 5-6-03] John found the 37's outside the rail. He pulled only one 49, but numerous nails from the 30's.

Iacovino got the unused nails from a man who acquired the nails from a freight house in Anaconda. The 61 was used in catenary poles, but I do not know how the 44 was used, if at all.

Charles and Cheryl Johnson pulled some odd nails from poles in Silver Bow Canyon, MT: rnd I (07) 13, sqr I (05) 27, rnd I (18B) 31, 2" rnd R (18B) 35, 2" sqr I (07) 41, and an aluminum Hubbard A/31. See also their story with photos in [Spring 2003, 14].

Canadian National

Maritime provinces

2 × 1/4	rnd I	stl (39)	24
1 1/2 × 1/4	rnd R	stl (38)	25
1 1/2 × 1/4	rnd R	stl (39)	26,34-37
1 1/2 × 1/4	rnd R os cp	stl (39)	27-33,33:b
1 1/2 × 1/4	rnd R cp	stl (39)	38-41,44-46,46:b,47

Western provinces

2 × 1/4	rnd I	stl (39)	24
1 1/2 × 1/4	rnd R os cp	stl (38)	26-31,33-42,44-47

Code nails in western provinces

7/8 × 1/8+	rnd I	stl ()	2,4 (Set # 46)
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All lines

1 1/2 × 1/5	rnd R ts	stl (37)	59,60
1 1/2 × 1/4	rnd R ts	stl (37)	61-68

Tie treating

"On some of the lines which now comprise the Canadian National we began tie treatment over twenty-five years ago..." [28, 127] This would mean the CN had treated ties in their tracks about 1903, which contradicts the statement made a page later that the Canadian Pacific was the first Canadian railroad to use treated ties, in 1906 (see CP for the quote).

The Dominion Tar & Chemical Co. built a treating plant at Transcona, near Winnipeg, which began creosoting ties in 1912. The plant had a contract to supply large numbers of ties to the CP, but also to treat some ties for experimental use on the Canadian Northern. The Canadian Northern came under Canadian National control before 1921 and was later (1923?) absorbed into the CN.

The only other well documented use of treated ties on the Canadian National before 1923 is the 1915 test of creosoted ties listed below under "Test sections."

The various railways which presently comprise most of the CN were unified in 1923. "By 1925 a definite [tie treating] policy was established and we then started to treat approximately 2,350,000 ties per annum." [WPN 12-55, 6]

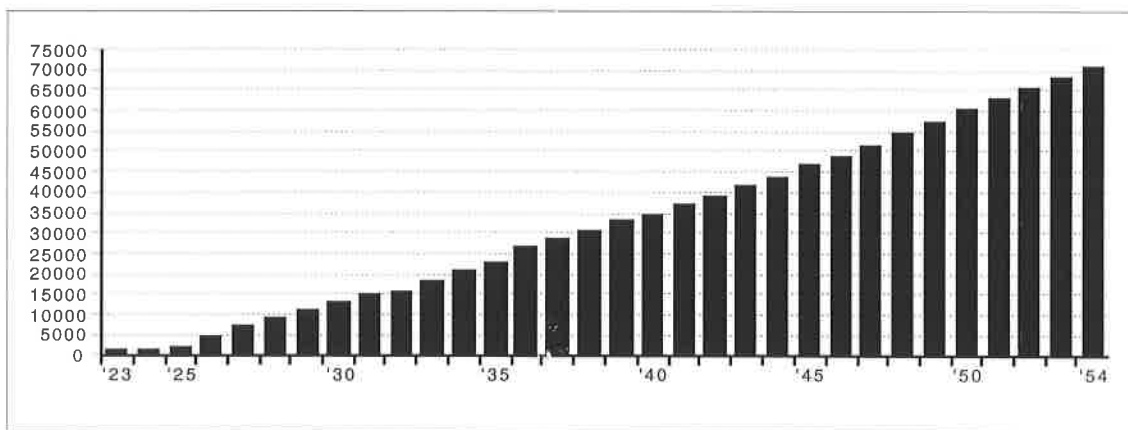
Ties were creosoted by commercial companies, one (maybe the only one) being the Canada Creosoting Co. The CCCo. built a plant in Newcastle, NE in 1924 for treating CN ties. They built other plants in Edmonton, AL and Truro, NS the same year, probably for the CN. [30, 424]

The CCCo. had plants prior to 1924, including Trenton, Ont. (1913), and Sudbury, Ont. (1920). The Sudbury plant treated ties for CP. Later plants included Delson, Quebec (1925), Prince Albert, Sask. (1938), and Fort William, Ont. (1940). The Truro plant was expanded in 1949.

By 1952, ownership of the Canada Creosoting Co.'s plants went to the Dominion Tar & Chemical Co. This is odd, because the CCCo. had taken over all of Dominion's plants sometime between 1924 and 1930. In 1955, thirteen plants were supplying ties to the CN. Dominion had only twelve plants, so at least one other treatment company must have been involved. Ties were treated with creosote by the Rueping process. [WPN 12-55, 8-9]

Here is a histogram of the number of treated ties in CN tracks. The data is from [WPN 12-55, 6]. In 1923, only 1.5% of ties on the CN were treated, compared with 79.4% in 1954.

CN treated ties in track (in thousands), 1923-1954



The 1,300,000 treated ties in the track in 1923 probably were placed by one or more of the pre-CN lines sometime in the period 1915-1923. With a difference of only 200,000 ties between 1923 and 1924, one can see why CN 24's are rare.

...Canadian National

Test sections

- St. Rosalie Jct, Quebec, 1915.
863 sawn beech, birch, and maple ties were laid, treated with an 80-20 creosote-coal tar solution by the Lowry process. The work was done at the Trenton, Ont. plant of the Canada Creosoting Co. [’37, 192][’41, 304]
- Ste. Genevieve, Quebec, 1925.
192 untreated jack pine and 192 Lowry creosoted jack pine ties were laid. [’53, 190, 193]
- Montreal, Quebec, 1930.
Full-cell ZMA treated ties were laid: 90 Douglas fir, 70 jack pine, and 94 red oak. [’53, 194]

The nails

The Maritime provinces include Nova Scotia, New Brunswick, Eastern Quebec, etc. The Western provinces consist of everything from Ontario west. In Quebec the two sets are found together. The (39) 24 has been found in Ontario and in Quebec. It may belong only to the Western set.

No nails were used in Newfoundland prior to 1959, possibly because the railroad there was narrow gauge at least through 1955, and the whole system may have been rebuilt in the late 1950’s. Newfoundland was receiving treated ties along with the rest of CN before 1955. [WPN 12-55, 8]

Dave Parmalee [J-F ’78, 1] wrote that no 43 has been found on the CN.

Steve Worboys and I found one each of the code 2 and 4 in Ontario.

A Grand Trunk round shank (25) 38 was found in a second hand tie. In addition to this, Russ Hallock pulled the following nails from the U.S. portion in Maine. All appear to be Grand Trunk nails.

1 1/2 × 1/4	rnd R	stl (01)	27-29
1 1/2 × 1/4	rnd R	stl (05)	44:c
1 1/2 × 1/4	rnd R cp	stl (10)	44

The following nails have been reported for CN, but are really from the TH&B:

1 1/2 × 1/5	rnd R	stl (39)	42-46
1 1/2 × 1/4	rnd R cp	stl (38)	50-57
1 1/2 × 1/5	rnd R ts	stl (37)	58

Canadian Pacific

2 1/2 × 1/4	rnd R os cp	stl (38)	26-31,35
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From poles

2 1/2 × 1/4	rnd I	stl (39)	22,23
2 × 1/4	rnd I	stl (39)	25
2 1/2 × 1/4	rnd R os cp	stl (38)	26,30
1 1/2 × 1/4	rnd R os cp	stl (39)	31,39,43,44:b,47 (44:b is shown in Set #2)
1 1/2 × 1/4	rnd R os cp	stl (38)	39-42,45,47,48
1 1/2 × 1/4	rnd R os cp	alm ()	46,49-61,64
1 1/2 × 1/4	rnd R cp	stl (39)	47

Code nails from poles

1 1/2 × 1/4	rnd R os cp	stl (38)	2,7,9
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“...the first timber commercially treated in Canada for a railway was some snow-shed timber treated in 1902 for the Canadian Pacific Railway. Certainly the first treated ties in Canada were some two or three hundred sent by the Canadian Pacific Railway to [Somerville,] Texas, for treatment in 1906.” [’28, 128] This test section is listed below.

In 1912 a tie treating plant using creosote by the Bethell process was erected at Transcona, Man., near Winnipeg by the Dominion Tar & Chemical Co. The plant treated jack pine, Norway pine, tamarack, and white spruce. It was the first tie treating plant in Canada, and had a ten year contract to supply from 500,000 to 1,000,000 ties annually to the CP. This “marks the [CP’s] first use of treated timber for ties on a large scale...” [RAG 11-15-12, 952][’13, 458]

1,000,000 ties per year was not nearly enough to cover CP’s needs, and it was not until 1921 that they began treating ties on a truly large scale. [’28, 128] That date coincides well with the 1920 two-retort plant of the Canada Creosoting Co., which is known to have treated ties for the CP. [’23, 327, 332]

...Canadian Pacific

The Dominion Tar & Chemical Co. was bought by the Canada Creosoting Co. sometime in the period 1924-1930. The CCCo. owned plants which treated ties for the CN, so it is difficult to identify which of the later Canadian plants treated ties for CP, and which for CN. See Canadian National for a list of later CCCo. plants.

In January, 1914: "No ties treated previous to 1911. Have record of total ties in track on each division and number renewed. Figure life on a percentage basis." They had been keeping records for 18 years. ['14, table][DNC, 289]

Test sections

- Virden, Man., 1906.
Near Virden, about 175 miles west of Winnipeg, 150 jack pine, spruce, poplar, and tamarack ties treated with German creosote by the Rueping process at Somerville, TX were laid. Judging by the woods, the ties were cut in Canada. ['28, 128]['41, 304]
- Rugby Jct., Man., 1909.
240 spruce ties, treated at the Republic Creosoting Co.'s works in Minneapolis. As of 1912 this plant used the Bethell process. ['41, 305]['12, 286]

The ties creosoted for the 1916 tests were probably treated at Transcona.

- Hamachiche-Trois Rivieres, Que., 1916.
59 creosoted beech ties. ['20, 94]
- Milton, Ont., 1916.
59 creosoted elm. ['20, 98]
- St. Martin Jct., Que., 1916.
59 creosoted oak ties. ['20, 110]
- St. Agathe, Que., 1916.
59 creosoted oak ties. ['20, 110]
- Chelsea, Que., 1916.
15 untreated beech ties. ['20, 95]
- St. Johns, Adirondack (Que.), 1916.
52 untreated beech ties. ['20, 96]
- Ottawa Broad Street yard, 1916.
59 untreated rock elm ties. ['20, 99]
- Tulford, 1916.
52 untreated rock elm ties. ['20, 99] Tulford is not on any of my maps.
- Oshawa, Ont., 1916.
236 untreated white elm ties. ['20, 99]
- Webbwood, Ont., 1916.
56 untreated white elm ties. ['20, 99]
- Sault Ste. Marie, Ont., 1916.
113 untreated white elm ties. ['20, 99]
- Delson, Adirondack (Que.), 1916.
52 untreated maple ties. ['20, 109]
- Chapleau, Ont., 1916.
106 untreated maple ties. ['20, 109]
- Schreiber, Ont., 1916.
56 untreated maple ties. ['20, 109]
- Venesta, Que., 1917.
59 untreated birch. ['20, 96]
- West Toronto, Ont., 1917.
100 rock elm ties, treatment unknown. ['20, 98]

...Canadian Pacific

- Camp Borden, Ont., date unknown.
4 sets S-ties, rock elm ties. "S-ties" might mean "switch ties". ['20, 98]
- St. Clet, Que., 1919.
80 jack pine and 77 hemlock ties, treated by the Lowry process, were inserted. ['41, 304] (['53, 193] says wrongly that the test was by the CN in 1920.)

The nails

Nails are very rare in ties. Arn Kreigh found several 27's on a branch line in Saskatchewan, and Terry Hill pulled a number of 35's at Bridgeford, Sask. Tie nails may have been used in test sections only. Pole nails are common.

The code 2, 7, and 9 were pulled by Terry Hill in Portlock, Ont. One pole had a 2 next to a 7, and another a 2 next to a 9, making "27" and "29". These probably indicated the date. I do not have photos of them yet.

The oval shank on most nails is vertical with respect to the numbers. On the 26 it is horizontal.

Cape Girardeau Northern

2	×	1/4	sqr R	stl (07)	14-17
2	×	1/4	sqr R	stl (05)	24,25

The CGN was a 104 mile long railroad in Missouri. It was abandoned in June, 1934 and was dismantled the next year.

Carson & Colorado

All nails are Southern Pacific. The C&C was bought by SP in March, 1900, became the Nevada & Colorado in May, 1905, and became a part of the SP in July, 1909. It was mostly abandoned in 1960. See Bob Thorpe's article in [M-A '86, 13-15].

Central California Traction

Probably from second hand Southern Pacific ties

2 1/2	×	3/16	rnd R gm	stl (07)	37,38,40
2 1/2	×	3/16	rnd R gm	stl (18C)	39,41,42

This line was electric until January, 1947. Its interchanges were primarily with the Southern Pacific.

Central of Georgia

The C of G was owned by the Illinois Central from 1909 until 1945, and was bought by the Southern RR on June 17, 1963.

In 1912 the C of G built a two retort treating plant at Macon, GA, which treated ties with ZnCl₂. Ties, piles, poles, crossing planks and dimension timbers were treated there. Both the Burnett process for ZnCl₂ and the Rueping process for creosote were in use as of 1915. A third retort was added in 1926, and between 1934 and 1940 it was acquired by the American Lumber & Treating Co. By 1944 it was owned by the Southern Wood Preserving Co. ['13, 450-451] ['15, 464, 472] ['40, 448] ['44, 432]

In the 1914 AWPAs report, which was compiled late 1913: "No special records other than have installed a mile of treated ties in two or three locations." "Have been using treated ties for one year only." [DNC, 289] ['14, table]

From 1925: "We...consider that it would not be worth the cost of purchasing and applying the nails and keeping the necessary records." [AREA '26, 709] [DNC, 329]

Tom Meyer has 3" mini spikes with the letter "A" on the head. He claims they are track section markers, and were driven into ties like date nails. The letter indicates the track section. [Winter 1999, 16-17]

Central RR of New Jersey

Code nails

1 × 1/4 rnd I

stl (07) $\frac{2}{TA}, \frac{2}{TC}, \frac{3}{TA}, \frac{4}{TC}$

Test sections

- Mouch Chunk, PA, 1867-68.

ZnCl₂-treated maple, beech, and hemlock ties were laid in the main track of the Lehigh & Susquehanna Ry. In 1871 the L&S was leased to the CRR of NJ, who gave a favorable inspection of the track in 1883. 50 semi-refined oil treated maple ties were also laid here. [ASCE 7-85, 258] [ASCE 8-85, 323][ASCE 6-01, 544][¹³, 196][¹⁶, 300, 303] ([ASCE 6-01] names the railroad the "Lehigh Coal & Navigation Co".)

In 1867 the Philadelphia & Reading built a plant for treating ties with ZnCl₂, but it was closed down after a short time because of unsatisfactory results. This is probably the plant which treated the Mouch Chunk ties. [Weiss, 12][¹³, 196]

- Near Bound Brook, NJ, 1875-1876.

Several thousand ties creosoted by the Hayford method were placed near Bound Brook, NJ. They include 10,000 Virginia pine, 5,000 hemlock (12 lb/ft³), and 500 cypress and cedar ties. Also, some ties treated with petroleum and others with zinc chloride were placed in the test track.

[ASCE 7-85, 268][ASCE 8-85, 323][AREA '09, 618][¹³, 90][¹⁵, table][¹⁶, 291, 324][²⁰, 126] [DNC, 7]

"These [creosoted] ties can easily be found in the track, both from their blackened appearance and by the odor.

"The Burnettized ties can be picked out from among the others by the somewhat weather-beaten appearance of the surface, as well as from the fact that on end of each was stamped with figures showing the date at which they were laid in the track." [ASCE 8-85, 323-324]

C. M. Taylor spoke at the 1923 AWP meeting "On the Jersey Central we have some hand-stamped ties put in the track in 1876. They were treated ties." [²³, 331]

- Lehigh & Susquehanna Division, 1879.

Creosoted cedar ties. [¹⁶, 291]

- ?, 1879.

5,000 creosoted shortleaf pine ties. [¹⁶, 323]

- Tremley to Sewaren, NJ, ca. 1880-1882.

In 1903 5,452 creosoted pine ties, at least 16 years old, were discovered. It is unknown how many were originally laid. Octave Chanute wrote "They must have been treated by Mr. E. R. Andrews at Elizabethport about 1880 or 1882, and some have lasted 21 years." [AREA '05, 775]

- Atlantic Highlands, NJ, 1891-92.

6,501 creosoted ties of various species. [¹⁶, 328] According to [AREA '09, 618], yellow pine piles and timber were also creosoted in 1892, location unknown.

- Finderne, NJ, 1896.

76,100 creosoted ties of various species were laid east and west of Finderne. [¹⁶, 328] [AREA '05, 775][AREA '09, 618] Octave Chanute, in [AREA '05], stated that it was unknown if the ties were treated, that the ties were 6 to 8 years old, and that the original number laid was also unknown. [AREA '09] says 50,000 yellow pine ties, 12 lb/ft³.

Tie treating and marking

The earliest known example of tie marking in the U.S. is on the 1875-76 Bound Brook ties described above. The year was stamped in the ends of the ties.

In 1912 the Philadelphia & Reading and the CRR of NJ built a two retort treating plant at Port Reading, NJ which creosoted ties by the Bethell process. [¹³, 448][RAG 7-19-12, 115] Ties were adzed and stamped before treatment, the stamps indicating the ownership and weight of rail. [¹⁴, 406] The plant was operating as of 1952, still jointly run by the Reading and the CRR of NJ. [⁵², 399]

...Central RR of New Jersey

The code nails

Richard Mauren, who lives in New Jersey and has pulled several of these nails, finds them in the ends of ties, and at most one nail is found in a mile or two of track. They are rare. The letters stand for the class of species of wood and the number is a code for the dimensions of a cross section of the tie.

The following is from the 1921 *Maintenance of Way Cyclopedica*, and is a general suggestion for American railroads.

Ties delivered on the premises of the railroad shall be stacked not less than ten (10) ft. from the nearest rail of any track at suitable and convenient places. . . Ties shall be piled as grouped below. Only the kinds of wood named in the same column may be piled together.

Class U—Ties Which May Be Used Untreated

GROUP UA	GROUP UC
Black Locust	"Heart" Cedars
White Oaks	"Heart" Cypress
Black Walnut	Redwood
GROUP UB	GROUP UD
"Heart" Pines	Catalpa
"Heart" Douglas fir	Chestnut
	Red Mulberry
	Sassafras

Class T—Ties Which May Be Used Treated

GROUP TA	GROUP TC
Ashes	Beech
Hickories	Birches
Honey Locust	Cherry
Red Oaks	Gums
	Hard Maples
GROUP TB	GROUP TD
"Sap" Cedars	Elms
"Sap" Cypress	Hackberry
"Sap" Douglas fir	Soft Maples
Hemlocks	Spruces
Larches	Sycamore
"Sap" Pines	White Walnut

[MOWC, 188]



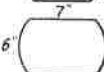




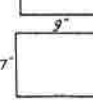
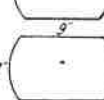
The same table of woods is preceded in [23, 233] by "The American Railway Engineering Association Proceedings 1921 page 331 have grouped the various species of treatment ties for inspection as follows:"

After the table, "Practical experience at many plants has shown this grouping to be quite satisfactory for seasoning and treatment purposes, as well as convenience in inspection and subsequent service in track."

The meanings of "TA" and "TC" on the CRR of NJ nails refer to groups TA and TC above.

...Central RR of New Jersey

The digit below the letters on the nails refers to the grade, or the dimensions of a cross section of the tie. Again from the *Cyclopedia*:

Grade	Sawed or hewed top, bottom and sides	Sawed or hewed top and bottom
1	None	
2		
3		
4		
5		

[MOWC, 187]

In the mid teens on the B&O and the Pennsylvania, ties were stamped with the class and grade. On the PRR the ties were stamped upon purchase, before reaching the treating plant. [W-P Apr-Jun '15, 27-28]

On the B&O: "When accepting ties for purchase, Baltimore & Ohio Inspectors will use branding hammers with changeable heads, so that the brand will indicate the class [=group] and grade. This precaution is to prevent ties purchased for treatment being confused with white oak or other non-treatment ties and put into tracks before being treated. Also to prevent white oak and other non-treatment ties being shipped to treating plants. In addition it will enable all concerned to readily distinguish the different classes [groups] of ties when a particular class is specified for certain territory." [W-P Oct-Dec '15, 69]

From all this information the use of the CRR of NJ nails can be reconstructed. Probably they were driven into ties when the railroad accepted them for treatment, and they were used in one or more of the following ways:

- so people would know which ties to ship to the treating plant.
- so treatment workers would be able to group proper batches of ties together for treating.
- so ties of the same group could be piled together along the right-of-way after treatment.

All this is consistent with the nails themselves. Because they are found in the ends of the ties, they were clearly driven before the ties reached the track. Also, they are short, and thus likely to fall out of the ties. They were not expected, like nails showing the date, to be read years after the ties were placed in the track.

Why is it that the nails are not found close together? Maybe—but this is just a guess—only one or two ties in a lot were given a nail, and the lots were kept intact through treatment.

Because the ownership of the tie was stamped into ties at the treatment plant, probably CRR of NJ ties and Reading ties were kept separate, so it is unlikely that these nails can be found on the Reading as well. ['14, 406]

Lastly, the nails have the type (07) diamond, so their use dates to sometime between 1921, when the system of classes was established by the AREA, and 1943, the last year the diamond appeared on type (07) shanks.

Other nails

The CABLE Hubbard nails #194 and #195 pictured in [DNC, 197] are found in ties outside the rail, and indicate a cable buried under the tie. They were not driven by the railroad.

Often L&NE nails turn up on the C of NJ in second hand ties. The C of NJ acquired parts of the L&NE after the latter's downfall in 1961.

Central Vermont

2 1/2 × 1/4	rnd R	mi (11)	26-28
2 1/2 × 1/4	rnd R	stl (07)	27,27:b,28-36
1 1/2 × 1/4	rnd R	stl (07)	37,38,45
1 1/2 × 1/4	rnd R os cp	stl (38)	38
1 1/2 × 1/4	rnd R	stl (05)	39,41-42,42:b,43,44,44:b
1 1/2 × 1/4	rnd R	stl (23)	40
1 1/2 × 1/4	rnd R cp	stl (07)	46
1 1/2 × 1/4	rnd R	stl (07)	46,47
1 1/2 × 1/4	rnd R	stl (06)	47
1 1/2 × 1/4	rnd R	stl (09)	59-66

Until November, 1872 the CV was known as the Vermont Central. From 1904 until 1970 the Central Vermont was owned by the Grand Trunk Western, which in turn was owned by CN.

The Vermont Central erected Burnettizing works in 1856, which they operated for about four years, treating hemlock ties. "...but it was so much work to get through with such large quantities of timber as are used upon a railroad that it was thought best to abandon the work..." [ASCE 7-85, 257-258] [ASCE 8-85, 303] ['13, 89]

CV nails are found between the rails, closer to one rail.

The (07) 27 is rarer than the (11) 27.

Three (38) 38's were found by John Iacovino in the proper position on the Swanton branch mixed with other true CV nails from the 30's. Russ Hallock pulled the 38's in both Vermont and Connecticut. These are probably not from ex-CN ties.

See [M-J '86, 27] for a nail hunt.

Charlotte Harbor & Northern

This railroad built a one retort creosoting plant in Hull, FL in 1912. Ties, piles, telegraph poles, dimension timbers and crossing planks were treated there. The Rueping process was used on ties and possibly other timbers. ['13, 450-451] ['15, 464, 472]

The plant was acquired by the Seaboard Air Line when the CH&N was absorbed into the SAL in 1926.

Chesapeake & Ohio

2 1/2 × 1/4	rnd R	stl (07)	17,26-31,34-40,42,43,54,55,58
1 1/4 × 3/16	rnd R	mi (11)	18
1 1/4 × 3/16	rnd I gm	cop (60)	23-25,26:c
2 × 1/4	sqr R	stl (07)	35
2 1/2 × 1/4	sqr R	stl (07)	39
2 1/2 × 1/4	rnd R	stl (06)	41,44-46,51,54,56,57,61
2 1/2 × 1/4	rnd I	stl (06)	46,48-50,52
2 1/2 × 1/4	rnd R	stl (25)	47,48,51-53
2 1/2 × 1/4	rnd R	stl (05)	49,50
2 1/2 × 1/4	rnd I	stl (05)	50
2 1/2 × 1/4	rnd R	stl (03)	54
2 1/2 × 1/4	sqr R rs	stl (06)	56
2 1/2 × 1/4	pnt R rs	stl (06)	56
2 1/2 × 1/4	rnd I	stl (07)	62
2 1/2 × 1/4	irr R ss	stl (07)	64
<i>Code nails</i>			
2 1/2 × 1/4	rnd R	stl (06)	P #2

...Chesapeake & Ohio

The Louisa RR, later part of C&O, tested some kyanized oak ties in Virginia in 1840.
[ASCE 7-85, 253-254][’13, 195][DNC, 7]

The C&O first used creosoted piles and other timbers in 1882, treated at its Newport News, VA facility. From then on all timbers used in Atlantic waters were creosoted to protect them against the teredo.
[’52, 282] The work was probably done at the Wyckoff Pipe Creosoting Co.’s Portsmouth, VA plant.
[’13, 199]

Tie treating plants

In 1915 the American Creosoting Co. built a one cylinder creosoting plant at Russell, KY, near Cincinnati. It went into operation April 17, 1916, creosoting ties for the C&O by the Lowry process. Adzing and boring machines were added in November, 1925, and in 1935 they installed a second retort.
[’18, 244][’52, 283][’44, 428] As of 1916 the plant was also treating ties for the Hocking Valley RR, a C&O subsidiary. [HWP, 12]

The Lowry plant was probably abandoned in 1948. On January 17, 1949 a new one retort treatment works opened at Russell, this time run by Koppers. Ties here were treated there by the Rueping process. A second retort was added in 1950. [’52, 283, 397]

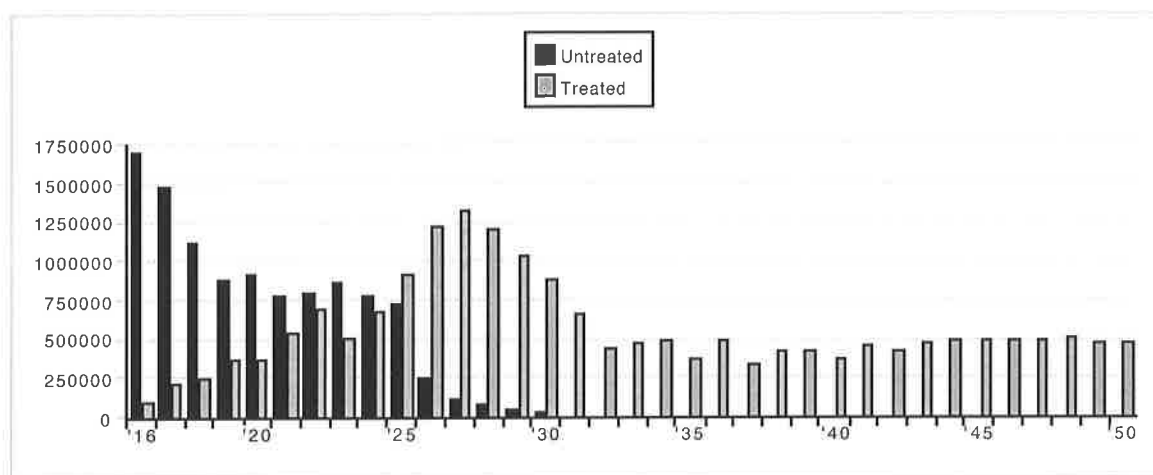
Treatments

Treatments used by the C&O

<u>Treatment</u>	<u>Date commenced</u>
Creosote.....	4-17-16 (Lowry process)
Zinc chloride	5-12-20
Creosote.....	3-12-23
80-20	10-18-23
65-35	5-1-24
60-40	6-1-32
Tar	11-7-35
50-50	9-1-39
60-40	11-1-44
80-20	3-15-45
60-40	1-29-46
60-40	1-17-49 (Rueping process—new treatment plant)

The proportions are for creosote and coal tar solution, so for example 80-20 means 80% creosote with 20% coal tar solution. The switch to zinc chloride was caused by the creosote shortage. [’52, 283]

Number of ties inserted for renewals



Treated ties were not used before 1916. By 1932 the vast majority of ties in the track were treated (and thus long-lived), so renewals were far fewer than they were when a large proportion were untreated. ['52, 283]

The nails

R. N. Beigen, Vice-President of the railroad, wrote in 1925 "Think present method of marking (dating nails in treated ties) is worth the cost until service life of treated ties is fully established." [AREA '26, 710] [DNC, 330]

But the C&O does not appear to have used nails except in test sections. Glenn Wiswell found a large variety of nails (those listed in DNC) "in a test section in West Virginia. I have heard rumors of two other test sections but have not had a chance to check them out yet. I have never found a date nail elsewhere on this line." [Wiswell 77]

Everyone else has the same problem finding nails on the C&O. Here are some finds which *are* known:

- Steve Worboys pulled two sqr R 39's in Doswell, VA.
- Brian Banta found a stretch of track in Richmond, IN in which each tie had a rnd R (06) 54 and a P.
- Ed Biedenharn found the rnd R (06) 54's and a P's in ties south of Muncie, IN. In the same area he found the 1 1/4" (11) 18's in sidings.
- Charles Sebesta told me of a collector who found sqr R (06) 56's and pnt R (06) 56's in one spot. These are not from second hand ties. The shape of the head may have held no significance for the railroad in this case.
- John Iacovino found rnd I (06) 50, 52; rnd R (25) 53, and rnd R (03) 54 between Beitner and Traverse City, MI. [(2nd) Fall 2001, 18]

At the 1996 Indianapolis railroadians show I met a dealer with lots of nails for sale, and quite a few were from the C&O. Unfortunately he lied about the origins of many nails. He claimed that he pulled certain square nails from the teens on the Southern in Alexandria, VA. They were obviously really from the Big Four. He also said that his Big Four sqr I 16 was from the Norfolk & Western. He had many C&O copper 26's and rnd R (06) 46's, rnd R (11) 19's, two or three sqr R (07) 39's, along with other nails might be C&O. Among these were one or two rnd R (11) 19's, which might go with the C&O (11) 18's which I already had in my C&O list.

The (03) 54 is also from a test section.

Chesapeake Western

2	× 1/4	rnd I	stl (07)	24
2 1/2	× 1/4	rnd R	stl (07)	25,26:d,27:b,28-32
2 1/2	× 1/4	rnd I	stl (07)	26-28,34,38,43,44
<i>From second hand ties</i>				
2 1/4	× 9/32	sqr R	stl (10)	28,29,31,32
2 1/2	× 1/4	cut R	stl (07)	34,35,38,40,43
2 1/2	× 1/4	cut R	stl (05)	47,49,53
2 1/2	× 1/4	rnd R	stl (07)	54,58
<i>From second hand bridge timbers</i>				
2 1/4	× 9/32	sqr R	stl (07)	26
2 1/2	× 1/4	cut R	stl (07)	41,42,42:b
2 1/2	× 1/4	cut R	stl (05)	44
2 1/2	× 1/4	rnd R	stl (05)	46

The CW was acquired by the N&W in 1954, and became part of the N&W in 1983.

All second hand nails were originally Norfolk & Western, except the rnd R (05) 46, which came from the Virginian, possibly via the N&W.

Two ties were found with both a 2" 24 and a rnd R 28. The 24's are rusted badly while the 28's are in good shape. Steve Worboys, who pulled all these nails, thinks that maybe the 24 is an ungalvanized treatment nail while the 28 is a railroad nail.

Chestnut Ridge

2 1/2	× 1/4	rnd R	stl (07)	25-32,37-41,48,50,52-55
1 1/2	× 1/4	rnd R	stl (23)	43
2 1/2	× 1/4	rnd R	stl (08)	44
2 1/2	× 1/4	rnd R	stl (05)	45,54
2 1/2	× 1/4	rnd R	stl (09)	47
2 1/2	× 1/4	rnd R	stl (17)	49
2 1/2	× 1/4	dia R	stl (07)	53

The CR is a 7.2 mile long Pennsylvania short line owned since 1901 by the New Jersey Zinc Co. It connects with the CRR of NJ and the L&NE.

Nails are found outside the rail. It is possible that they also used the (07) 44:b, and also other (08) nails.

Some nails may be from second hand ties. The (23) 43 was used by the St. Johnsbury & Lamoille County, and the (17) 49 has also turned up in second hand ties on the Dansville & Mt. Morris, the FJ&G, and the Barre & Chelsea.

Cheswick & Harmar

2	× 1/4	rnd R	stl (07)	37,38
2	× 1/4	sqr R	stl (07)	40,41

The C&H was a 4.2 mile short line near Pittsburgh.

Chicago & Alton

2 1/2 × 1/4 rnd I	stl (07) 03-05,07,10:d,11,18
<i>From second hand ties</i>	
2 1/2 × 1/4 rnd R	stl (06) 35
2 1/2 × 1/4 rnd R	stl (17) 40,41
<i>Code nails from second hand ties</i>	
2 1/2 × 1/4 rnd R	stl (18A) X #7
2 1/2 × 1/4 rnd R	stl (07) X #3

The C&A became the Alton RR in July, 1931, and was merged into the Gulf, Mobile & Ohio June 1, 1947. The Toledo, St. Louis & Western controlled the C&A from 1908 until 1921.

In 1880 the railroad tested some ties treated by the Wellhouse process. [ASCE 7-85, 258]

In 1900 the C&A began using zinc chloride treated ties and creosoted timbers. As of August 13, 1908 the C&A had used 450,000 ZnCl₂ treated ties. [AREA '09, 619][HWP, 10]['16, 329]

"No record now kept. Formerly used dating nails. Expect to install experimental sections." "Dating nails formerly used but discontinued this year [1914]" "Now planning to install special test sections with accurate records." ['14, table][DNC, 289]

Test section

- Iles, IL, 1907.

97,920 Burnettized red oak ties were laid. This is about 30 miles of track, if the ties were laid out of face. It may also be fifteen miles of double track. ['17, 180]['20, 115]

Bill Bunch found the 03-18 driven into the wall studs and rafters of a C&A tool shed in Centralia, MO. It may be that the 18 was used by the C&A in a test section, while the earlier dates were used throughout the system.

The second hand nails are from the Santa Fe.

Chicago & Eastern Illinois

2 1/2 × 1/4 rnd I	stl () 00:b,3
2 1/2 × 1/4 rnd I	stl (01) 4,5
1 1/2 × 1/4 dia I	stl (07) 08,9,9:b,10,10:b
2 1/2 × 1/4 dia I	stl (07) 10
<i>From the Tuscola test section</i>	
2 1/2 × 1/4 sqr I	stl (07) 23-29,31,34,37-43
2 1/2 × 1/4 sqr I	stl (05) 23:b,24-26,26:b,27-31,32:b,32:c
<i>From Danville, IL</i>	
2 1/2 × 1/4 rnd I	stl (06) 44,45
<i>Code nails from Danville, IL</i>	
2 × 3/16 rnd I	mi (11) A
<i>Probably from second hand ties</i>	
2 1/2 × 1/4 rnd R	stl (09) 40
2 1/2 × 1/4 rnd R	stl (17) 41,42

The Mt. Vernon plant

The Chicago Tie Preserving Co., under the direction of Octave Chanute, built its second treatment plant at Mt. Vernon, IL, which went into operation July 17, 1899. The company's first plant, in Chicago, had treated ties for the Rock Island since 1886. At Mt. Vernon red, water and black oak ties were treated by Chanute's three-step modification of the Wellhouse process for the C&EI, commencing only two years after the railroad's first experiment with treated ties. [RG 8-18-99, 581][WPN 3-32, 49]

...Chicago & Eastern Illinois

Besides stamping the date of treatment in the end of each tie, Chanute saw to it that "zinc coated nails, with countersunk figures in the head...are driven in the ties to make sure that no question shall hereafter arise as to the date of treatment." [RG 8-18-99, 581] This extra precaution was taken to avoid the recurrence of a problem the treatment company had with rumors of short-lived ties on the Rock Island. [RG 7-27-00, 507]

At 1,000 ties per day, the output of the Mt. Vernon treating works far exceeded the 100,000 ties required annually by the C&EI. For this reason the entire plant was made portable "by putting the retort on trucks, putting the boilers and machinery on cars, and arranging the tanks, platforms, and other parts so that they can readily be loaded on flat cars." In this way ties for other railroads could be treated as well. [RG 8-18-99, 581]

From 1899 until at least 1903 the plant also treated some ties for the Chicago & Western Indiana, a subsidiary of the C&EI. They also may have treated ties in 1904-05 for the Munising RR, judging by the nails found there.

The Mt. Vernon plant had one retort, and was operated by Charles D. Chanute, Octave's son. Octave died in 1910, and as of the beginning of 1911 C. D. Chanute was still running the plant, which was treating ties with zinc chloride only. In 1911 ownership of the plant was transferred to the T. J. Moss Tie Co., which treated ties with $ZnCl_2$, creosote, and zinc-creosote. They were still operating the plant in 1952. [RG 8-18-99, 581][¹¹, 212][¹², XIII, 285][⁵², 398] As I explain below, the C&EI may have stopped buying ties from the Mt. Vernon plant after 1905.

Later tie treating

The C&EI tested ties treated with zinc creosote in 1902. These ties were treated by the Allardyce method at Mt. Vernon. Apart from this test, they used zinc-tannin treated ties from the Mt. Vernon plant through the end of 1905, as well as large numbers of untreated ties. In 1906 they switched to straight zinc chloride, and in the Fall of 1907 they began also using Lowry creosoted ties treated by the American Creosoting Co.'s Marion, IL plant. After 1905 the use of untreated ties declined, and through 1914 about equal numbers of ties were treated with $ZnCl_2$ and creosote. Afterwards the proportion of creosoted ties increased. 1923 was the last year $ZnCl_2$ was used on C&EI ties. [¹¹, 21][²⁴, 339][AREA '17, 1288]

The C&EI had a treating inspector in Evansville, IN as of 1916. Evansville was the location of a treating plant of the Indiana Tie Co., built in 1907. Ties were treated here with $ZnCl_2$ when the plant opened, and eventually various other methods were employed for ties. This plant probably supplied zinc chloride treated ties to the C&EI. It was abandoned between 1930 and 1934. [¹⁰, 139][¹⁵, 466, 475][¹⁶, 32][²², ix]

As of 1932, an 80-20 creosote-coal tar solution was being used on C&EI ties. This is one of the two treatments tested at Tuscola, IL in 1912, so its use may date back that far. [WPN 3-32, 49ff]

Numbers of treated ties installed

The following table, compiled from several sources, shows how bad railroad statistics can be.

Year	Number of ties renewed, treated & untreated	Treated oak ties installed	Total mileage
1899		111,816	
1900	301,324	221,568	1,061
1901	320,030	172,477	1,146
1902	261,288	194,430	1,188
1903	235,224	92,317	1,251
1904	166,383	181,426	1,391
1905	131,619	363,409	1,479
1906	218,892	448,113	1,493
1907	323,981	144,329	1,507

...Chicago & Eastern Illinois

I calculated the "number of ties renewed" from the total mileage and the number of ties renewed per mile, both treated and untreated, in [WPN 3-32, 51]. These numbers are approximate, give or take 500 to 750. The figures for "Treated oak ties installed" are from [AREA '07, 489], ['16, 306], and ['20, 110-111], and include red, black, and water oak.

The numbers for 1904-1906 cannot be reconciled, even by adding ties installed in new construction, and by assuming that the numbers from [WPN] are for the fiscal year beginning the preceding July 1.

F. J. Angier wrote that 1,647,605 ties were laid 1899-1909 inclusive. This figure contradicts the numbers in both the second and third columns above, which add to 1,958,741 and 1,929,885 ties respectively for 1899-1907. ['11, 123][RAG 1-20-11, 127] But [AREA '09, 618] states that 1,929,855 oak ties were used to 1908.

Date nails and record keeping

The Chicago Tie Preserving Co. drove date nails into all ties treated at their Mt. Vernon works from 1899 to at least 1905. As of December 17, 1902, nails were driven after the ties were laid, but by January, 1904 the nails were driven "before the ties are forwarded from the tie yard, or treating plant." They also stamped the year of treatment in the end of each tie. [AREA '04, 103][RG 8-18-99, 581][RG 7-22-00, 507] [Spring 2002]

From a 1914 inspection: "On June 26 near Mt. Vernon I saw a number of red oak ties in track treated with the Wellhouse process bearing dating nails 1899..." ['15, 211]

Nails were originally purchased from the American Steel & Wire Co. By March, 1900 nails were being purchased by the hardware firm Crerar & Adams. In August Chanute rejected another offer from Crerar & Adams, and by December 1902 he was buying them from the hardware firm Orr & Lockett. [Spring 2002]

Judging by Chanute's wording in letters printed in *Nailer News* Fall 2001 to Spring 2002, the treatment company used rnd I (07) 99, rnd I 00's and rnd R 00's from Crerar & Adams, rnd I () 1-3 (like Big Four nails), and the (01) 4, 5 listed above.

In 1907, after they began using creosote as well as zinc chloride, round headed nails indicated $ZnCl_2$ -treated ties while square headed nails indicated creosoted ties. ['14, 405] Diamond nails were considered to be square.

The use of date nails in the C&EI's first decade of tie treatment was a failure. The records collected by foremen revealed hardly any treated ties removed, which was clearly not the case. At first the bad reports were taken at face value: "They have put into track to date about 845,000 ties, of which 64 have been taken out of track." [RA 3-24-05, 497][AREA '05, 778] Another report, from 1907, proudly states that only 6,087 treated ties out of 1.25 million had been removed, an illustration of the long life of treated ties. [AREA '07, 491] In fact, the number of treated ties removed must have been much higher. F. J. Angier wrote in 1911 "A statement taken from the Chicago & Eastern Illinois' records, made December 31, 1909, shows only 9 1/2 per cent removed, account of decay, from a total of 111,816 ties treated in the year 1899. From a total of 1,647,605 ties laid during the years 1899 to 1909 inclusive, the records show only 1.1 per cent. removed due to decay. This record was made by placing a dating nail in each tie as treated and laid, and depending upon the section foreman to hand in correct reports of ties put in and taken out of track. It has proven a very unsatisfactory method of keeping a record and doubtless many inaccuracies occur." ['11, 123][RAG 1-20-11, 127]

"The use of dating nails was discontinued after 1910." [AREA '17, 1288] Like many railroads at that time, the C&EI relegated the use of date nails to test sections. They had one large test near Tuscola, IL, established in 1912. For the use of nails there, see below. The record of all treated ties which had been kept since 1899 was stopped about 1913. In a letter dated November 3, 1916, L. C. Hartley, Chief Engineer, wrote "About three years ago this record was discontinued on all of the divisions except the Illinois Division, which consists of the territory in Central and Southern Illinois, south of Villa Grove." After introducing some statistics on Wellhouse treated ties he wrote "This statement has been made up from reports by section foremen and there are no doubt a number of inaccuracies." [AREA '17, 1287]

Herman Steury found one 00 in a C&EI tool shed at Henning, IL. Charles Sebesta has another. Otherwise no pre-1903 nails are known.

Herman found the 3, 4, and 5 in tool house studding at North Yard in Danville, IL. He also found the two known (11) A's in a track at the Danville shops, along with one each of the (06) 44 and 45. See

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[M-A '78, 1].

The second hand 40 and 42 are probably from ex-Wabash ties, and the 41 might be a misidentified Wabash nail.

Test sections

- Cypress to Joppa, IL, 1900.

New track was constructed here in 1900. 24,271 red oak ties treated at Mt. Vernon were placed. "When these ties were placed in track there was a dating nail put in them." Actually, the nails were driven at the treating plant. In 1914 "...they had a man from the Engineering Department count every tie still remaining in the track that had a dating nail in it." 75% of the ties remained after 14 years. ['15, 210-211, table]

- ?, May 1902.

Ca. 15,000 Allardyce (zinc-cresote) treated red, black, and water oak ties. [AREA '02, 116-117]

- Tuscola, IL, 1912.

When the second main track was constructed between Findlay Junction and Villa Grove, IL, a test track consisting of 11,095 ties was established in the Fall of 1912 just south of Tuscola, IL. In addition to 1,470 untreated white oak ties, the following were placed:

	<u>ZnCl₂</u>	<u>80-20 Lowry</u>	
Beech	803	1,507	
Hickory Elm	0	1,356	
Gum	353	0	
Red Oak	2,786	2,820	['26, 213]

80-20 are proportions for a mixture of creosote and coal tar by the Lowry process. "Each tie was marked and numbered so it could be identified at any time." [WPN 3-32, 51]

"The ties in each group were numbered consecutively and a separate design of tie-dating nail placed in every tie of each group. Ties replacing test ties are marked with two dating nails indicating the year the test tie was removed from track." [WPN 2-26, 27]

This seems to imply that the original ties had 1912 nails, the shape of the head indicating the different treatments. When a 1912 tie was renewed, two nails were driven in the replacement tie: the old 1912 nail, and a new nail showing the date of renewal.

"Each kind of tie is marked with a different kind of dating nails and any test tie renewed is replaced by a test tie marked with a nail showing the year tie was renewed." ['41, 293]

Of the numerous dated ties found at the test section, no pre-1923 nail was found, indicating that the 1912 nail was *not* driven into the new tie.

Careful records were kept of the ties in this test, and annual inspections were made into the 1940's.

Because of misprints in ['20, 94, 115, 117], we know that the Lowry treated elm ties were treated at the American Creosoting Co.'s Springfield, MO plant, and that the other Lowry treated ties came from the American Creosoting Co.'s Marion, IL facility. The location of the white oak ties is given as "Stations 12-40 and 23-84" in ['20, 117]

Herman Steury and Russ Olsen pulled many nails from 23 through 43 here.

Chicago & Illinois Midland

2 1/2 × 1/4	rnd R	stl (07)	26-31
2 1/2 × 1/4	rnd R	stl (09)	32-35,37,45,46,46:b,48-63
2 1/2 × 1/4	rnd R	stl (06)	36,38-45
2 1/2 × 1/4	rnd I	stl (06)	45
1 1/2 × 1/4	rnd R	stl (09)	64-67

Parmalee wrote that no 47 had been found in [J-F '78, 1].

Chicago & North Western

1 3/4 × 5/16 rnd I	stl (01) 5,05,6,06,7,07,8,10-13
2 × 11/40 rnd I	stl (07) 9
2 1/2 × 1/4 rnd R	stl (07) 23
2 1/2 × 1/4 rnd I	stl (07) 24,24
1 3/4 × 5/16 rnd I GM	stl (07) 25-27,27:b
2 1/2 × 1/4 rnd R gm	stl (07) 25,26
1 3/4 × 11/40 rnd I	stl (17) 29
1 3/4 × 1/4 rnd I	stl (17) 29,30
1 3/4 × 1/4 rnd R	stl (17) 30,30:b
2 × 1/4 rnd R	stl (07) 30
2 × 11/40 rnd I	stl (07) 31
2 1/2 × 1/4 rnd R	stl (06) 57,58
<i>Code nails</i>	
1 3/4 × 5/16 sqr I rs GM	stl (07) 7,7:b
2 1/2 × 1/4 rnd I	stl (06) E #4
1 3/4 × 3/16 rnd R	stl (06) ^F NB #5
2 1/2 × 1/4 rnd I	stl (07) P #5
<i>From second hand ties</i>	
2 × 1/4 rnd R	stl (07) 29
2 1/2 × 1/4 rnd R	stl (07) 30
2 1/2 × 1/4 rnd I	stl (05) 31,32,35,50
2 1/2 × 1/4 rnd I	stl (06) 34,36
1 1/2 × 1/5 rnd R	stl (09) 45
1 1/2 × 1/5 rnd R	stl (06) 43,46,47,50-55,57
2 1/2 × 1/4 rnd I	stl (07) 50
2 1/2 × 1/4 rnd R	stl (06) 54
<i>Code nails from second hand ties</i>	
2 1/2 × 1/4 rnd I	stl (07) X #4

Tie treating

The C&NW's first tie treating plant was built at Escanaba, MI in 1903. It began treating ties by the zinc-tannin method sometime between July 1 and October 16 that year. The plant had three retorts. [RA 10-16-03, 514][¹², 284]

"We started with the Wellhouse process, used it four years and then commenced to treat with a mixture of zinc chloride and creosote oil [by the Card process, in 1908]." The Card process was still in use as of 1915, but by 1916 they had changed to the Burnett process, probably on account of the wartime creosote shortage. [AREA '09, 619, 665][HWP, 10] [¹¹, 139][¹², 284][¹⁵, 476]

By the time Escanaba plant was rebuilt with three longer retorts in 1926, they had certainly adopted empty-cell creosoting. The railroad shut down the plant in 1954. [³⁰, 419][⁵², 395] (See also Frank Bourke's article "C&NW's Escanaba Tie Treatment Plant," in *North Western Lines*, Summer 1998.)

A second plant was constructed at Riverton, WY in 1915. It was a one retort plant, with two more cylinders added in 1926. Sometime between 1945 and 1952 it was bought by the Empire Timber Treating Co. [¹⁸, 244][³⁰, 419][⁴⁵, 263][⁵², 395]

As of 1945 the C&NW had a treating inspector at the Republic Creosoting Co.'s Minneapolis plant. [⁴⁵, 284]

In the 1967 C&NW annual report to the ICC, the railroad reported having installed the following in the year 1967:

	New crossties	Second hand crossties
Renewals	539,611	83,272
New construction	25,793	2,821

Chicago & North Western

Ties were treated two different ways: with a 50-50 creosote-petro oil solution at 8 lb/ft³, or with a 60-40 creosote-coal tar solution at 7 lb/ft³. 84% received the 50-50 solution while 14% received the 60-40 solution. The treatment given for each is "Empty Cell-Rueping and Lowry".

Early test sections

- ?, 1871.

A small number of Foremanized ties were laid in a test, but they were lost sight of before any results could be obtained. Foremanized ties were treated with arsenic and mercuric chloride. [ASCE 7-85, 286]

Late in the Fall of 1888 the Chicago Tie Preserving Co. treated 5,934 hemlock and 2,393 cedar ties with zinc tannin for the C&NW. In 1906 some of the hemlock ties were rediscovered between Mayfair and Evanston, IL, and the rest were searched for. The result was the following two tests.

- Milwaukee, WI, 1888.

"Of the 2,303 cedar ties sent to J. B. Berry at Milwaukee, 875 only can be located, these are under tracks in the Milwaukee train shed and in good state of preservation, though badly worn by traffic, and for that reason require replacement." [AREA '09, 470]['16, 289]['20, 96]

- Dixon, IL and Between Mayfair & Evanston, IL, 1888.

"Of the 5,934 hemlock ties sent to H. G. Burt, West Chicago Shops (40th St.), no definite record is obtainable. It appears certain, however, that a number of them were laid in main track of the Galena Division about one-half mile west of Dixon, and that they were taken out about six or seven years ago. . . The balance of these ties, it is supposed, were placed in track north of Mayfair on Chicago Cut-off, but no record can now be obtained." [AREA '09, 470]['16, 300]['20, 105]

Individual tests

- Elmhurst, IL, 1903.

1,000 untreated cedar ties. None remained by 1918. ['17, 110]['20, 96]['22, 109]['23, 161][DNC, 252]

- De Smet, SD, 1903.

153,402 zinc-tannin treated hemlock ties. This may be just the total number of ties treated at Escanaba in 1903. ['20, 106]

- Peninsula Div., Wisconsin and Michigan, 1904.

17,622 zinc-tannin treated ties. ['17, 226]['20, 129] This test may include some of the 1904 tests listed below.

- Oconto, WI, 1904.

1,906 zinc-tannin treated hemlock. ['20, 106]

- Daggert, IL, 1904.

2,950 zinc-tannin treated hemlock. ['20, 106]

- Carney, WI, 1904.

2,119 zinc-tannin treated hemlock. ['20, 106]

- Pensaukee, WI, 1904.

1,721 zinc-tannin treated hemlock. ['20, 106]

- Little Suamico, WI, 1904.

1,042 zinc-tannin treated hemlock. ['20, 106]

- Clyman, WI, 1905.

142 zinc-tannin treated hemlock. ['17, 144]['20, 106]

- West Elgin, IL, 1905.

10,792 zinc-tannin treated hemlock. ['17, 144]['20, 106]

- Maribel, WI, 1905.

46,800 zinc-tannin treated tamarack. ['17, 224]['20, 129]

- Laona, WI, 1905.

76,000 zinc-tannin treated tamarack. ['17, 224]['20, 129]

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- West of Madison, WI, 1905.
14,827 full cell creosoted hemlock. All were removed by 1923 for causes other than decay. [’20, 105][’25, table]
- Mason City-Cartersville, IA, 1905.
325 zinc-creosote Card treated hemlock. [’20, 106][’23, 167]
- Elgin-Freeport, IL, 1905.
4,972 zinc-tannin treated red oak. [’20, 117]
- Belle Plaine-Miami, IA, 1905-1906.
11,990 zinc-tannin treated hemlock ties. All were removed by 1913. [’20, 106][’22, 110][’23, 165][DNC, 253]
- Pierre-Rapid City, SD, 1906.
483,840 zinc-tannin treated hemlock ties. [’20, 106] This number seems to be the total of ties treated at the Escanaba plant from 1903 to 1906.
- Near Janesville, WI, 1907, 1910.
In December, 1907, in conjunction with the Bureau of Forestry, 3,040 hemlock and tamarack ties were laid, treated with zinc-tannin, ZnCl_2 , creosote (open tank), or untreated, along with 50 untreated white oak ties. Here are the numbers:

	<u>Hemlock</u>	<u>Tamarack</u>	<u>White Oak</u>
Untreated	170	132	50
Zinc-tannin	1,535	738	
ZnCl_2	25	388	
Creosote	33	19	

The creosoted ties received between 5 and 6 lb/ft³. [’11, 139][’16, 299-301, 312, 327, 328][’17, 142-148, 188, 222-226][’20, 105-107][’22, 114][’23, 166, 167][’34, 223][DNC, 252-254]

In 1910 81 ZnCl_2 -treated tamarack ties were laid here. [’20, 128]

- St. Francis, WI, 1907-1908.
1907: 325 Card treated oak ties. [’20, 110]
1908: 325 ash, 125 beech, 288 yellow birch, 325 white birch, 76 white elm, 675 maple, and 112 soft maple ties were laid, all treated with zinc-creosote by the Card method. [’16, 329][’17, 98, 104, 108, 120, 158, 164][’20, 94-96, 99, 109, 110]
- Hawarden, IA, 1908.
346 hemlock ties, treatment not known. [’20, 104]
- East of Centerville, SD, 1908.
299 hemlock ties, treatment not known. [’20, 104]
- Madison-Cottage Grove, WI, 1914.
500 creosoted hemlock ties. [’20, 105]

The 1914 test sections

During “the last four months of 1914 [the C&NW] laid test tracks on eight divisions in five different states”. Each of the eight tests had seven species of wood, used untreated and treated three different ways. About 23,170 ties were tested. Here is a table of the total numbers of ties:

Wood	Untreated	Creosote	Zinc-creosote	ZnCl_2
Red Oak	799	800	799	782
Yellow Birch	800	806	800	803
Loblolly Pine	799	797	806	900
Longleaf Pine	792	902	800	700
Tamarack	801	803	802	800
Hard Maple	800	801	762	801
Hemlock	798	800	801	798

...Chicago & North Western

Creosoted ties received 7 lb/ft³, and were probably treated by the Rueping or Lowry process. In addition to these totals, 799 ties treated with T. G. S. oil were laid. T. G. S. oil is a mixture of 50% water-gas tar and 50% coke-oven tar.

The locations of the tests were

- 40th St. Station, Chicago.
- Womac, IL.
- Calamus, IA.
- Carroll, IA.
- Bark River, MI.
- Verdi, NM.
- South of Norfolk, NE.
- Chadron, NE.

About 100 ties of each wood and treatment, totaling about 2,900 ties, were laid at each site. [WPN 5-24, 72-73]['22, 111-114]['23, 162-164, 166, 167]['29, table]['42, 307-309][DNC, 252-254]

The nails

G. M. Davidson of the C&NW spoke at the 1911 AWPAs meeting: "We have been using up to the present time a dating nail, but we hope to change that in the near future. The results have been satisfactory, but seven years is too short a time to get any definite information." ['11, 139] The C&NW abandoned the date nail after 1913 and concentrated their records on the 1914 test sections. In 1923 they again took up the use of nails in every treated tie.

There are variations for the stubby (1 3/4 × 5/16) 25, 26, and 7 which are not shown on page 19 of Volume III.

From Jerry Penry: The common nails are the stubby 25-27, stubby code 7, and the 57 and 58. Nails are found outside the north rail on east-west routes, and probably the west side on north-south routes. Some 58's in Nebraska were found about 12" inside the base of the north rail. The letter E was found in the center of the tie, probably also the location for the P.

John Beck pulled about five stubby (01) 10's with a raised bar under the date, probably on the C&NW. The bar might be a factory error.

The underscore on some 24's was filed or ground after the nail was made, while on others it appears to have been factory stamped.

The square stubby 7 was traditionally thought by nail collectors to represent 1927. I do not believe it represents a date. It has been found in ties near stubby 25 and 26, and was used in the mid-1920's. There are about four variations of this nail. The "7" might have been used in ties treated with 7 lb/ft³ of preservative. See above under "Tie treating."

Jerry suggests that the letter nail $\begin{smallmatrix} F \\ NB \end{smallmatrix}$ stands for First National Bank, and that the ties were leased, but this is only a guess. The nail is found in the ends of larger-than-normal ties. It has been found in a tie with a 31. [J-A '89, 10]

The E #4 and the second hand X #4 were found in the middle of the tie.

See also [S-O '91, 3].

...Chicago & North Western

Sources for second hand nails

Chicago North Shore & Milwaukee

2 1/2 × 1/4	rnd I	stl (05)	31,35
2 1/2 × 1/4	rnd I	stl (06)	34
1 1/2 × 1/5	rnd R	stl (09)	45
1 1/2 × 1/5	rnd R	stl (06)	43,46,47,50-55,57

The 31-34 were pulled by Arn Kriegh at Buffalo Gap, SD. The 43-45 were mostly found in northern Nebraska by Jerry Penry [S-O '93, 9]. Other CNS&M nails were found in Nebraska by John Beck. They were found in the middle of the tie.

Great Northern

2 × 1/4	rnd R	stl (07)	29
2 1/2 × 1/4	rnd R	stl (06)	54

Jerry Penry found one each of these nails in a spot with several 57's and 58's.

Pennsylvania

2 1/2 × 1/4	rnd I	stl (05)	50
2 1/2 × 1/4	rnd I	stl (07)	50

Code nails

2 1/2 × 1/4	rnd I	stl (07)	X #4
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Texas & Pacific

2 1/2 × 1/4	rnd I	stl (05)	32
2 1/2 × 1/4	rnd I	stl (06)	36

Arn Kriegh found these at Buffalo Gap, SD.

Chicago & Western Indiana

2 1/2 × 1/4	rnd R	stl (06)	33
2 1/2 × 1/4	rnd R	stl (05)	34
2 1/2 × 1/4	cut R	stl (05?)	35,36
2 1/2 × 1/4	cut R	stl (07)	37-41
2 1/2 × 1/4	rnd R	stl (09)	50,51

The list of nails is taken from DNC's list.

From 1899 to at least 1903 the C&WI installed some oak ties which were treated with zinc-tannin at the Mt. Vernon plant of the Chicago Tie Preserving Co. This plant's main contract was with the C&EI, the railroad which owned the C&WI. The zinc-tannin oak ties used on the C&WI all had the same date nails as those used on the C&EI, which include rnd I 99-02, and rnd I (01) 3. None have been found so far on the C&WI. The locations and numbers of these ties are given as follows:

• Chicago, IL. ['20, 117]

Date	No. of ties
1899	9,585

• Dolton branch. ['17, 166]['20, 117]

Date	No. of ties
1899	272
1900	3,000
1901	4,000
1902	1,088
1903	1,225

In 1916 the C&WI had a "Creosoting Engineer & Tie Inspector", so by then creosote was the principal chemical for treating ties. ['16, 32]

Chicago, Burlington & Quincy (Burlington Route)

2 1/2 × 1/4 rnd I	stl () 00-03
2 1/2 × 1/4 rnd I	stl (01) 04,05
1 3/4 × 5/16 rnd I	stl (01) 6,7
2 1/2 × 1/4 rnd I	stl (07) 07,8,08:b,09,09,9,9:b,10,10,11,12
2 1/2 × 1/4+ dia I	stl (07) 8
2 1/2 × 1/4 rnd R	stl (07) 12-14,28-31,33
1 3/4 × 1/4 rnd R	stl (07) 15,15:b,15:c,16-24,24:b,25-28
2 × 1/4 rnd R	stl (07) 28-31
1 3/4 × 1/4 rnd R	stl (06) 31,34-41
2 1/2 × 1/4 rnd R	stl (06) 32
2 × 1/4 rnd R	stl (06) 32-34
<i>Code nails</i>	
2 1/2 × 1/4 rnd I	stl () H #6
2 1/2 × 1/4 rnd I	stl (07) A #5,B #10,C #8,D #5,E #5,H #7,I #1,K #1,L #1, N #2,P #6,R #2,S #12,T #4,X #6,Y #1,Z #1
2 1/2 × 1/4 rnd R	stl (07) ZA,ZA:b
2 1/2 × 1/4 rnd I	stl (07) 0-9 (Set #20)
<i>From the ends of ties</i>	
1 1/2 × 3/16 rnd R	stl (07) 37
1 1/2 × 1/5 rnd R	stl (06) 45
<i>Code nails from bridge timbers</i>	
2 1/2 × 1/4 rnd I	stl (06) 0-9 (Set #22)
2 × 3/16 rnd I	alm (61) 2 (Set #43)
<i>From second hand ties</i>	
2 1/2 × 1/4 rnd R	stl (18B) 28,29
2 × 1/4 rnd R	stl (18B) 30
<i>From poles</i>	
1 3/4 × 1/4 rnd R	stl (06) 39

Tie treating to 1909.

The CB&Q was the first U.S. railroad to test creosoted crossties. In 1868-69 they laid 25,000 ties in Illinois treated by Charles Seeley's open-tank method. The test was a failure. [ASCE 7-85, 268-269] [Rowe, 298-299]

Apart from a small test of ZnCl₂-treated hackberry ties in 1894, the CB&Q had no other experiences with tie preservation until they decided to build a treating plant. In 1898 a few hundred experimental treated ties were laid, and in 1899 the CB&Q's first treating plant was built at Edgemont, SD. Frank J. Angier, Superintendent of Timber Preservation, saw to the construction of the plant, which began operating in the middle of November, 1899. Lodgepole pine and Douglas fir ties were treated with zinc chloride by the Burnett process for lines west of the Missouri River (in South Dakota, Wyoming, and Western Nebraska). There untreated pine and fir ties had an average life of five years in the track. [RG 4-6-00, 213] ['10, 119] ['16, 299] [WPN Dec '23, 191]

In the latter part of 1901 the plant was moved to Sheridan, WY in order to be closer to the timber supply. An average of over 650,000 ties were treated annually in the first three and a half years of operation. Additionally, some ties were purchased from commercial works. In 1903 150,000 ZnCl₂-treated red oak ties were bought from Ayer & Lord's Carbondale, IL plant. [RA 9-4-03, 283] [RA 10-16-03, 515]

"There have also been treated for experimental purposes a few carloads of red oak, hemlock and tamarack ties." [RA 9-4-03, 285] Also, at least in 1902 and 1903, one month per year was set aside for treating ties with Barshall salts by the Hasselmann process. [AREA '09, 619] In 1905 the Forest Service established a tes on the CB&Q of zinc-creosote and straight creosote. [RA 9-4-03, 283]

The Sheridan works had two treating cylinders and an annual capacity of about 600,000 ties per year. Only railroad crossties were treated there. [RA 9-4-03, 283] ['13, 457]

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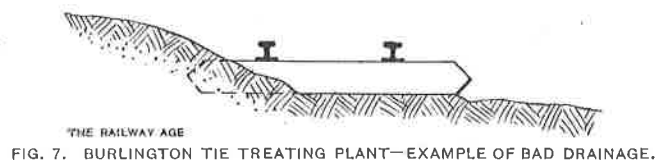
Untreated ties continued to be used on lines east of the Missouri River. Oak was more common in this territory, and it gave a longer life than untreated pine or fir. But as timber prices continued to rise and oak became more scarce, it was decided to construct a treating plant for the eastern lines at Galesburg, IL. This plant was built in 1907 and went into operation either late that year or early 1908. [13, 454][35, 210-211]

Straight zinc chloride was not suitable for use on eastern lines because of heavy rainfall. This, and the high cost of timber, led the CB&Q to adopt Card's zinc-cresote method for the Galesburg plant. The primary woods treated there were red oak, white oak, gum, and southern pine. Meanwhile, zinc chloride continued to be used at Sheridan. [35, 211]

Angier, like many others, did not believe that empty-cell creosoting worked. He spoke against empty cell methods at the 1911 AWP meeting. [11, 124-125]

Tie shapes.

Ties treated at Edgemont/Sheridan in the first years of operation were cut so that their ends formed wedges. This can be seen in photographs of the stacks of ties at the plant, and in this diagram, which was drawn to illustrate a drainage problem:



[RA 9-4-03, 285]

I do not know how long ties were cut this way. They may have quit using this shape by 1909.

The Great Northern was not the only railroad to use ties with a triangular cross section. The CB&Q conducted two tests of triangular ties in 1903 and 1904. In total over two miles of track were laid with triangular ties at these sites. The ties may have been cut by the GN, but at least the 1904 test ties were treated at Sheridan. See GN for a diagram of the cross section of one of these ties.

Record keeping to 1909.

The month and year of treatment were stamped in the ends of ties at the treating plant beginning 1899. Because the ties did not have a flat end, they stamp was probably made on one of the beveled faces. [RG 4-6-00, 213][RA 9-4-03, 286]

Date nails were driven into ties treated at Edgemont/Sheridan beginning with the opening of the plant in 1899. "The first eight years the nails were driven by the section men after the ties were laid in track, and the last two years the nails were driven at the treating plant after the ties were treated. The head of the nail bore the imprint of the year in which the ties were treated..." [11, 127]

The record they obtained after a decade is described by Angier, who wrote in 1914:

In 1899 the Burlington built its first treating plant, in South Dakota. For ten years thereafter dating nails were driven in every treated tie (or, at least, were supposed to have been driven), and a record was kept in my office for ten years to endeavor to show the life of those ties. A report was made once a month by each section foreman, and on the nineteen divisions of the Burlington system there are about fifteen hundred section foremen. This means that fifteen hundred reports came into my office each month. Everyone knows that the average section foreman is not a clerk, therefore the reports, many of them, were improperly made out and figures illegible and inaccurate. Many of the reports never did show a tie put in or taken out of track during the ten years that record was kept. Dozens of the reports were returned every month for explanation of some kind, which could not be furnished. [14, 407-408]

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See also [DNC, 31] for another description of the same problem. For the reason he gave above, Angier easily received authorization to stop using date nails in every tie in 1909.

The 1909-1910 test sections

Even if the record from date nails was reliable, it would not have been enough. Angier, in [RAG 5-6-10, 1124] and [’11, 128] wrote:

...what kind of record do you have when every tie has a dating nail? A tie is a tie, it matters not whether it is made of oak, pine, chestnut, maple, beech, or any one of the twenty other species of wood. Your record then cannot show you which kind of wood is giving the longest life. There may possibly be some particular wood that is giving only one third or one half the record of other treated wood, but how are you to know from the record? Your record shows that so many ties are taken out each year, some for decay, others for rail-cut, breakages, etc., but does your record say that gum ties are breaking in greater numbers than hickory, or that maple ties are being destroyed much more by rail cutting and spiking than beech or ash ties? These are questions you want answered, and they never can be answered by the present method of putting a dating nail in every tie, and depending on the nail and the section foreman to give you a report.

But not just the species of wood is important in keeping tie records. The CB&Q was using or experimenting with several different preservative methods, and the climatic conditions and annual traffic varied greatly over the system. In order to determine which combination of wood and treatment was most economical in each territory, Angier and A. W. Newton, General Inspector Permanent Way and Structure, designed a plan to institute nineteen test sections, one for each division, each of 1,000 ties. Twenty species of wood, both untreated and treated three different ways were to be laid out of face. The treatments were Burnettizing (zinc chloride), Card process (zinc-creosote), and straight creosote (full cell). [’11, 122][’14, 282][’35, 211]

Angier was so convinced that empty cell creosoting was a mistake, that despite the fact that a large proportion of ties in the U.S. were being treated that way, he did not include any in his 1909-1910 tests.

The experimental ties were being installed by April, 1909. The date nail was abandoned except for use in these sections. Each test tie received two or three nails, one for the date, one for the wood, and a third specifying treatment. See below under "Test sections" for details of the plan. [’14, 404]

These CB&Q test sections soon became the model for other railroads wanting specific information about the life of treated ties. By 1911 many other major railroads had taken the Burlington's lead and abandoned the date nail in favor of tests involving a variety of woods and treatments. The Santa Fe, Great Northern, Chicago & Eastern Illinois, Rock Island, Monon, Illinois Central, and El Paso & Southwestern were among those following the advice of Angier.

Later tie treatment

F. J. Angier left the CB&Q to work for the B&O on May 10, 1910. He was succeeded by J. H. Waterman, who continued to inspect and report on Angier's test sections. Waterman instituted many of his own, also. The CB&Q did eventually return to the practice of putting a date nail in every treated tie. The 2 1/2" 28's, 29's and 30's can be found just about anywhere, but not dates 27 and below, so their policy was reversed in 1928. After 30, however, the nails seem to have been used only in test sections again. [’14, 283]

The treatment plants were expanded. In 1912 the two retorts at Sheridan were replaced by longer models. A third retort was added in 1925, and in 1936 a new retort replaced one from 1912. [’13, 456][’30, 420][’44, 429]

In 1912 the Galesburg plant went from three retorts to five. Four of these were dismantled and two new ones were added in 1930. [’13, 454][’44, 429]

The CB&Q continued to buy some of its ties from commercial plants. By 1934 over 10% of treated ties which had been used on the CB&Q were treated by outside companies. A 1954 document (mentioned below) lists Metropolis and Denver as the locations of two of these works. [’35, 209-210]

The Metropolis plant was built by Joyce-Watkins in 1913 with one retort. This company was also known as the Watkins Creosoting Co. A second retort was added in 1921. Between 1934 and 1940 it was acquired by the Wyoming Tie & Timber Co. [’15, 466][’18, 246][’34, 472][’40, 453]

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There were three treatment works in Denver. I do not know which supplied ties to the CB&Q. The companies were

Broderick Wood Products Co. Built 1946, one retort.

Koppers Co., built by National Lumber & Creosoting Co. with one retort in 1928, expanded to two retorts 1929.

Western Wood Preserving Co. Built 1946, two retorts. ['30, 421]['52, 395, 397, 400]

I have found two sources for tie treating after 1910. The first is an article by H. R. Clarke, Engineer Maintenance of Way, which was written in 1934 and published in the 1935 AWWA report. In it we find that through 1934 about five ties out of six which had been treated at Sheridan were Burnettized, i.e. were treated with straight zinc chloride. The balance received Card's zinc-creosote treatment. At Galesburg the proportions were reversed: the majority, over two thirds, were Card treated with the remainder being Burnettized.

Miscellaneous other treatments had been tried. These include petroleum-creosote, straight creosote, and Card treatment with ZnCl_2 & water gas tar.

The other document, supplied by Arn Kriegh, is an "Adzing & Boring templet for ties for 100 to 131 lb. rail." This sheet is dated Dec. 31, 1954 and has drawings of ties with lots of miscellaneous information.

Ties were stamped on both ends. An example is shown. In one end is "110-F 5" which shows the weight of rail, species, and class. The code for rail weight is given:

100	100, 110, or 112 lb. rail.
131	131 lb. rail.
2 T.R.	112 lb. T.R. rail.
9 T.R.	129 lb. T.R. rail.

The species of wood are given as

F	Douglas fir.
G	Lodgepole pine.
H	Hardwood (not in effect after June 11, 1941).
K	Hemlock.
L	Larch.
P	Western yellow pine.
R	Red oak.
S	Softwood (not in effect after June 11, 1941).
T	Gum.
W	White oak.
X	Miscellaneous hardwoods.
Y	Southern pine.

The class of the tie is a code for the dimensions of the cross section. See Central RR of New Jersey for an explanation.

On the other end of the sample tie is "C 55 G", which gives the kind of treatment, year treated, and treatment plant. The code for treatment is

A	Straight creosote.
B	Card process.
C	Creosote-petroleum.
D	Zinc-meta-arsenite.
E	Zinc-meta-arsenite & oil.

Presumably, because the letters run consecutively A through E, the treatments were arranged from the most common (A) to the least common (E) for 1954. Sometime between 1934 and 1954 creosote became the norm on the Burlington.

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The treating plants were

- D Denver.
- G Galesburg.
- M Metropolis.
- S Sheridan.

Adzing, boring, and stamping were done prior to treatment. "Semi-seasoned ties will have letter "S" prefixed before letters, below, showing treatment & date" Similarly, "G" prefixed indicated a green tie. For example, "S-C-34 G" is a semi-seasoned creosote-petroleum tie treated in 1934 at Galeton.

Jerry Penry found two CB&Q ties, one with a 38 nail and the other with a 39 nail, each with the stamp "C 38 S" in the end. These were creosote-petroleum ties treated at Sheridan in 1938, so the CB&Q had started to use creosote by the late 1930's.

No mention is made of date nails on the document.

Early test sections.

- New Boston Branch, IL, 1868-1869.
25,000 hemlock ties creosoted by the Seeley method were installed. These ties were probably treated at Charles Seeley's works in Chicago. The ties failed from dry rot due to the fact that they were treated unseasoned, and not enough creosote was used. [ASCE 7-85, 268-269] [Rowe, 298-299][Weiss, 12-13][AREA '09, 618]['10, 121]['16, 299]['20, 105]
- Just west of Gillette, WY, 1894.
60 Burnettized hackberry ties were laid April 17, 1894. They were treated by the Santa Fe at Las Vegas. ['11, 126][RAG 1-20-11, 127]['16, 299]['20, 104]

1898-1909 test sections.

- ?, 1898.
"...a few hundred treated cross-ties were placed in track." [WPN Dec '23, 191] These ties were probably a preliminary experiment made before the Edgemont plant was built. The location of the test is unknown.
- Near Mystic, SD, 1900.
550 ZnCl₂-treated red oak ties were laid at the east end of bridge 73. The ties were treated at Edgemont and were laid in the track October 1, 1900. ['11, 125]['14, 284]['16, 309]['17, 180]['20, 115]
- Alden, NE, 1900.
3,200 ZnCl₂-treated Douglas fir ties. ['20, 102]
- Between Sidney, NE and Petz, CO, 1900-1901.
14 miles of ZnCl₂-treated western yellow pine ties, treated at Edgemont in 1900, were laid in the Fall of 1900 and Winter of 1900-01. Originally 6,354 ties were under observation. ['13, 98]['14, 285]['16, 319]['17, 210]['20, 126][AREA '30, 865]
- Between Brush and Story, CO, 1903.
5,414 ZnCl₂-treated triangular Douglas fir ties. They may have been cut at Somers by the Great Northern's timber facility. ['16, 295]['20, 102]
- Between Concord and Jacksonville, IL, 1903-1904.
Ten miles of new track was laid from November 15, 1903 to February 5, 1904. 35,120 ZnCl₂-treated red oak ties were laid. This is the only known section of track on eastern lines on which treated ties were used before 1908. These ties were probably among the 150,000 bought from Ayer & Lord's Carbondale plant ['14, 285]['16, 309]['20, 115]
- Gillette, WY, 1904.
At the milepost east of Gillette and extending east, 1,320 triangular tamarack ties were laid in June, 1904. The ties may have been cut by the GN, but they were treated at Sheridan with zinc chloride in March, 1903. Some, if not all, were seasoned after treatment in an experiment in moisture loss. [AREA '04, 80][AREA '30, 867]['15, T]['16, 327]['17, 222]['20, 128]

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- Sheridan, WY, 1904-1907.

1904: 61 Douglas fir and 61 lodgepole pine ties boiled in ZnCl_2 . ['16, 294]

1906: 61 Red Fir and lodgepole pine ties treated by three methods: Burnett, Allardyce, and Rueping. ['16, 292]['20, 103]

1906: 1,996 ZnCl_2 -treated lodgepole pine ties. ['16, 321]['17, 196]['20, 122]

1907: 58 creosoted lodgepole pine ties, some treated by Lowry's method, some by the Rueping method. ['16, 321]['17, 196]['20, 121]

In ['19, 224] this test is said to have had lodgepole pine and three other species.

- Elsberry, MO, 1905.

A detailed article on this test is found in [AREA '15, 881-890]. Hermann von Schrenk wrote "During the spring and summer of 1905, a number of lodgepole pine and Douglas fir ties from Montana were treated, under the writer's direction, at the United States Government experimental timber-preserving plant on the World's Fair Grounds at St. Louis. These ties were treated by various processes, as shown in Table No. 1:

Treatment	Douglas fir		Lodgepole Pine	
	Number of ties	Average absorption, lbs. per cu. ft. for all runs	Number of ties	Average absorption, lbs. per cu. ft. for all runs
Untreated	89		10	
Rueping creosote	40	5.775	25	4.920
Straight creosote	74	7.456	39	8.841
Zinc chloride	91	0.262	63	0.309
Immersed in creosote	32	3.990		
Zinc-creosote	41	Creo. 1.466 Zinc 0.289	77	Creo. 1.652 Zinc 0.384"

The Zinc-creosoted ties were treated by the Allardyce process. Also, some other ties were treated by the Giussani process, but their record was lost.

"They were all well-seasoned ties, both hewn and sawed ties being included. The ties were given a serial number, and each tie was weighed before and after treatment, so that the actual absorption of preservative was recorded in each case. After treatment the ties were shipped to Elsberry, Mo., and were laid during the first part of August, 1905, in a stretch of track about one and one-half miles north of Elsberry. The ties were laid out of face in a section of perfectly straight north-and-south track. After they were laid, the ties were given a series of consecutive track numbers, tie No. 1 being located just north of the bridge No. 70.03. The different treatments were scattered irregularly."

As of 1914 no Rueping treated ties had been removed from track, though 30% of the Burnettized ties had been taken out. Waterman made this observation, but was still not convinced to switch to empty cell creosoting.

Included in the article are photographs of twelve ties removed from track. Five of these have three date nails close together between the rails, closer to one rail. They are colinear, determining a line parallel with the tie. Three of these have another nail close to the other rail. Another tie has a single nail. The ties were in bad shape, and the photos are not too clear, so probably they all had four nails each. The single nail is probably the date, while the others give specifics on treatment, species, and maybe tie number.

The ends of nine ties are pictured. All have a square tag about 1 1/2" on a side. These show the tie number only. They do not seem to be attached well, and may have been added just for the photo.

Records of this test can also be found in ['16, 293, 294, 321], ['17, 128, 130, 132, 196, 198], and ['20, 101-103, 121, 122].

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- Kane, WY, 1906.
3,120 ZnCl₂-treated Douglas fir ties. ['17, 132]['20, 102]
- Chicago, IL, 1908, 1910.
In 1908 31 untreated red gum ties were laid. The track was elevated in 1910, and all these ties were out by 1911. ['16, 296]['20, 103]
In 1910 314 Card treated white elm ties were laid. ['17, 120]

1909-1910 test sections.

"It was at first intended to install one special test of 1,000 ties on each of the 19 operating divisions but this has since been extended until as many as two or three tests have been installed on some divisions and 26,000 are now under special observation. Differing from the Santa Fe plan, the ties are either renewed to face in an old track to present a continuous stretch of ties of the same age or where possible, advantage is taken of new track to place these test sections where it will not be necessary to remove old ties. In this way each tie, at least at first, carried its full share of the load and all ties are placed upon an equal basis." ['14, 402-403]

These test sections were installed beginning as early as April, 1909, and the last was put in in 1910, no later than May 10, when Angier was replaced by Waterman. ['14, 283, 404]

Angier described one of these 1,000 tie tests in [RAG 5-6-10, 1124-1125] and ['11, 128-130]. "A description of one of these test tracks will answer for all." Not only are the number of ties of each wood and treatment given for this sample test, but also the actual order of the ties as they were laid in the track. Here are the numbers:

Wood Nail	Treatment:	Card (no nail)	Burnett Z	Creosote Y	Untreated hardwood X	Untreated softwood U	Total
W	White oak	15			5		20
R	Red oak	50	10	10	10		80
N	Pin oak	35	15		5		55
I	Beech	40	20	10	10		80
K	Pignut hickory	15			5		20
A	Ash	15			5		20
E	White elm	42	10	7	8		67
M	Hard maple	35	3		5		43
F	Soft maple	35	8	7		5	55
B	Red birch	40				8	48
Q	Chestnut	15			15		30
T	Tamarack	47	8	8		8	71
H	Hemlock	47	8	7		8	70
V	Tupelo gum	40	9	7		8	64
G	Red gum	39	8	7		9	63
P	Loblolly pine	45	7	7		10	69
S	Sycamore	15				5	20
D	Cottonwood	27	8			5	40
C	Cypress	35				10	45
L	Poplar	35				5	40
Total		667	114	70	68	81	1000

"*Explanation.*—Each kind of wood is designated by a letter stamped on the head of a nail driven into the tie, on the top side about 34 ins. from one end." 34" from one end is between the rails, about 13" from base of the rail.

"Burnettizing process (or straight zinc chloride) is designated with the letter "Z" following the letter designating the kind of wood. For instance, "R - Z" means a red oak tie treated with zinc chloride only.

"Straight creosote process is designated by the letter "Y" following the letter designating the kind of wood.

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"Card process (or a mixture of creosote and zinc chloride), has no letter, and a tie containing only the letter designating the kind of wood in addition to the dating nail "09" means that it has been treated with the Card process.

"Untreated ties are designated with the letters "X" and "U." "X" means that it is an untreated "hardwood" tie, and "U" an untreated "softwood" tie."

For this test section, the ties were arranged by wood, beginning with white oak and running through the list to poplar. For each wood, ties of various treatments were sometimes interspersed in some pattern, or they were arranged in order by treatment. The article contains a drawing of the entire test track, and little flags marked "M.P." occur at each end. These cannot mean "mile post" because there are more than a thousand ties per mile.

From later in the same article: "Suitable stakes with copper plates mark the beginning and ending of every test track." From CB&Q Standard Practice Circular No. 22 we know what was written on these plates: "Experimental ties placed in track, month....., 19..... When any of the experimental ties are removed they must not be destroyed, but must be reported immediately to the Division Superintendent." This document is owned by Arn Kriegh. On the same page: "Prior to annual inspection all experimental ties consisting of lots of miscellaneous kinds of woods and treatments, shall be numbered with white paint, beginning with number one, numbers running from one up in the same direction that the mileposts are numbered."

The table in [DNC, 252-254] is of completed test sections, those for which no ties remained in the track as of 1923. Out of 19 CB&Q tests of a total of 1,408 ties, one test of 50 ties, or 3.5% of the total, was inserted in 1910. The other 18 tests, amounting to 1,358 ties, were installed in 1909. This gives us a rough estimate of the proportion of tests from 1910.

Douglas fir is conspicuously missing from the list of woods. Fir was one of the two main species treated by the CB&Q before 1909, and it was used and tested much after 1910.

Some tests had fewer than 1,000 ties.

The total number of ties is given as 26,000 in three sources, and one admits it is only an approximation. Waterman said in 1913 "...there are over 26,000 experimental ties in round numbers..." In the annual reports, which were published in *Wood Preserving News* through 1944, the total number of ties is smaller. This is because the data presented reflects only "ties placed in what are termed the thousand-tie lots on the various divisions." So the 1909-1910 tests with fewer or more than 1,000 ties were excluded, possibly because percentages are easy when dealing with multiples of 1,000.

The totals are still off, though. In 1923 they claimed to have laid 23,873 ties in "thousand-tie lots". In the 1941 report, they claimed to have laid 24,874 ties. The difference here is 1,001, so the discrepancy might result from two errors, one by a tie and the other by an entire 1,000 tie test. But still, for some woods, the total number of ties listed as originally laid is higher in the 1923 list than in 1941. For others it is less. Ultimately we are dealing with poor accounting, which was not at all uncommon in tie statistics.

Also, these reports disagree with some of the numbers in [DNC, 252-254], the "Record of completed service tests of ties." In this list, 53 gum ties were laid in the 1909-1910 tests on lines west. According to the 1923 report, only 40 had been placed.

For individual test sections in other years, the locations are given exactly in reports. For these 1909-1910 tests the locations appear only as "lines east" or "lines west". The CB&Q deliberately held back in publishing the locations of the tests. Of course, some have been found by nail collectors. Dave Parmalee wrote in [M-A '78, 1] about the letter nails "Our Iowa and Nebraska collectors are finding these..." The tests I know of so far are

- Galesburg, IL. [11, 132]
- Ticona, IL, 1909.

8 ZnCl₂-treated hemlock ties. [16, 300] Given that the exact location of this test was published, it might seem that it does not belong to Angier's 1909-1910 experiments. But the date is right, and the number of ZnCl₂-treated hemlock ties in the sample test above is the same as in this test. Probably 1,000 ties were in the Ticona test.

- Near Barr Lake, CO, north of Denver.

Chicago, Burlington & Quincy

- West of Edgemont, SD, 1909.
Sheridan Div., from MP 476.96 westward to MP 490. 980 ties. This information comes from a track elevation diagram revised 8-12-57. Arn Kriegh, who has the diagram, found dates 00 all the way up to 40 here. [CB&Q 2]
- In the vicinity of Sidney, NE to Petz, CO, 1909.
A comparison was made in [AREA '30, 865] between the 1900 test section from Sidney to Petz, and one of the 1909 tests "in the vicinity of this test section".
- West of Casper, WY.
514 ties.

Test sections 1910 and later.

The next three tests may have been part of the 1909-1910 tests, introduced late in order for a better understanding of straight creosote. The woods and date are right, but they may be tests initiated by Waterman after May 10.

- Hanover, IL, 1910.
356 ties were inserted.
[16, 290, 291, 301, 304, 307, 311, 313, 325, 326][17, 106, 114, 116, 150, 160, 168, 186, 188, 214]
[20, 96-98, 107, 109, 111, 117, 119, 127]

<u>Species</u>	<u>ZnCl₂ Burnett</u>	<u>Creosote—full cell</u>
Sycamore	45	45
Red birch	45	45
White oak	15	15
Poplar	30	30
Cypress	15	15
Pignut hickory	5	6
Hard maple	30	
Pin oak	15	

- Blanding, IL, 1910.
235 ties were inserted.
[16, 290, 291, 301, 304, 307, 311, 313, 325, 326][17, 106, 114, 116, 150, 160, 168, 186, 188, 214]
[20, 96-98, 107, 109, 111, 117, 119, 127]

<u>Species</u>	<u>ZnCl₂ Burnett</u>	<u>Creosote—full cell</u>
Sycamore	30	30
Red birch	28	30
White oak	10	10
Poplar	20	20
Cypress	10	10
Pignut hickory	4	4
Hard maple	20	
Pin oak	9	

...Chicago, Burlington & Quincy

- Barr, CO, 1910.

357 ties were inserted.

The ties were seasoned one year after treatment. ['16, 290, 291, 301, 304, 307, 311, 313, 325, 326]
['17, 106, 114, 116, 150, 160, 168, 186, 188, 214, 218]['20, 96-98, 107, 109, 111, 117, 119, 127, 128]

<u>Species</u>	<u>ZnCl₂ Burnett</u>	<u>Creosote—full cell</u>
Sycamore	15	15
Red birch	30	59
White oak	15	15
Poplar	30	30
Cypress	30	29
Pignut hickory	15	14
Hard maple	15	
Pin oak	45	

- Baders, IL, 1911.

62 ties were laid:

- 5 Creosote & crude oil treated beech. ['16, 288]['17, 100]['20, 95]
- 15 Creosote (Rueping) treated red oak. ['16, 308]['17, 176]['20, 112]
- 3 Crude oil treated red oak. ['16, 308]['17, 178]['20, 113]
- 6 Crude oil treated beech. ['16, 288]['17, 102]['20, 95]
- 2 ZnCl₂ & crude oil treated tamarack. ['16, 328]['17, 224]['20, 129]
- 14 Creosote (full cell) treated red birch. ['16, 290]['17, 106]['20, 96]
- 3 Crude oil treated cypress. ['16, 291]['17, 114]['20, 97]
- 2 Crude oil treated white elm. ['16, 292]['17, 118]
- 5 ZnCl₂ & crude oil treated hemlock. ['16, 300]
- 4 Crude oil treated soft maple. ['16, 304]['17, 162]['20, 109]
- 3 Creosote & crude oil treated red oak. ['16, 307]['17, 176]['20, 113]

- Utica, NE, 1911.

ZnCl₂-creosote Card treated ties were laid. 45 hackberry and 540 hard maple ties. ['17, 140, 162]
['20, 104, 109]

- Ottumwa, IA, 1912.

160 ZnCl₂-creosote Card treated Douglas fir ties were laid. ['20, 103] In ['19, 224] nine species are said to have been tests at Ottumwa.

- Hardin, MT, 1913.

99 Full-cell creosoted Douglas fir ties were laid. ['20, 100]

- Douglas, WY, 1914.

3,202 ZnCl₂-treated Douglas fir ties. ['17, 132]['20, 102]

- Orin Jct., WY, 1914.

3,121 ZnCl₂-treated Douglas fir ties. ['17, 132]['20, 102]

This stretch of track was built in 1914. Arn Kriegh walked this section, finding nails 30-41, and one round metal tag about 1 3/4" in diameter with "33" stamped on it. It was held to the tie with one small nail.

- Red Oak, IA, 1915.

150 cypress ties were laid. 100 of them were full cell creosoted and 50 received zinc-creosote by the Card method. ['20, 97, 98]

- LaCrosse Div., 1915.

This line ran from St. Paul to Chicago. 18,000 ZnCl₂-creosote Card treated cypress ties were laid. ['20, 98]

- Beardstown, IL, 1916.

1,000 untreated chestnut and 5,128 ZnCl₂-treated white oak ties were inserted. ['20, 97, 119]

Chicago, Burlington & Quincy

- Armento, WY, 1916.
514 ZnCl₂-treated Douglas fir ties. ['20, 102]
- Hookdale, IL, 1916.
3,048 ZnCl₂-treated red oak ties. ['20, 115]
- Smithboro, IL, 1916.
Red oak ties were inserted here. 2,308 were treated with ZnCl₂, while 3,791 were Card treated.
['20, 115, 116]
- ?, 1916.
Some full cell creosoted Douglas fir ties were laid in a test section. ['20, 100]
- Crawford, NE, 1918.
Two tests were established just east of Crawford, one of 3,857 ties (beginning roughly MP 421 and extending east), and the other of 15,552 ties (MP 416.3 to MP 421.34). The latter was in a single stretch of track (as opposed to both tracks on double track). The treatments used are not specified on my source, [CB&Q 2].
- Between St. Paul, MN and LaCrosse, WI, 1929.
From MP 380.05 to MP 383.68, the following numbers of ties, treated with ZMA, were laid:
6,000 gum
3,200 oak
3,250 pine
The ties were treated at Galesburg in the Fall of 1928 and placed in the track in early 1929.
['30, 296][AREA '30, 687]
The ZA nails were found on this test section. Lowell Hard wrote "My father, Harry Hard, said he found the ZA letter nails up river from Winona, Minnesota." ZA stands for Zinc-meta-Arsenite.

Other locations of test sections.

Dave Parmalee found 18, 21, 23-26 in Lewiston, IL. [S-O '98, 15]

In ['19, 224-227] is a list of locations of test sections on various railroads in which zinc chloride treated ties were tested. Several of these tests are from the CB&Q, but neither the dates of the tests nor the numbers of ties is given. Some of the locations can be traced to tests listed above, but many can not. Here they are, with what information was given about them. Dates accompany tests which have been identified.

Tests of ties which gave at least eight years' service

Sterling, CO	2 species	
McCook, NE	2 species	
Omaha, NE	7 species, hardwoods	
Odell, NE	3 hardwoods	
St. Joseph, MO	7 species	
Brookfield Div., MO	4 species	
No. Missouri	4 species	
Hannibal, MO	13 species	
Waverly, IL	8 species	
Carman, IL	4 species	
Between Galesburg & Hudson, IL	Red gum & beech	
Big Cut, IL	Loblolly pine, elm, others	
Aurora Div., near Big Cut, IL	Red oak	
Calvert, WI	Sap pine & beech	
Gillette, WY	Hackberry	1894
Sidney, NE	Yellow pine	1900-01
Ottumwa, IA		1912?
Jacksonville, IL	Red oak	1903-04

...Chicago, Burlington & Quincy

Tests of ties which gave at least ten years' service

Casper, WY	Yellow pine	
Nodaway, IA	Red gum	
Kane, WY	Douglas fir	1906
Sheridan, WY	Lodgepole pine & 3 other species	1904, 1906, or 1907

Tests of ties which gave at least twelve years' service

Peruque, MO	Loblolly pine	
Mystic, SD	Red oak	1900
Elsberry, MO	Douglas fir	1905

Some tests are much older than the eight, ten, or twelve years' service would indicate. The Gillette, WY 1894 test was given under Eight years' service, for example. We can only hope that many of these locations, like Casper, WY, are among the 1909-1910 1,000-tie tests.

The nails

Arn Kriegh's set appears in [N-D '89, 6-7]. Along with the standard set, some odd nails are shown. John V. Howard's article and photo appear in [M-J '79, 6], and was reprinted in [J-F '86, 7].

In [Lewis, 136] are photos of some nails from the 1909-1910 test sections, wrongly attributed to the Santa Fe.

No 99's have been found yet. This is not surprising, because out of the 600,000 or so ties treated in 1900, only two 00's have been found. One was west of Edgemont, SD, and the other near Lincoln, NE.

Arn Kriegh found a tie a couple hundred yards from a CB&Q track near the Nebraska-South Dakota border with a CB&Q 03 and the rnd I () H. The H has the same shank markings as the CB&Q 01, 02, and 03, and is of a different style from the H they used in their 1909-1910 test sections. The letter probably stands for "Hasselmann."

The rnd I (07) letter nails are from the 1909-1910 test sections. Their meanings are given above in the description of the tests. Parmalee, in [M-A '78, 1], claimed that there is a variation in the "B". These nails have 9 heavy anchors on each side of the shank, and a small nick nearer the point. The exception is the Y, which has four heavy anchors and no nick. All have a slightly oval shape to the head.

The rnd R 14's are all 2 1/4" long, but were certainly meant to be 2 1/2".

The ZA's were used in the 1929 test section between St. Paul, MN and LaCrosse, WI. ZA stands for the treatment Zinc-meta-Arsenite.

The nails from code Set #20 represent curve elevation. A 0 was driven into a tie at the beginning of a curve, a few ties later was a 1, then a 2, and so on until 9, which was placed at the highest point of the curve. The numbers then descended back to 0. The nails marked reference points and don't represent any specific form of measurement. They have been found by Arn Kriegh on the main line north of Denver.

Code sets #22 and #43 were driven into the top guard planks of bridges, which were two timbers running parallel to the rails, outside the rails. The nails were driven above the piers, and indicated span length. The nails were found in bridges in the Black Hills. The aluminum 2's were found in only one bridge, in Upton, WY. Four of them were found with four steel 8's to indicate a span of 28 feet (four times).

Tie nails are found about a foot inside the rail. The common nails are the 2 1/2" rnd R (07) 28-30, and even these are rarely found in the track today. Of the older dates, 09 is the most common.

The 1 1/2" 37 and 45 found in the ends of ties were driven at the treating plant or before. 37's were found near Lincoln, NE by Leroy Johnson.

The second hand nails were originally used by the Colorado & Southern, a subsidiary of the CB&Q. They were pulled near Malmo, NE.

For a short article by Larry Ostermeyer with a photo of a stubby 6 in the tie, see [S-O '92, 1-2]. See also [J-A '92, 11].

Chicago, Indianapolis & Louisville

See Monon Route.

Chicago, Milwaukee & St. Paul and Chicago, Milwaukee, St. Paul & Pacific

See Milwaukee Road.

Chicago North Shore & Milwaukee

2 1/2 × 1/4	sqr I	stl (05)	16,24
2 1/2 × 1/4	rnd I	stl (07)	16,17,18:b,19:b,20,21
2 1/2 × 1/4	rnd R	stl (07)	20
2 1/2 × 1/4	rnd I	stl (05)	22-25,28-31,33,35
2 1/2 × 1/4	rnd R	stl (05)	26,27
2 1/2 × 1/4	rnd I	stl (06)	32,34
1 1/4 × 3/16	rnd R gm	cop (60)	36:b,37,38:c
1 1/4 × 3/16	rnd R	cop (06)	39-41
1 1/2 × 1/5	rnd R	stl (06)	42-44,46,47,49-58
1 1/2 × 1/5	rnd R	stl (09)	45

The CNS&M was an electric railroad which ceased operations January 21, 1963.

Some nails may be from second hand ties. Many CNS&M nails are found in second hand ties on other railroads, including the Akron, Canton & Youngstown, the Arcade & Attica, the Barre & Chelsea / Montpelier & Barre, the Chicago & North Western (see [S-O '93, 9]), the Green Bay & Western, and the Milwaukee Road.

Chicago, Rock Island & Pacific

See Rock Island Lines.

Chicago South Shore & South Bend

Many are probably from second hand ties

2 1/2 × 1/4	rnd I	stl (07)	23-33
2 1/2 × 1/4	sqr I	stl (07)	28
2 1/2 × 1/4	sqr I	stl (05)	29-31,31:c,32
2 1/2 × 1/4	rnd R	stl (07)	29,30,38
2 1/2 × 1/4	rnd R	stl (05)	30,31
2 1/2 × 1/4	rnd R	stl (06)	31-43,48,48:b,49,50
2 1/2 × 1/4	rnd I	stl (06)	34-42,46-49
2 1/2 × 1/4	rnd R	stl (04)	44,45
2 1/2 × 1/4	rnd R	stl (25)	44,45,51,59
2 1/2 × 1/4	rnd R	stl (19)	46,47
1 1/2 × 1/4	rnd R	stl (25)	59

The Chicago, Lake Shore & South Bend, an electric line, became the Chicago South Shore & South Bend in July, 1925. It was taken over by the C&O January 3, 1967.

As of June, 1923 this line was using creosoted ties. [WPN 6-23, 95]

Mel Smith got most of his CSS&SB nails from Carl Thompson. Many seem to be from second hand ties. But which ones? The (25) nails may be from the Illinois Central.

The (04) 44,45 and (19) 46,47 also turn up on the NC&StL and Michigan Central. Maybe the nails were originally used by the NC&StL and are found in second hand ties on the CSS&SB and the MC.

Russ Hallock found a (06) 42 in a pole.

Chicago Transit Authority

Code nails

2 1/2 × 1/4	rnd R	stl (18C)	R #5
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Chicago Transit Authority

This nail was used about 1990 in subway ties. Also, Russ Hallock found this "R" in the early 1980's in Rock Island track at Blue Island, IL, near Chicago.

Clarendon & Pittsford

2 1/2 × 1/4	rnd R	stl (07)	30
<i>From second hand ties</i>			
2 1/2 × 1/4	rnd I	stl (05)	22
2 1/2 × 1/4	rnd I	stl (07)	23
2 × 1/4	rnd I	stl (07)	24
2 × 1/4	rnd R	stl (07)	25
2 1/2 × 1/4	rnd R	stl (07)	25,26,28-33
2 1/2 × 1/4	cut R	stl (03)	35
1 1/2 × 1/4	rnd R os cp	stl (38)	38

The C&P is a Vermont short line which connected with the Rutland and D&H. Russ Hallock believes that the C&P used the rnd R (07) 30: "I found quite a few which looked like they had been in the ground a LONG time."

The 2" 25's were found outside the rail. This 25 and the (05) 22 have also been found in second hand ties on the Norwood & St. Lawrence. Some 2 1/2" 25's were found between the rails, closer to one rail. All other nails were found in the middle of the tie.

An indent 41 is reported in [Dec '76, 7].

Sources for second hand nails

Central Vermont or Canadian National

1 1/2 × 1/4	rnd R os cp	stl (38)	38
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New York, New Haven & Hartford

2 1/2 × 1/4	rnd I	stl (05)	22
2 1/2 × 1/4	rnd I	stl (07)	23
2 × 1/4	rnd I	stl (07)	24
2 1/2 × 1/4	rnd R	stl (07)	25,26,28-33
2 1/2 × 1/4	cut R	stl (03)	35

Cleveland, Cincinnati, Chicago & St. Louis

See Big Four Route.

Clinchfield

2 1/2 × 1/4	rnd R	stl (19)	43,44
2 1/2 × 1/4	rnd R	stl (25)	53
2 1/2 × 1/4	rnd R	stl (03)	54

This railroad was owned by ACL and was merged into the Seaboard System in 1983.

The 53 and 54 may be from ex-C&O ties.

Coal Belt Electric

2 1/2 × 1/4	rnd I	stl (07)	13,16-18,21-26
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CBE, a subsidiary of the Missouri Pacific, was an 11 mile line in Missouri which became part of MoPac in October, 1927.

Colombia (Ferrocarriles Nacionales)

2 1/2 × 1/4	rnd R	stl (07)	33,35-37
2 1/2 × ?	rnd R	stl (07)	39,46

Glenn Wiswell took a vacation to Colombia in early 1980 and pulled nails from ties on the narrow gage line which runs from Bogota to Santa Marta. He walked over five miles of track in three spots and pulled only seven nails from the 1930's. He bought 49 46's from a track worker at his home. [Wiswell 80s]

These nails were evidently bought by the Colombian railroad and are not from second hand U.S. ties.

Colorado & Southern

1 3/4 × 1/4+	rnd R	stl (18B)	16,17
1 3/4 × 1/4+	rnd R	stl (18A)	18
2 1/2 × 1/4	rnd R	stl (18B)	28,29
2 1/2 × 1/4	rnd R	stl (07)	29
2 × 1/4	rnd R	stl (18B)	30

In 1908 the Chicago, Burlington & Quincy gained control of the C&S.

In 1902 the C&S was switching from untreated mountain pine ties to treated (either ZnCl₂ or zinc-tannin) mountain pine ties. [RG 3-21-02, 203]

The 16-18 are rare. Their shanks measure about .260". See [J-F '91, 2-3]. The (07) 29 might not belong to the set.

Colorado Arizona Mine

From second hand Southern Pacific ties

2 1/2 × 1/4	rnd I	stl (18B)	08
2 1/2 × 1/4	rnd I	stl (07)	09,09:b,10,14,18,21,22
2 1/2 × 1/4	rnd I	stl (18A)	24

This private railroad was owned by Gleason Co. Either the SP was responsible for track maintenance, or the nails are from second hand SP ties.

Colorado Midland

According to the history at http://www.netreach.net/rphillips/pg3_1e.html, the CM installed zinc chloride treated oak ties, with tie plates, in 1917. Prior to this they had used only unplated, untreated ties.

Columbus & Greenville

2 1/2 × 1/4	rnd R	stl (09)	51
2 1/2 × 1/4	rnd R	stl (06)	52
2 1/2 × 1/4	rnd R	stl (25)	53-56,56:b,57-60

The C&G, which operated 167.6 miles of track in Mississippi, became part of ICG in September 1972, only to recover its identity in October, 1975.

This list is taken mainly from DNC. All nails were also used by the Illinois Central, except the 54 and 56:b. There does seem to be some connection between the C&G set and the IC set. It is not true that all C&G nails are from second hand IC ties (though some may be) because of the 54 and 56:b. It may be that the IC did C&G's trackwork, so that the C&G set is a regional variation on IC, just as the Ann Arbor set is slightly different from Wabash. Or maybe the C&G people adopted whatever tie policies the IC had and bought nearly the same nails.

Copper Range

2 1/2 × 1/4	rnd R	stl (07)	23-27,31
2 1/2 × 1/4	rnd R	stl (05)	46,47
2 1/2 × 1/4	rnd R	stl (06)	50,51
2 1/2 × 1/4	rnd I	stl (06)	51

This 60 mile Michigan railroad was abandoned March 2, 1973.
This list is almost identical to DNC's list.

Copper River & Northwestern

2 1/2 × 1/4	sqr R	stl (07)	16-20,23,26-28
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This Alaska railroad was abandoned in 1939. The list of nails comes from two independent sources: Bruce Gough and Jim Wright. Probably other nails belong to the set. [Winter 2001, 11-12]

Cotton Belt Route (St. Louis Southwestern)

1 1/4 × 3/16	rnd I	cop (07)	03,05-08,10
1 3/4 × 5/16	rnd I	stl (01)	5,6,7,8,10,12-14,15:b
1 3/4 × 5/16	rnd I GM	stl (07)	09,11
2 1/2 × 1/4	rnd I	stl (07)	12,13,16-21,25,25:b
2 1/2 × 1/4	rnd I	stl (01)	14,15
2 1/2 × 1/4	rnd I	stl (14)	15
2 1/2 × 1/4	rnd I	stl (05)	17,22-24
2 1/2 × 1/4	rnd R	stl ()	21,22,24,25
2 1/2 × 1/4	rnd R	stl (07)	24,25,27,34
2 1/2 × 1/4	rnd R	stl (05)	26,26:b,27-31,31:b,33-39,42
2 1/2 × 1/4	rnd R	stl (10)	28-30
2 1/2 × 1/4	rnd R	stl (01)	27:b
2 1/2 × 1/4	rnd R	stl (06)	31,32,34,35,37,39-42,51:b,52,57
2 1/2 × 1/4	rnd R	stl (17)	32,33,35,36,38,45,49
2 1/2 × 1/4	rnd R	stl (09)	35,36,39,43,44,44:b,45,46,46:b,47,47:b,47:c,48,50,50:b,50:c,50:d,53:b,54-56
2 1/2 × 1/4	rnd R	stl (04)	32,33,35-38,40
2 1/2 × 1/4	rnd R	stl (19)	39,40
2 1/2 × 1/4	rnd R	stl (03)	41
2 1/2 × 1/4	sqr R rs	stl (17)	49

Tie and timber treating

International Creosoting and Construction built a plant at Texarkana in 1902, originally treating ties with ZnCl₂. By 1910 the Allardyce process was also in use. The plant had two retorts and was still running in 1952. Loblolly pine, shortleaf pine, longleaf pine, and red oak ties were treated there. [AREA '04, 75] ['10, 139] ['13, 199] ['52, 396] This is probably the plant which treated Cotton Belt ties. The other plant in Texarkana, run by The National Lumber & Creosoting Co., treated ties for the Texas & Pacific.

The early copper nails were originally reported to me as type (01), but they are really type (07). There is a (01) 05, but its origin is unknown. The Cotton Belt began creosoting piles and timber in 1905, the same year they began testing the zinc-creosote process. It may be that copper nails were driven into ZnCl₂ treated ties, and steel nails were driven into zinc-creosoted ties, at least to 1910.

The Cotton Belt's big test section in 1910-1911 was at Texarkana, TX, and 53% of the ties tested were cut from trees less than 35 miles away. [31, table] Also, the railroad had a treating inspector in Texarkana at least 1922-1940, so one of the two tie treating plants in Texarkana had a contract to supply ties to the Cotton Belt. ['22, 505] ['24, 338] ['34, 502] ['40, 485]

...Cotton Belt Route

Test sections

- ?, 1905.

Some Card treated shortleaf pine ties were tested this year. They may have been treated by the NL&C plant. Card patented his process in 1906, so this was either an initial experiment of the process, or "Card" was a misprint for "Allardyce." [AREA '09, 619]['16, 323]['20, 124]

- Texarkana, TX, 1910-1911.

In July, 1910, between mileposts 419 and 420 south of Texarkana, 2,154 creosoted ties were put in track. The species were loblolly pine, shortleaf pine, longleaf pine, red oak, and white oak. The pine received 12 lb/ft³ while the red and white oak received between 7 and 8 lb/ft³. With the exception of white oak, these are exactly the species treated at the ICC plant.

In December, 1911 400 ties were laid, including 200 creosoted red oak (7.8 lb/ft³), 100 zinc-creosoted (Allardyce) shortleaf pine, and 100 zinc-creosoted (Allardyce) loblolly pine.

The Allardyce-treated ties were certainly treated at the IC&C plant. ['31, table]['34, 224] ['16, 307, 311, 320, 321, 323]['17, 176, 186, 190, 194, 198, 202, 204]['20, 112, 117, 120-122, 124]

The nails

The copper 05-07 may not be from the Cotton Belt. The 05 was attributed to the CB long ago, and the 06 and 07, both very rare, are probably from the same railroad. The stubbies are also a problem. If they were used by the Cotton Belt, they have only been found in Texas. None have been found in Missouri or Arkansas.

Nails were placed outside the rail. Most were driven on the south or east side of the track. The 23-26 were on the opposite side, and appear to be tupelo gum (bleached out with open grain). The 18-21 and 27-40 seem to be heart pine (from Bill Bunch).

The following nails were once in the Cotton Belt list. Do any deserve to be put back? Maybe other nails in the list above were not used by the Cotton Belt, also.

2 1/2 × 1/4	rnd R	stl (10)	26
2 1/2 × 1/4	rnd R	stl (07)	30
2 1/2 × 1/4	rnd R	stl (09)	32,34,38,40
2 1/2 × 1/4	rnd R	stl (18C)	41
2 1/2 × 1/4	rnd R	stl (19)	42
2 1/2 × 1/4	rnd R	stl (17)	58

The (09) 32 and 34 were acquired by John Speicher from Fred Gump, who reportedly pulled the nails.

The (04) 32 may not be Cotton Belt. It has been found on the Missouri Pacific. The (09) 36 is dubious, also.

The () 24 is rare.

The (04) 35 and (09) 36 were reported by Kenneth White in [M-J '89, 10]. Larry Fister thinks that the 36 was only used by the Peoria & Pekin Union.

Bill Bunch pulled fewer than 20 2" rnd R (01) 27's near East Prairie, MO in a track mixed with 2 1/2" (01) 27's. They are either the result of a factory mix-up or were cut too short.

Walt Scheuerell wrote an article titled "Help" in [M-J '85, 4]. He compiled the information on the Cotton Belt set in [DNC] and [Lewis] and was naturally not pleased with their differences.

CSX Transportation

2	× 3/16	rnd I	alm ()	94
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Many of these were found in new ties by John Iacovino in Williamsburg, VA. It is possible that they are treatment company nails. They were found in the center of the tie.

Dansville & Mount Morris

Short line code set

2 × 1/4 rnd I stl (07) 34

Code nails

1 1/2 × 1/4 rnd I stl (07) 4,8 (Set #28)

1 1/2 × 1/4 rnd I stl (07) 8 (Set #29)

From second hand ties

2 1/2 × 1/4 rnd I stl (07) 12,14,27,30:b,32,34,35,37,46

2 1/2 × 1/4 rnd R mi (11) 15-17,21,23,27-29,31,32

2 1/2 × 1/4 sqr I stl (05) 21,35

2 × 1/4 rnd I stl (07) 24

2 1/2 × 1/4 rnd I stl (01) 30

2 1/2 × 1/4 rnd R stl (07) 30-33,42

2 1/2 × 1/4 sqr I stl (07) 30

2 1/2 × 1/4 rnd I stl (05) 36

2 1/2 × 1/4 rnd R stl (17) 49

This western NY short line connected with the DL&W.

See the treatment company nail section in the back of the book for a description of the short line code set.

Sources for second hand nails

Delaware, Lackawanna & Western

2 1/2 × 1/4 rnd R mi (11) 15-17,21,23,27-29,31,32

2 1/2 × 1/4 rnd R stl (07) 42

Erie

2 1/2 × 1/4 rnd I stl (07) 27,30:b,32,34,35,37,46

2 1/2 × 1/4 rnd I stl (05) 36

New York Central

2 1/2 × 1/4 sqr I stl (05) 21

2 1/2 × 1/4 sqr I stl (07) 30

Dayton-Goose Creek

2 1/2 × 1/4 sqr R rs stl (07) 24

2 1/2 × 1/4 sqr R stl (07) 24:b

The D-GC was a 25.4 mile Texas short line purchased by the SP (Texas & New Orleans) in May, 1926. Many collectors have these 24's in their SP sets.

See Charles Sebesta's article in [J-A '91, 6].

Delaware & Hudson

2 1/2 × 1/4 rnd I stl (01) 07,30

2 1/2 × 1/4 rnd R stl (07) 26,29,32-37,37:b,38-43,44:b,45-59

2 1/2 × 1/4 rnd I stl (07) 26-29,31:b,32,33

2 1/2 × 1/4 rnd I stl (05) 36

From poles

2 1/2 × 1/4 rnd R stl (07) 48

Questionable nails

2 1/2 × 1/4 rnd I stl (07) 39,41,44,45-48,49:b,50,51,53

...Delaware & Hudson

From second hand ties

2 1/2 × 1/4	rnd I	stl (07) 18:b
2 1/2 × 1/4	rnd R	stl (07) 19
2 × 1/4	rnd R	stl (07) 25
2 1/2 × 1/4	rnd R	stl (08) 44:b
2 1/2 × 1/4	rnd I	stl (06) 52

Test sections

- Just north of Waterford Jct., NY, 1892.

One mile of each were placed in track: vulcanized hemlock, untreated yellow pine, zinc-tannin treated hemlock, and vulcanized yellow pine. [RG 2-12-92, 116]

- Esperance, NY, 1907.

According to [Shaw, 81] there was a test section here. Some rnd I (01) 07's may come from here.

The treating plant

In 1921 the Federal Creosoting Co. built a one retort plant at Livingston Manor, NY. The only railroad to serve the town was the New York, Ontario & Western. The plant disappears from the lists at the same time as the plant at Sidney, NY appears. The Sidney works, run by the same company, were built in 1939 and treated ties for the D&H. It is probable that the Livingston Manor plant also treated D&H ties, since it opened the same year the D&H began nail use (1921). Perhaps the facility was moved from one town to the other [Shaw, 81] [22, 483]

For a vast table of tie renewal statistics, see [AREA '54, 549], reprinted in my article in [Fall 2000, 9-11]. Using the table I show that the D&H did indeed begin using treated ties in 1921, but that they began using date nails in 1926.

The nails

The 07's were found "on an abandoned logging railroad in upstate N.Y." [Wiswell 77]

Some dates in the 20's are found outside the rail. The rest are found between the rails, closer to one rail. It may be that the rnd R (07) 26, 29, 32, and 33 do not belong to the set. The (05) 36's might come from ex-Erie ties.

John Iacovino and Russ Hallock have found numerous rnd I (07) nails from 39 up. It is not clear which of these (if any) were used by the D&H (they are definitely scarcer than the rnd R nails from the same period), which are from second hand Erie or Lehigh & Hudson River ties, and which might be from nail factory mix-ups.

In one tie on each of two small trestles in Portlandville, NY about fifty rnd R 52's were used to write "56" in the tie. Also, at the south end of the Mohawk River in Schenectady, NY rnd R 55's were used also to write "56" in one bridge tie. Each of the Portlandville bridges were made partially from second hand bridge timbers turned on their sides. One had rnd I 27's, the other rnd R 51's.

Russ Hallock found the rnd R (08) 44's. This nail is otherwise known only from the Grafton & Upton (and Illinois Central?).

Many more dates can be found in poles, but I do not know which nails.

[Shaw, 79-81] shows rnd R (07) 22-24, 25:b, 26, 27, 28:b, 29:b, and 30-54. He also shows rnd I (07) 27-35, and claims that the D&H also used nails in 1921 (page 35). His information is unreliable.

See [S-O '89, 2] and [J-F '88, 5] for nail articles.

Delaware & Northern

Probably from second hand ties

2 1/2 × 1/4	rnd R	stl (07) 26,29:b
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The D&N, known as the "Damned Nuisance," was abandoned in 1942. The track was deplorable, and derailments common.

Russ Hallock pulled these nails from fenceposts near the bed. The lip on the 6 of the 26 does not extend beyond the bottom loop. Otherwise it is like 26:b.

Delaware, Lackawanna & Western

2 1/2 × 1/4	rnd R	mi (11)	10,11,11:b,12-21,21:b,22-29,29:b,30,30:b,31-33
2 1/2 × 1/4	rnd I	mi (11)	13
2 × 3/16	rnd I	mi (11)	14
2 1/2 × 1/4	irr R rs	stl (07)	18
2 × 1/4	rnd R	stl (07)	34:b
2 1/2 × 1/4	sqr R	stl (07)	41
2 1/2 × 1/4	rnd R	stl (07)	42-44,44:b,45-52,58

The DL&W and Erie merged to form Erie Lackawanna on October 17, 1960.

Tie treating to 1909.

The DL&W owned an open tank creosoting plant at Nanticoke, PA. It was built in 1907 for their coal mining dept., and treated cross arms, mine props, fence posts, and paving blocks. It was dismantled sometime between 1918 and 1922. If any ties were treated here, they were for test purposes only. ['13, 461]

From 1905 to 1909 the majority of bridge-tie renewals were made with creosoted longleaf yellow pine. The ties, which were used on main lines, were steam-seasoned, "the fiber being injured by the steaming process before treatment. . ." Also, the flanges on the bottom of the tie plates contributed to the destruction of the ties. ['16, 321]['28, 115][RAG 4-16-15, 839]

Tests were also made in 1906-1908 of steam-seasoned creosoted crossties, some of which may have been treated at the Nanticoke plant.

Tie treatment beginning 1909.

George J. Ray was promoted to the position of chief engineer for the DL&W on January 1, 1909. During his 25-year tenure he was personally responsible for all aspects of the Lackawanna's ties, from method of treating, to tie plates and spikes, to tie renewal policies.

In 1909 the railroad entered into a contract with the Federal Creosoting Co., which built a plant for treating DL&W ties at Paterson, NJ. The one retort plant began operating in the Spring of 1910, creosoting ties by the Lowry process. ['13, 89, 448]

"The Lackawanna first commenced to creosote crossties on an extensive scale in 1910. During 1910 and since that time all main and sidetrack renewals have been made with creosoted ties, with the exception of the chestnut ties which were available. These chestnut ties were used in side-tracks and on branch lines, where service is light." [RAG 4-16-15, 839]

The progress the Lackawanna made in tie treatment after the Paterson plant was built can be seen in the following table.

	Ties inserted for renewals		
	Untreated	Treated	% treated
1908	676,943	0	0.0
1909	581,952	0	0.0
1910	258,927	163,433	38.7
1911	173,815	409,680	70.2
1912	180,428	425,498	88.1
1913	209,434	534,042	71.8
1914	194,512	476,370	71.0
1915	304,405	438,832	59.0
1916	165,281	352,614	68.1
1917	108,629	308,097	73.9
1918	83,867	240,199	74.1

['20, 137][RAG '20, 491]

These numbers do not include treated ties installed in new construction. For example, in 1910-1911 the DL&W laid over 800,000 creosoted ties: 573,113 for renewals, 216,020 in constructing the portion from Port Morris Jct. to Slateford (see test sections), and the balance in other construction. ['28, 118]

According to [RAG '25, 367], in 1922 81% of ties inserted for renewals on the DL&W were creosoted. By 1923 it was 87%.

Beginning 1910 date nails were driven into treated ties. I found a 15 once in the bottom of the tie, which suggests that the nails were driven at the treating plant.

In 1910 hand machines were used for boring ties for spikes at the track, after which creosote was applied to the holes. In 1911 a Greenlee Bros. boring and adzing machine was installed in the treatment plant, and in 1913 two larger machines replaced the 1911 model. [RAG 4-16-15, 840-841]

It is the 1913 machines which are referred to in ['14, 406], reprinted in [DNC, 16]: "Within the past two years air hammers have been installed on the adzing machines in the treating plants of the Delaware, Lackawanna & Western and the Philadelphia & Reading. . . At the Lackawanna plant the ties are marked to indicate the weight of rail for which the ties are bored and adzed and whether they are hard or soft wood. . ."

Screw spikes

In February, 1909 the DL&W tested the use of lag screws and clips, together with flat-bottom tie plates. Beginning early 1910, when the new treating plant opened, they began the general use of screw spikes and flat tie plates "in all ties placed in main tracks and in heavy-running yard tracks and leads". By 1915 over two and a half million ties were secured with screw spikes. [RAG 4-16-15, 839-840]

Screw spikes were used just like common cut spikes: they served both to hold the rails to gauge and to hold down the rail. This practice continued through at least 1920. By 1928 things had changed. Now the screw spikes were used to secure the tie plate to the tie, and cut spikes were used to hold down the rail. So the duty of the screw spikes was reduced to holding gauge. ['28, 124]

The Canadian Pacific initiated tests in 1992 using screw spikes in exactly this way. "The concept was to put a wear barrier plate on the top of the tie, to install a tie plate, and then to use screw spikes to fasten the plate to the tie to prevent movement at the interface between tie and plate.' Rail is then laid in the seat of the tie plate, using conventional spikes, which allows the rail to "breathe" under train movements." [RA Feb '93, 20]

Screw spikes are still common in older DL&W track today. The spikes read "DLW" on the head, making them an interesting item to go with their date nails.

European influence

The DL&W is the only U.S. railroad to have used screw spikes on a large scale. In Europe they were common by 1900, and G. J. Ray's inspiration came from there. European influence did not stop with spikes. Hermann von Schrenk spoke at the 1928 AWP meeting:

"There is one outstanding thing in connection with treated ties. . .which is not yet being generally followed. . .which I consider one of the coming problems in America, and that is to obtain the maximum life, maximum service out of our treated crossties, and that is the practice which was first started by the Lackawanna and which is now being followed by many others in considering the possibility of using crossties up to a certain maintenance point on the main line tracks, and then relaying those ties in other tracks where the traffic demands are not as high.

"That practice has, of course, been used abroad for a great many years by the operation of so-called 100 per cent renewal. In other words, in England and France particularly where ties are laid in track for periods of ten- or fifteen-year cycles, they are all taken out, reclassified, and placed either in main or side-tracks, as the case may warrant, and that has, doubtless, added a good deal of useful service, and a good deal to the total service of individual crossties." ['28, 131]

Ray even travelled to Europe in 1925 to study track practices there: "This past summer I had the opportunity of examining ties on various roads in England and other parts of Europe where dating nails are quite generally used. I had but little trouble in determining the date on nails placed in ties from twenty to thirty years ago. Galvanized dating nails with raised letters placed in ties in 1892 and 1893 in Belgium seemed to be in good condition and no doubt can be plainly read for many years to come." [AREA '04, 710][DNC, 19, 330]

One can even speculate that his choice of malleable iron (11) date nails was made after seeing cast nails in Europe. Even today cast indent date nails from 1900-1910 are common in France and Luxembourg.

Ray became vice-president and general manager of the railroad in 1934. His successor as chief engineer evidently did not favor date nails, because none have been found for dates 35-40. DL&W nails pick up again in 1941.

Test sections

- Buffalo division, 1905.
12,000 creosoted yellow pine bridge ties. They were killed by steaming prior to treatment. [AREA '09, 619]['16, 324]['20, 126]
- Buffalo division, 1906.
535 creosotes longleaf yellow pine bridge ties, killed by steaming. These were on Deck-plate girder bridge no. 241.56 on the eastbound track. ['16, 321][RAG 4-16-15, 839]
- Hoboken terminal, 1906.
Steam-seasoned (thus damaged) creosoted yellow pine switch and cross ties were laid out of face. [RAG 4-16-15, 839]['28, 115]
- ?, 1907.
8,000 creosoted pine ties, which failed because of "crushing under tie plate". [AREA '09, 619]['16, 324]['20, 126]
- Boonton, NJ, 1907-1908.
In 1907 183 steamed full-cell creosoted chestnut ties were laid. These ties were 7" x 9", and were placed in two groups, one of 88 and the other of 95 ties. The 95 were all removed by 1922. ['16, 289]['17, 110]['20, 97]['22, table][DNC, 252]
In 1908 255 steamed full-cell creosoted non-pressure beech, birch and maple ties were laid. These 7" x 9" ties may have been treated at the Nanticoke facility. ['16, 288]['17, 100]['20, 94]
- Bergen Hill, NJ, 1909.
In February, 1909 the double track through Bergen Hill was laid with short, creosoted yellow pine ties. Flat tie plates were used, and the ties were fastened with lag screws and clips. This was the DL&W's first experiment with screw spikes. [RAG 4-16-15, 840]
- Cut-off, 1910-1911.
From Port Morris Jct., NJ to Slateford, PA 216,020 creosoted pine and other species were laid from the fall of 1910 to December 1911. Nearly 29 miles of double track, with sidings, was constructed. ['17, 100]['20, 135]['28, 118]
- Paterson, NJ, 1912-1915.
In 1912 733 Lowry creosoted chestnut, 16 untreated chestnut, and 6 Lowry creosoted oak ties were laid. ['16, 289]['17, 110, 164]['20, 97]
In 1913 812 Lowry creosoted beech, birch and maple ties were laid. ['16, 288]['17, 100]
In 1915 99 Lowry creosoted southern yellow pine ties were laid. ['16, 315]['17, 206]
- Alford, PA, 1914.
845 creosoted red oak ties. It may be that the cast indent 14's are from this test section. They were found between Hop Bottom and Nicholson, a stretch of track about eight miles south of Alford. The railroad might have ordered indented 14's to distinguish test ties from other ties. The argument against this is that the indent 14's were not found in Alford, but the old ties in the stretch of track from Alford to Hop Bottom all have 1915 date nails, and from Hop Bottom south they have 14's. ['16, 305]['17, 164]['20, 113]
- Dover, NJ, 1915.
37 Lowry creosoted southern yellow pine ties. ['16, 315]['17, 206]

The nails

No date on the DL&W is particularly difficult to locate. Some of the variations, however, are rare. These include the 11:b (small head), the cast indent 13 and 14, the irregular 18, and the variations on the 29 and 30. The 44 is much more common than 44:b.

...Delaware, Lackawanna & Western

Nails are found in the middle of the tie, except 34's, which are generally found outside the rail. The heads of type (11) nails break off easily, so it is not uncommon to walk a DL&W track and see many headless nails.

Glenn Wiswell and Dave Parmalee found scattered cast indent 13's on the DL&W. No one else seems to be able to find one. Perhaps some were used in the 1913 Paterson test section. [Wiswell 78]

Dave Parmalee pulled over 50 cast indent 14's between Nicholson and Hop Bottom, PA. They have not turned up elsewhere, and may be the result of a keg mix-up, but there is also the possibility that they are from the Alford test section. [N-D '81, 1-2]

The irr (07) 18's have been found on both the DL&W and the Erie, and they are rare on both railroads. It seems that they fit the Erie set better, but it may be that they are from second hand ties originally used by some unknown railroad. Russ Hallock found three of these 18's in the DL&W's Jersey City freight yard.

Glenn Wiswell found some sqr R (07) 38's on a power company spur in Morristown, NJ. They are not DL&W nails.

Occasionally a nail from an ex-Erie tie turns up on th Lackawanna. In this case the tie was re-used after the formation of Erie-Lackawanna.

For the "anatomy of a (11) nail", see [S-O, '94, 3].

See [M-J '89, 3-5, 8] and [J-A '89, 13] for nail hunts.

Denver & Rio Grande Western

1 1/2 × 1/4 rnd R stl (18B) 30

From second hand ties

1 1/2 × 1/4 rnd R stl (03) 29

Until August, 1921 this railroad was the Denver & Rio Grande.

The D&RG treating plant at Alamosa, CO was built by Rowe & Rowe. Plans of the plant appear in [Rowe, 10, 28] and are dated August 28, 1903 and September 21, 1903. Presumably it went into operation in 1904, treating ties with zinc chloride by either the Burnett or Wellhouse process. It was a three retort plant, and appears without date or treatment information in the lists of treatment plants in [AREA '08, 737], ['10, 138] and ['11, 212]. It is not listed in any subsequent AWWPA *Proceedings*. Was it abandoned, or did it somehow escape the attention of the AWWPA?

The Rio Grande established a series of test sections in 1927. On each of five divisions (Pueblo, Salida, Grand Junction, Alamosa, and Salt Lake) 400 ties were laid: 100 each of Engelmann spruce, mountain Douglas fir, lodgepole pine, and western yellow pine. The treatment was a 45-55 petroleum-cresote mixture by the Rueping process. The source for the test, [AREA '30, table], says that the mountain Douglas fir ties were treated by the Lowry process, but they may have intended to write Rueping.

This is just the kind of test a railroad establishes when it begins to use treated ties, or when it changes its treating methods. Most likely ties on the D&RG were not creosoted before 1927. One table says that in 1928 the Rio Grande installed 150,205 untreated and 891,629 treated ties, so they were definitely using treated ties regularly by then. [AREA '30, 1106]

The only other mention of the Rio Grande in the literature is a reference to their Superintendent of Treatment in Salida, CO in 1940. Salida was the home of an open tank plant run by Koppers. It was built in 1925 and probably treated timbers other than ties. ['40, 457, 485]

Chris John (cajrrman@earthlink.net) wrote to me May 23, 2000: "My brother pulled two 30s from the Rio Grande near Salida, Colorado. These nails are not shown in either DNC or your book. They are 1 1/2 x 1/4 steel Round Raised type (18B) 30. I have one and he probably doesn't have the other one any more. The numbers match the 30 on page 48 of Volume 3 but the nail is only 1 1/2 (actually 1 5/8) inches long. This size is not shown in the book." If these are indeed Rio Grande nails, they are certainly from a test section. [Fall 2000, 13]

Lowell Hard pulled the (03) 29's in Blanca, CO.second hand.

Presumably some ex-Denver & Salt Lake nails have been found on the Rio Grande.

Denver & Salt Lake

2 1/2 × 1/4	rnd I	stl (07)	31
2 1/2 × 1/4	rnd R	stl (07)	31-33
2 1/2 × 1/4	rnd R	stl (06)	34,35

The D&SL was owned by the Rio Grande, and was merged into it in April, 1947.

Des Moines & Central Iowa

1 1/2 × 1/4	rnd I	stl (17)	29
2 1/2 × 1/4	rnd I	stl (07)	31
<i>Code nails</i>			
1 1/2 × 1/4	rnd I	stl (17)	AY #9
<i>From second hand ties</i>			
2 1/2 × 1/4	rnd I	stl (07)	09,10;b,11
2 1/2 × 1/4	rnd R	stl (07)	24,30
2 1/2 × 1/4	rnd R	stl (06)	31
1 1/2 × 1/4	rnd R	stl (06)	49

The DM&CI was an electric railroad, reclassified as steam in January, 1956.

Nails are scarce, especially the 31. The 29 and AY are found together. See Larry Harvey's articles in [M-J '86, 3-5] and [J-A '91, 3-5]. The second article is a history of the line.

The second hand nails, except the 49, are from the Rock Island.

Detroit & Mackinac

1 1/2 × 1/4	rnd R	stl (21)	35
1 1/2 × 1/4	rnd R	stl (07)	42
2 1/2 × 1/4	sqr I	stl (05)	48
1 1/2 × 1/4	rnd R	stl (06)	49,50
1 1/2 × 1/5	rnd R	stl (06)	51-57
2 1/2 × 1/4	rnd R	stl (09)	57,69
1 1/2 × 1/5	rnd R	stl (05)	58-62,65
1 1/2 × 1/4	rnd R	stl (09)	66,67
1 1/2 × 1/5	rnd I	stl (06)	66

The D&M built a treatment plant at East Tawas, MI in 1926. At least by 1929 they were treating ties with an 80-20 creosote-coal tar solution. The plant was still operating in 1940, but is not included in the 1944 AWPAs list of treatment plants. ['30, 420]['40, 449]

In 1929 the D&M experimented with natural brine (NaCl) as a preservative. 200 of their hemlock ties treated with NaCl were included in the Forest Service test track on the Milwaukee Road in Madison, WI. The brine came from a 600 foot deep well at East Tawas. ['35, 139]

The D&M is the only railroad known to test common salt as a wood preservative. They may have installed test sections of brine-treated ties in their own tracks as well.

John Hoffmann claims that the (09) 57 and the (06) 66 do not belong. He is probably right.

Detroit & Toledo Shore Line

1 1/2 × 1/4	rnd I	stl (05)	25,26,28,32-34,37-39
1 1/2 × 1/4	rnd I	stl (07)	27,29-31,36;b,39-42
1 1/2 × 1/4	rnd R	stl (23)	35
1 1/2 × 1/4	rnd I	stl (23)	35

At least 1940-1945 the D&TSL had a "Track Master & Supvr. of Treatment" in Monroe, MI. There was no treating plant in or near Monroe, which was just north of Toledo. ['40, 473]['45, 286]

Detroit Terminal

From second hand ties

2 1/2 × 1/4	sqr I	stl (07)	22,23,32
2 1/2 × 1/4	sqr I	stl (05)	24
2 1/2 × 1/4	rnd I	stl (07)	24,25:c
2 1/2 × 1/4	rnd R gm	stl (07)	25,26
2 1/2 × 1/4	rnd R	stl (05)	26:b,27,28
2 1/2 × 1/4	rnd R	stl (01)	27:b
2 × 1/4	rnd R	stl (01)	29,30
1 1/2 × 1/4	rnd I	stl (07)	31,36,40-42
1 3/4 × 3/16	rnd R gm	stl (07)	32
1 3/4 × 3/16	rnd R gm	stl (06)	33,34
1 1/4 × 3/16	rnd R gm	cop (60)	35
2 1/2 × 1/4	rnd R	stl (10)	37
2 1/2 × 1/4	rnd R	stl (24)	37
2 1/2 × 1/4	rnd R	stl (09)	38

Sources for second hand nails

Chicago & North Western

2 1/2 × 1/4	rnd R gm	stl (07)	25,26
and possibly			
2 1/2 × 1/4	rnd I	stl (07)	24

Cotton Belt

2 1/2 × 1/4	rnd R	stl (05)	28
2 1/2 × 1/4	rnd R	stl (09)	38

Michigan Central or Cotton Belt

2 1/2 × 1/4	rnd R	stl (05)	26:b,27
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Milwaukee Road

1 3/4 × 3/16	rnd R gm	stl (07)	32
1 3/4 × 3/16	rnd R gm	stl (06)	33,34
1 1/4 × 3/16	rnd R gm	cop (60)	35

New York Central

2 1/2 × 1/4	sqr I	stl (07)	22,23
2 1/2 × 1/4	sqr I	stl (05)	24

Detroit, Toledo & Ironton

1 1/4 × 3/16	rnd I gm	cop (60)	22-25,25:b,26,26:b,27,27:b,28,29
1 1/4 × 3/16	rnd I	cop (07)	30,30:b,31

From second hand ties

2 1/2 × 1/4	rnd I	stl (07)	27,30-32,34,35,37-48,49:b,49:c,51,54
2 1/2 × 1/4	rnd I	stl (10)	33,36
2 1/2 × 1/4	rnd R	stl (07)	35,38-40,42,44,50,53,54
2 1/2 × 1/4	rnd R	stl (18C)	43
2 1/2 × 1/4	rnd I	stl (06)	52

Henry Ford purchased controlling interest in the DT&I July 9, 1920, and sold the railroad June 27, 1929. The railroad was in terrible condition in 1920 and from then until 1923 Ford engaged in extensive upgrading of the right-of-way. The part north of Springfield was overhauled first.

..Detroit, Toledo & Ironton

Believing that steel companies maintained artificially high prices, Ford refused to buy quality rail from US manufacturers, and at one point was purchasing rail from Belgium! This attitude may account for the use of (60) copper nails on the DT&I. The switch to copper (07) (American *Steel & Wire Co.*) was made exactly when Ford sold the railroad. It would have been interesting for nail collectors if he had also bought his date nails from Europe.

From 1951 until 1977 the DT&I was controlled by the Pennsylvania / Penn Central.

The second hand nails are primarily from the Erie. Mel Smith says that maybe some nails (not listed above) are from the Wabash. [M-A '85, 1-2]

See [M-A '89, 8] for a nail hunt.

Sources for second hand nails

Erie

2 1/2 × 1/4	rnd I	stl (07)	27,30-32,34,35,37-48,49:b,49:c,50,51,54
2 1/2 × 1/4	rnd I	stl (10)	33
2 1/2 × 1/4	rnd I	stl (06)	52

and possibly

2 1/2 × 1/4	rnd R	stl (07)	50,53,54
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Duluth, Missabe & Iron Range

2 1/2 × 1/4	rnd R	stl (07)	24,27-31,33,62:b
2 × 1/4	rnd R	stl (07)	27
2 1/2 × 1/4	sqr R	stl (07)	28
2 1/2 × 1/4	rnd R	stl (06)	32,34-40,42,46-48,48:b,49-58,61
2 1/2 × 1/4	rnd R	stl (47)	41,44,44:b,44:c,45,45:b
2 1/2 × 1/4	rnd R	stl (09)	59,60

Code nails

2 1/2 × 1/4	rnd R	stl (07)	P #1
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The Duluth & Iron Range became part of the Duluth, Missabe & Northern in January, 1930. In July, 1937 the railroad changed its name to Duluth, Missabe & Iron Range.

Test sections

- Main line, 1890.

In the Fall the D&IR laid 85 white pine, 85 tamarack, and 86 Norway pine ties, all treated by the Wellhouse process by the Chicago Tie Preserving Co. [RA 2-3-05, 151][RAG 1-20-11, 128] [AREA '09, 618]['11, 127]['15, T]

- ?, 1902.

7,500 untreated tamarack ties were laid. ['16, 327]['20, 128]

From Summer 1908 to Spring 1909 the DM&N installed about 22,400 Carnegie steel ties. [RAG 3-20-12, 590]

Mark Gilles has been walking DM&IR track, and he reports that the round 28 was used by the DM&N, while the square 28 was used by the D&IR. More work need to be done to untangle the pre-1930 nails. [e-NN 11-22-02]

Duluth, Winnipeg & Pacific

1 1/2 × 1/4	rnd R os cp	stl (38)	36,41,42,44
1 1/2 × 1/4	rnd R	stl (25)	37
1 1/2 × 1/4	rnd R cp	stl (25)	38
1 1/2 × 1/4	rnd R cp	stl (10)	39-41
1 1/2 × 1/4	rnd R cp	stl (06)	45,46
1 1/2 × 1/4	rnd R	stl (06)	47
1 1/2 × 1/5	rnd R ts	stl (37)	58-60
1 1/2 × 1/4	rnd R ts	stl (37)	61-63,65-68
1 1/2 × 1/4	rnd R	stl (09)	64

...Duluth, Winnipeg & Pacific

The DW&P was owned by the CN until 1975. Many of these nails were used also by CN, GT, and CV. Are any second hand?

Durham & Southern

2 × 1/4 rnd R stl (19) 39:b,40-42

The D&S operated 56.8 miles in North Carolina and is now part of CSX.
This list is taken from DNC.

East Jordan & Southern

From second hand ties?

2 1/2 × 1/4 rnd I stl (07) 09-18

The EJ&S was abandoned August 12, 1961. It operated 18.6 miles in Michigan.

It may be that the usable, dated crossties from the Manistee & Grand Rapids, abandoned sometime 1919-1921, found their way to the EJ&S. Note the similarities in the sets.

East St. Louis & Suburban

Many from second hand ties?

2 1/2 × 1/4 rnd R	stl (07) 23,25,27,28,30,31,33
2 1/2 × 1/4 rnd R	stl (06) 32
2 1/2 × 1/4 rnd R	stl (05) 35-37
2 1/2 × 1/4 rnd R	stl (17) 37,40

This electric railroad was abandoned in July 1932, to be rescued by the Illinois Terminal RR.

El Paso & Southwestern

2 1/2 × 1/4 rnd I	stl (01) 3,03-06,6,07
2 1/2 × 1/4 rnd I	stl (07) 03,08-10
2 1/2 × 1/4 dia I	stl (07) 06,06:b,07,08,09:c,10:b
2 1/2 × 1/4 rnd I	stl (18A) 8,08,09,10
2 1/2 × 1/4 rnd I	stl (18B) 08
2 1/2 × 1/4 dia I	stl (18) 09
2 1/2 × 1/4 sqr I	stl (18) 10,11

The El Paso & Rock Island was owned by the El Paso & Northeastern, which became part of the El Paso & Southwestern in August, 1908. The SP purchased the whole lot in November, 1924.

In 1902 a two retort treatment plant was built in Alomogordo, NM. It was run by the Alomogordo Lumber Co. Ownership of the plant is given as EP&SW beginning 1911, so the lumber company may have been a subsidiary of the railroad. In any case, the plant was built to supply treated ties for the EP&SW. [’11, 212]

Judging by the date nails the plant began operating in 1903. There pine ties were treated by the zinc-tannin method through the end of the decade. In 1906 the railroad began also using ties treated with creosote by the Rueping process. To distinguish the two treatments the railroad drove round date nails into its Wellhouse (zinc-tannin) treated ties and diamond (later square) nails into its creosoted ties. In 1911 the treatment listed for the plant was only creosote by the Rueping process. [’10, 138][’11, 212] [’13, 199][Goltra I, 47] By 1913 they were treating white pine, yellow pine, and douglas fir. [’13, 459]

In 1909 an engineer from the EP&SW wrote “I have recommended to our management that after January 1, 1910, we discontinue the use of dating nails.” [AREA ’10, 866][DNC, 27]

The (01) 6 is strange, and may be a 9. At least five have been found. See J. L. Leitschuh’s article in [M-J ’95, 1-2].

El Paso & Southwestern

Many nails in people's SP collections are really EP&SW nails. The most obvious of these are the diamond nails, which the SP never used. Leon and Myra Sorenson pulled rnd 05, 06, 11, and dia 08 from the EP&SW ([M-J '81, 1-2]), and Mel Smith pulled both (01) and (07) 03's, 05, 06, and 08-10 ([M-J '86, 28-29]).

Charles Sebesta and Bill Turner found an open keg of rnd I (18B) 08's near the EP&SW. These nails have also been found in ties.

See also [M-J '88, 1], [J-A '91, 4], [J-A '94, 1].

Elgin, Joliet & Eastern

2 1/2 × 1/4	rnd R	stl (07)	29,30
2 1/2 × 1/4	rnd R	stl (06)	31-50,60-70,72
<i>From poles</i>			
2 1/2 × 1/4	rnd R	stl (06)	51,61,70,72

At least 1934-1945 the EJ&E had a timber treating inspector in East St. Louis, IL, the location of a T. J. Moss treating plant. The plant was built in 1921 with two retorts, and was still operating in 1952. [’22, 483][’34, 505][’40, 488][’45, 307][’52, 398]

From the 1914 AWP report: "Put dating nails in all treated ties." Records had been kept since 1908. "Believe satisfactory tests obtained by keeping careful record of a few ties on one section." [DNC, 290]

In 1925: "We consider records given by the use of dating nails as well worth the cost of application." [AREA '26, 711][DNC, 331]

Jerry Penry has a rnd R (07) 15 in his EJ&E set.

Shank lengths on the 70 can vary wildly. Vince Smedley found lengths ranging from 1 1/4" to 2 1/2".

The 51 may have also been used in the track. The pole nails were used to hold various brackets, ground wires, etc., and were not used to date the poles.

Erie

2 1/2 × 1/4	rnd I	stl (07)	10,10:c,11-15,15:b,16,17,20-28,28:b,29,30,30:b,31-35,37-48,49:b,49:c,50-53,53:b,54
2 1/2 × 1/4	rnd I	stl (05)	12,36,36:b
2 1/2 × 1/4	rnd R	stl (05)	12
2 1/2 × 1/4	sqr I	stl (07)	13,25
2 1/2 × 1/4	irr R rs	stl (07)	18
2 1/2 × 1/4	rnd R	stl (01)	27:b
2 1/2 × 1/4	rnd I	stl (10)	33,34
2 1/2 × 1/4	rnd R	stl (07)	41-54,57,58
2 1/2 × 1/4	rnd I	stl (08)	44,45
2 1/2 × 1/4	rnd I	stl (06)	50-52,55
<i>From bridge timbers</i>			
2 1/2 × 1/4	rnd I	stl (07)	33
<i>From second hand ties</i>			
2 × 1/4	rnd R	stl (24)	36
2 × 1/4	rnd R	stl ()	38

The DL&W and the Erie merged to form Erie Lackawanna on October 17, 1960. See [Winter 1999, 3-10] for my complete article on Erie treating and record keeping.

Early tie and timber treating

In 1858, at its bridge shop in Owego, NY, the Erie began using the Nichols process on bridge timbers. This involved boring a hole longitudinally through the timber to allow sap to escape, preventing checking. No chemical was used. They continued this until the shop burned in 1869. [ASCE 7-85, 282-284]

...Erie

In 1861 the Erie built a treatment plant at the Owego shop. Primarily bridge timber and plank-ing were treated, but a small number of ties were also run through. The plant, which used zinc chloride, burned in 1869 and was not rebuilt. The timbers were not seasoned properly, and the treatment was rushed. Some oak switch ties treated at Owego lasted more than 17 years. [ASCE 7-85, 258-261][¹³, 195]

The New York, Pennsylvania & Ohio RR, a predecessor of the Erie, tested some ties treated with cop-per sulfate by the Thilmany process in 1879. It was a failure. [ASCE 7-85, 279][¹⁶, 328]

The Erie tested some ties treated by the Wellhouse process in 1882. [ASCE 7-85, 258] This test was initiated by Octave Chanute himself, who was chief engineer for the Erie from 1873 to 1883. Among other improvements, he changed the gauge from six feet to standard by laying a third rail.

Creosoting

Judging by the nails and the practices of nearby railroads, the Erie began using creosoting ties in large numbers in 1910. In the list of treatment works in the 1912 AWPRA report, the only plant which might have been built for the Erie is the American Creosoting Co.'s Newark, NJ plant. It is listed as having been built in 1910 with one retort. [¹², 284] But in later lists, from 1913 on, the plant is listed as having been built in 1906 with two retorts. In [¹⁸, 244] the two retorts are listed as having different lengths, both from 1906. It may be that the plant was built in 1906 with one retort, then a second retort was added in 1910 for the Erie. Note that this American Creosoting Co., with headquarters in New York City, is not connected with C. B. Lowry's company of the same name.

The Erie was buying ties from the Georgia Creosoting Co.'s Brunswick, GA plant at least 1923 and 1934. The plant was built in 1915 with two retorts, and was still operating in 1952. In 1915 the plant em-ployed the Rueping and Card processes as well as either Bethell or Burnett. The company was a subsidiary of the Federal Creosoting Co. [¹⁵, 472][²³, 526, 551][³⁴, 501][⁵², 396]

In 1934 the Erie had a treating inspector at Joyce-Watkins' Metropolis, IL plant. It was built in 1913 and expanded in 1921. By 1940 it was owned by Wyoming Tie & Timber. [³⁴, 472, 499][⁴⁰, 453]

Also in 1934 the railroad had a treating inspector at the Century Wood Preserving Co.'s Orrville, OH plant. This plant was built by the Ohio Wood Preserving Co. in 1912, and was expanded in 1921 and 1924. In 1928 the 1912 retort was replaced by two new models. Sometime between 1930 and 1934 Cen-tury acquired the plant, and it was owned by Koppers by 1940. [¹³, 452][²⁴, 314][³⁰, 422][³⁴, 471, 501][⁴⁰, 453]

From at least 1940 to 1945 the Erie had a treating inspector at the Baker Wood Preserving Co.'s Marion, OH plant. This outfit was built in 1922 and expanded in 1937. [⁴⁰, 448, 484][⁴⁵, 301]

Also from at least 1940 to 1945 they had a treating inspector in Clifton, NJ. There were four treating plants in the vicinity, the closest being the Paterson plant which supplied ties to the DL&W. It is pos-sible that this inspector was located in Clifton on the Erie at the receiving end of treated ties. [⁴⁰, 481][⁴⁵, 297]

According to a 1954 USS Creosote advertisement, the Erie had used pressure creosoted ties since 1914. They contrast this with untreated ties, implying that the Erie did not treat their ties prior to 1914. But the number of 1910 date nails which have been found indicates that in some manner they were treat-ing their ties earlier. The 1914 date may reflect the date the Erie signed up with the Georgia Crosoting Co.

Test sections

- Ohio, 1903.

8,605 untreated oak ties. [¹⁶, 305][²⁰, 110]

- Bergen County, NJ, 1910-1911.

In 1910 2,880 untreated longleaf pine ties were laid. The next year 2,880 creosoted shortleaf pine ties were installed. [²⁰, 123]

- Ravenna, OH, 1931.

"Four lots of 100 ties each were installed July 23rd, 1931 in the east bound main line, one lot of gum ties, treated Lowry marked "GBL", one lot of gum ties, treated Rueping marked "GMR" and two lots of oak ties, treated Rueping, one marked "OMR" and one marked "OOR". [⁴⁸, 196][⁵³, 192]

All ties received an 80-20 creosote-oil mixture.

Ties may have been numbered consecutively, 1-100 for each group, judging by the accompanying data in [’48, 197-198]. The marks may have been tags nailed to the ties. The first letter stands for the wood: “G” is Gum and “O” is oak. The second letter is the treating plant: “B” is Brunswick, “M” is Metropolis, and “O” is Orville. The third letter is the treatment: “L” is Lowry, and “R” is Rueping.

The nails

From the 1914 AWP report: “Keep record of all treated ties by dating nails only.” “Nails used since 1910.” [DNC, 290]

From 1925: “Believe it advisable to mark tie in such a manner that both the kind of wood, character of treatment and treating plant can be identified in case of failure.” [DNC, 331][AREA ’26, 711]

With rare exceptions, all nails are found between the rails.

On the Buffalo, NY to Jamestown, NY branch each date has a specific spot in the tie, like the BR&P. The scheme reconstructed here reflects observations of hundreds of nails dated 20, 25-32, 34-37, 39, 40, and 47. 18’s were placed 8" inside the west rail, and each successive date was inserted 2" east of the previous year’s nails. This continued through 1937. In 1938 the system was begun again, nails being placed in the same location as the 18’s. Probably around the late 1940’s the practice was stopped.

Nails measured on the Livonia, NY branch near Golah, and on the branch in Barberton, OH reveal no pattern. On the branch north out of Middletown, NY 28’s and 29’s are consistently found outside the rail. 58’s are found both outside the rail and between the rails near Sloatsburg, NY and Allendale, NJ.

Six 10:a’s were found north of Wayland, NY intermingled with the standard 10:c’s. These 10:a’s have deeper, cruder numbers than the nail pictured in DNC. They may have been used only in this spot on the Erie, and may be the result of a keg mix-up.

Fred Easton found the rnd I (05) 12’s on the Wyoming division (Scranton east toward Lackawaxen). The rnd R 12’s are found on the Newburgh – Greycourt, the Middletown – Pine Bush, and Ferrona branches.

Russ Hallock found sqr 13’s in several places, especially west of Otisville, NY on the main line. He also found both types of (07) 15, and pulled several sqr 25’s on the line north out of Harriman, NY. It may be that the square nails are from nail factory mix-ups.

John Speicher and Dave Parmalee have each found the irregular 18. John wrote “I pulled this nail off the Erie at Farrell, Penn. in yard tracks.” This nail has been also found on the DL&W.

As an illustration of the odd nails to be found on a large system, Here are some one of a kind nails Russ Hallock has found in Erie ties:

2 1/2 × 1/4	sqr I	stl (07) 21,22
2 1/2 × 1/4	rnd R	stl (07) 22
2 × 1/4	rnd I	stl (07) 24

Any of these could be the result of a nail keg mix-up. The 21 was not used by any nearby railroad. The sqr 22 was used by the NYC. The 24 was used by the NYNH&H, but it has also turned up in large quantities in second hand ties on several short lines. I found two once-used ties each with a sqr I (07) 29 in them, but the ends of the ties were stamped “NYC 37”, so the entire ties, complete with date nails, ended up on the Erie from the NYC’s Rome, NY treating plant.

Buz Johnston and Russ Hallock have found many (08) 44’s. The (08) 45 is common in western NY.

Buz reported some odd finds in [J-A ’88, 2, 4, 5]. He and Tom Pennise found bridge tags, one with the date “1931”, the others recording mileage. In each tie with a 36 they found a roofing nail with a thin square shank. Also they pulled a 2" rnd R (07) 1 (Set #6—a UP code nail), which is not an Erie nail.

Pre-1920 nails are generally rare, exceptions being the 10:c and 14. Nails from 1920 on up are common. A few dates are represented by different types. The (01) 27:b is much rarer than the (07) 27. The (10) nails are scarce. The (06) 51 is reported only by Ed Biedenharn. The (06) and (07) 50’s are each common on the eastern portions of the Erie while the (07) 50 is more common in the west. In the east the (07) 52 is more common than the (06) 52, but in western NY the (06) 52 is much more common. Both (05) 36 and 36:b are common, as are 49:b and 49:c. The 53:b is rare. Generally the rnd R nails through 52 are scarcer than the indents. No 56 has been found.

...Erie

The Erie controlled the New York, Susquehanna & Western until 1940. Unlike on the Erie, on the NYS&W the rnd R (01) 27:b is fairly common.

Russ Hallock found east of Meadville, PA some 1 1/2" galvanized roofing nails in the ties in place of date nails. He thinks they may have represented 1956.

Sometimes ex-DL&W nails can be found on the Erie. They arrived in second hand ties after the formation of Erie Lackawanna.

There may be other nails found in bridge timbers.

See also [J-F '88, 5], [M-A '90, 9], [M-J '90, 9], [J-A '92, 4-5], and [Winter 2003, 12-15].

Escanaba & Lake Superior

2 1/2 × 1/4	rnd I	stl (07)	08-14,16-18,20-31,34-40
2 1/2 × 1/4	rnd I	stl (14)	15
2 1/2 × 1/4	rnd I	stl (05)	19
2 1/2 × 1/4	rnd R	stl (07)	30
2 1/2 × 1/4	rnd R	stl (21)	30
1 1/4 × 3/16	rnd I	mi (11)	30
2 1/2 × 1/4	rnd I	stl (06)	32,33,41
2 1/2 × 1/4	rnd R	stl (06)	41,47-52,54
2 1/2 × 1/4	rnd R	stl (05)	43-46
2 1/2 × 1/4	rnd R	stl (17)	47,49
2 1/2 × 1/4	rnd R	stl (25)	53,55-57

Larry Fister has the rnd I (07) 26 in his collection. Also, his 30 is (10), not (21). Who has pulled these nails?

Ferrocarril del Pacifico

See Pacific.

Ferrocarril Kansas City Mexico y Oriente

See Kansas City, Mexico & Orient.

Ferrocarril Mexicano del Pacifico

See Mexican Pacific.

Ferrocarriles Nacionales de Mexico

See National Railways of Mexico.

Ferrocarril Sonora Baja California

See Sonora-Baja California.

Florida East Coast

2 1/2 × 1/4	rnd I	stl (07)	24
2 × 1/4	rnd R	stl (19)	39
1 × 1/4	rnd	stl (07)	blank
2 × 1/4	rnd	stl (07)	blank
2 1/2 × 1/4	rnd	stl (07)	blank
2 × 1/4	rnd	stl (19)	blank (from 1940)
2 1/2 × 1/4	rnd R	stl (07)	58
2 1/2 × 1/4	rnd R	stl (09)	58-62

Test sections

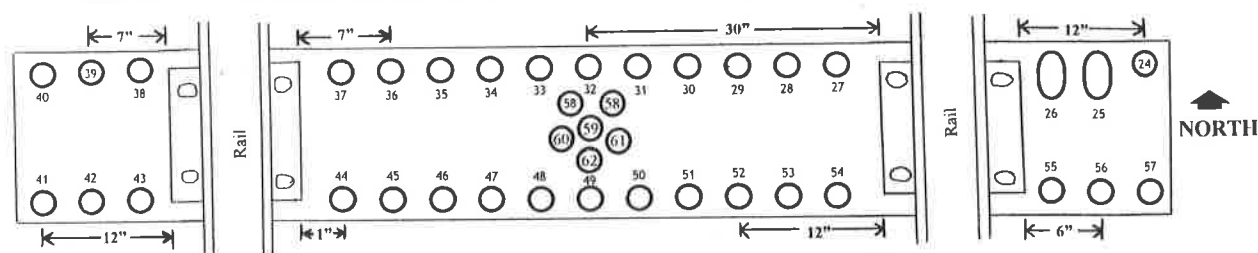
- ?, 1907.

16,000 creosoted pine ties. [AREA '09, 619] ['16, 315]

...Florida East Coast

From John Iacovino: Nails are found in the middle of the tie, on main lines and in sidings. Theresa and Tom Meyer found all the nails listed, and say the 62 is most common. The 24 has kind of a narrow date.

The blank nails dated the ties by their position according to this plan (from Tom Meyer):



For 1925 and 1926 a mini spike was used. The 2" nails were used for the other years. [Spring 2001, 10-11]
Southern Wood Piedmont nails can be found here.

Fonda, Johnstown & Gloversville

2 1/2 x 1/4	sqr I	stl (07)	26-39,40:b,41
2 1/2 x 1/4	sqr R	stl (07)	40
2 1/2 x 1/4	cut R	stl (03)	42,43
2 1/2 x 1/4	rnd R	stl (07)	44:b, $\frac{K}{44}$
2 1/2 x 1/4	sqr I	stl (05)	49-51
<i>Short line code set</i>			
2	x 1/4	rnd I	stl (07) 34
<i>Code nails</i>			
1 1/2 x 1/4	rnd I	stl (07)	4,8 (Set #28)
1 1/2 x 1/4	rnd I	stl (07)	7,8 (Set #29)
<i>From second hand ties</i>			
1 3/4 x 5/16	rnd I	stl (01)	11-15
2 1/2 x 1/4	rnd I	stl (07)	11-14,15:b,15:c,16,17,25:d,26:c,32-35,37,43,54
1 3/4 x 5/16	rnd I	stl (05)	16,17
2 1/2 x 1/4	sqr I	stl (07)	18,22,23
2 1/2 x 1/4	rnd I	stl (64)	18
2 1/2 x 1/4	sqr I	stl (05)	24,26:b
2 1/2 x 1/4	rnd R	stl (07)	24,26,27:b,28,28:b,31,37,38,40-42,49,50
1 1/4 x 3/16	rnd R	mi (11)	25-28
2 1/4 x 1/4	cut I	stl (03)	26:c
2 1/2 x 1/4	rnd I	stl (01)	30
2 1/2 x 1/4	rnd R	stl (06)	31
2 1/2 x 1/4	rnd I	stl (05)	36,36:b
<i>From second hand bridge ties or timbers</i>			
2 1/2 x 1/4	sqr R	stl (05)	24,25

The FJ&G, an upstate New York short line, went into receivership in 1933, the year their nails become very common.

The FJ&G 26-28 are difficult to find. If the 26 is 26:b, it may be a Nickel Plate nail which found its way to the FJ&G in a second hand tie. 26:b is common in second hand ties of other short lines. 27 and 28 may be from ex-NYC ties. 29-32 are definitely FJ&G, and 33-44, 49-51 are extremely common. The sqr R 40 is scarcer than the sqr I 40.

The FJ&G placed nails in the center of the ties. They dated second hand ties originally used on other railroads, so often two nails are found in a tie: one from the original railroad, and one from the FJ&G. They even dated their own reused ties, so sometimes a tie will have two FJ&G nails of different years. Here is a table of the number of ties Steve Worboys and I have found used twice by the FJ&G:

(continued)

Fonda, Johnstown & Gloversville

		Earlier date (FJ&G)					
		33	34	35	36	37	38
Later date (FJ&G)	37	0	1	0	1		
	38	2	1	1	0	0	
	39	10	12	2	1	0	1
	40	4	4	2	4	0	1

Note that we have found re-inserted FJ&G ties for 1937 to 1940 only. The primary second hand sets found here were re-dated by the FJ&G in 1932, 1933, 1935, 1936, and 1942-44. See the Schenectady Ry and the Shadow Set chapter beginning on page 347 of Volume II for further combinations. Steve Worboys and I also found the following nails together:

rnd R (07) 24	FJ&G 33
rnd I (07) 26:c	FJ&G 33
sqr I (07) 22	FJ&G 38
rnd R (07) 27	FJ&G 49.

Both the $\frac{K}{44}$ and 44:b have been found with Schenectady RY nails. This establishes that these 1944 dates are true FJ&G nails, and that the $\frac{K}{44}$ was not used as a treatment nail here. The $\frac{K}{44}$ may have been manufactured as a treatment nail and used as such someplace else, with a wartime shortage causing many to be sold to the FJ&G for normal use.

One 36 was found on the unused side of the tie.

See Steve Worboys' article in [J-A '91, 7-8]. [Shaw, 82-84] shows and describes some nails found on the FJ&G.

Sources for second hand nails

Erie

2 1/2 × 1/4	rnd I	stl (07)	32-35,37,43,54
2 1/2 × 1/4	rnd I	stl (05)	36,36:b

New York Central

2 1/2 × 1/4	sqr I	stl (07)	22,23
2 1/2 × 1/4	sqr R	stl (05)	24,25
2 1/2 × 1/4	sqr I	stl (05)	26:b

Rutland or B&A

2 1/2 × 1/4	cut I	stl (03)	26:c
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Schenectady

2 1/2 × 1/4	rnd I	stl (07)	12-14,15:b,15:c,16
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Shadow sets

Enigma set

2 1/2 × 1/4	rnd I	stl (64)	18
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Stubby shadow set

1 3/4 × 5/16	rnd I	stl (01)	11-15
1 3/4 × 5/16	rnd I	stl (05)	16,17
2 1/2 × 1/4	sqr I	stl (07)	18

and possibly

2 1/2 × 1/4	rnd R	stl (07)	24
2 1/2 × 1/4	rnd I	stl (07)	25:d,26:c

Fore River

1 1/4 × 3/16	rnd I gm	cop (60)	30,31
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The Fore River, now the Quincy Bay Terminal Co., operates 2 1/2 miles of track in Massachusetts. It connects with the NYNH&H. This list is copied from DNC, via Wiswell's list in [Dec '74, 6]. The nails were pulled by Robert R. Booth #429.

Fort Dodge, Des Moines & Southern

2 1/2 × 1/4	rnd R	stl (07)	30
2 1/2 × 1/4	rnd R	stl (06)	31
2 1/2 × 1/4	rnd R	stl (18B)	35
2 × 1/4	rnd R	stl (17)	36
2 1/2 × 1/4	rnd I	stl (06)	38
2 1/2 × 1/4	rnd R	stl (17)	44
2 1/2 × 1/4	rnd R	stl (09)	44
2 1/2 × 1/4	rnd R	stl (18C)	48,49

The FDD&S was an electric line re-classified as steam in January, 1956. It was leased to the C&NW June 21, 1971, having been previously owned by the DM&CI.

See Kevin Fister's articles in [M-J '86, 6-8] and [N-D '87, 6]. Some think that these nails are second hand. Not many nails have been found, and except for some track which remains in Des Moines, Boone, Ames, and Fort Dodge for switching purposes, the entire line was dismantled by 1985. Nails were found in ties piled along the right of way.

Fort Worth & Denver City

2 1/2 × 3/16	rnd R gm	stl (18B)	27
2 1/2 × 1/4	rnd R	stl (18B)	27-31

The FW&DC was owned by the C&S and became the Fort Worth & Denver in August, 1951. In [WPN 2-25, 30] is this table:

Crosstie renewals in main track			
Date	Untreated	Creosote	ZnCl ₂
1904	153,861	0	0
1905	138,755	0	0
1906	196,130	0	0
1907	259,867	54,175	0
1908	147,694	193,237	0
1909	0	163,936	0
1910	0	114,682	0
1911	0	68,474	0
1912	0	139,619	0
1913	0	197,011	0
1914	49,073	56,904	12,544
1915	126,744	0	90,207
1916	0	0	153,819
1917	0	0	100,676
1918	0	0	86,562
1919	0	0	43,014
1920	0	0	127,455
1921	0	0	90,045
1922	0	0	82,426
1923	0	77,947	0

Tie treatment began in 1907. The switch to ZnCl₂ in 1914 was due to the difficulty in acquiring a sufficient supply of imported English creosote during the war. By 1923 the supply had been restored.

Nails were placed about in the middle of the tie.

Frankfort & Cincinnati

From second hand ties, possibly Texas & Pacific

2 1/2 × 1/4 rnd R stl (18C) 45,47,49

From second hand B&M ties

2 1/2 × 1/4 rnd R stl (07) 31,33-41,46-52,54

1 1/2 × 1/5 rnd R stl (07) 42,43:c,44,45

From second hand NC&StL ties

1 3/4 × 1/4 rnd stl (07) blank

2 1/2 × 1/4 rnd R stl (04) 45

See Wiswell's listing of the nails pulled by Herman Heiden #191 in [Oct '74, 7]. He left off the 1 1/2" 45. In addition I have added Bruce Gordon's finds. [Spring 2000, 6-7]

Parmalee wrote in [J-F '78, 1] that no 53 had been found. Besides the second hand Boston & Maine nails listed above, some ex-B&M type (11) nails have also been found.

Frisco Lines (St. Louis-San Francisco)

2 1/2 × 1/4 rnd I stl (07) 8,08,09:b,10:c

From second hand ties

2 1/2 × 1/4 rnd I stl (07) 24

2 1/2 × 1/4 rnd I stl (18B) 26 (may be (18A))

2 1/2 × 1/4 rnd R stl (18B) 26

2 1/2 × 1/4 rnd R stl (01) 27:b

2 1/2 × 1/4 rnd R stl (07) 27,28,29:b

2 1/2 × 1/4 rnd R stl (17) 30,31:b,35

2 1/2 × 1/4 rnd R stl (06) 30,31,36

Code nails from second hand ties

2 1/2 × 1/4 rnd R stl (18A) X #7 (may be (18B) X #8)

2 1/2 × 1/4 rnd R stl (07) X #3

2 1/2 × 1/4 rnd R stl (18C) X #9

Treating plants

On June 30, 1906 Hermann von Schrenk became the "consulting forest expert" for the Rock Island, Frisco, Chicago & Eastern Illinois, and Santa Fe. He consolidated tie treating on the first three lines through new plants erected by C. B. Lowry's American Creosoting Co. The plants were constructed in 1907 to treat ties with creosote by the Lowry process. (See [Summer 2002, 5-7] for more on these plants.)

Location

Kansas City, MO

Springfield, MO

Hugo, OK

Marion, IL

Treated ties for

Rock Island

Frisco, C&EI

Frisco

C&EI, Rock Island ['13, 89][Goltra I, 45][Cronin, 143-144]

The Rock Island acquired some Lowry treated ties at the end in 1907, but for the most part these plants began operating in 1908. All four plants were still operating in 1952. [AREA '09, 619]['52, 394] Each plant was built with two retorts. Between 1924 and 1930 the Hugo and Marion plants were reduced to one retort. ['24, 312]['30, 419]

The Frisco had a treating inspector in Springfield from at least 1912 through 1945, and [Cronin, 143] states explicitly that the Hugo plant was constructed to treat Frisco ties. ['12, 15, 17]['15, 21]['22, 506] ['23, 552]['34, 498]['40, 480]['45, 295]

Tie treatment and dating

Frisco Lines began testing creosoted ties in 1905. Tie treatment on a large scale began when the creosoting works opened in late 1907 or early 1908. Also with the opening of the plants the Frisco began to put date nails into every treated tie.

...Frisco Lines

The Frisco stopped driving nails into every treated tie in 1910, and instituted test sections in 1914. The test ties from 1914-1915 probably had date nails, but because they were untreated, none have been found by collectors.

The first test sections

- Pacific, MO, 1905.
296 ties, all but four creosoted, were treated by various methods, including Giussani, no steaming, live steam in superheated coils, Bethell, and Rueping. ['15, table]['16, 295, 296] ['17, 136, 170, 172, 176]['20, 104, 112-114]
[AREA '09, 619] lists 332 Rueping treated red oak ties.
- St. Clair, MO, 1906.
321 sawed red gum and 752 hewn red oak ties, all creosoted by the Rueping process, were laid. The timber for the ties was cut in 1903, and this was a test of seasoning. ['15, table]['16, 295, 308] ['17, 136, 176]['20, 103, 112][AREA '30, 867]
[AREA '09, 619] says 1,107 ties total.

The 1914 test sections

"We selected from 2 to 5 miles of track on each operating division, attempting to get tangent track as much as possible, because these particular tests were made with the idea of determining the life of ties without especial reference to mechanical destruction. An inventory was taken of the ties in each test section and the condition of these ties has been followed since these test sections were inaugurated in 1914, by making inspections annually." ['21, 172]

There were already in these sections ties with date nails from 1908-1910, so their progress was recorded along with the untreated white oak ties installed in 1914-1915.

The source for these tests is ['21, 158].

- Diggins, MO.
1908 103 Lowry treated red oak.
1909 476 Lowry treated red oak.
1910 219 Lowry treated red oak.
1914 1,342 untreated white oak.
1915 473 untreated white oak.
- Eureka, MO.
1908 136 Lowry treated red oak, 198 Lowry treated gum.
1909 394 Lowry treated red oak, 155 Lowry treated gum, 90 Lowry treated elm.
1910 135 Lowry treated red oak.
1914 1,081 untreated white oak.
1915 613 untreated white oak.
- Afton, OK.
1908 293 Lowry treated red oak, 107 Lowry treated gum, 63 Lowry treated pine.
1909 1,312 Lowry treated red oak, 199 Lowry treated gum, 120 Lowry treated pine.
1914 252 untreated white oak.
1915 193 untreated white oak.
- Poteau, OK.
1908 90 Lowry treated red oak, 69 Lowry treated pine.
1909 154 Lowry treated pine.
1910 74 untreated red oak.
1914 142 untreated white oak.
1915 250 untreated white oak.
- Woodville, OK.
1908 56 Lowry treated gum, 298 Lowry treated pine.
1909 94 Lowry treated red oak, 684 Lowry treated pine.
1910 71 untreated pine.
1914 655 untreated white oak.
1915 599 untreated white oak.

...Frisco Lines

- Valley Center, KS.
 - 1908 190 Lowry treated red oak, 398 Lowry treated gum.
 - 1909 268 Lowry treated red oak.
 - 1910 68 Lowry treated red oak.
 - 1914 408 untreated white oak.
 - 1915 348 untreated white oak.
- Bonita, KS.
 - 1908 329 Lowry treated red oak, 244 Lowry treated gum.
 - 1909 532 Lowry treated red oak.
 - 1914 861 untreated white oak.
 - 1915 601 untreated white oak.
- Sulligent, AR.
 - 1914 944 untreated white oak.
 - 1915 373 untreated white oak.
- Memphis, TN.
 - 1914 831 untreated white oak.
 - 1915 968 untreated white oak.

The nails from second hand ties

The branch from Newburgh, MO to Ft. Leonard Wood was built sometime after 1938, and many ties used in the construction are from the Santa Fe. This is the source of the second hand Santa Fe nails listed above. With a few exceptions, the nails were found outside the rail. 29's and 30's were found with X's (not the (18A) X's). See Frank Schultz' article, with photos, in [Dec '76, 3].

In poles along this branch Santa Fe and Western Union nails have been found.

Galesburg & Great Eastern

1 1/4 × 3/16	rnd R gm	cop (60)	36
1 1/4 × 3/16	rnd R	cop (06)	40
2 × 3/16	sqr R	stl (07)	40,41

The G&GE was abandoned June 30, 1960. It operated 10 miles of track in Illinois, and connected with the CB&Q.

Only one 40 is known. About forty of the 41's have been found, and no more than half a dozen each of the copper nails were found.

General Crushed Stone

From second hand ties

1 3/4 × 5/16	rnd I	stl (01)	11,13,15
1 3/4 × 5/16	rnd I	stl (05)	16
2 1/2 × 1/4	sqr I	stl (05)	24,26:b
2 1/2 × 1/4	rnd I	stl (07)	25,26
2 1/2 × 1/4	rnd R	stl (07)	27:b,28:b
2 1/2 × 1/4	sqr I	stl (07)	27

This industrial spur served the stone quarry in Oaks Corners, NY. It connected the NYC with the LV main line. Tie replacement may have been the responsibility of the NYC.

The square nails are from second hand New York Central ties.

...General Crushed Stone

Shadow sets

Stubby shadow set

1 3/4 × 5/16	rnd I	stl (01)	11,13,15
1 3/4 × 5/16	rnd I	stl (05)	16
and possibly			
2 1/2 × 1/4	rnd I	stl (07)	25

Georgia

Code nails

2 1/2 × 1/4	rnd R	stl (07)	0-6,7-9	(Set #10)
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The code nails were used to number switches.

Test sections

- Barnett, GA, 1907.
1,000 full-cell creosoted loblolly pine ties. ['16, 319]['17, 190]['20, 121]
- Union Point, GA, 1907.
1,000 full-cell creosoted loblolly pine ties. All were removed by 1924. ['17, 190]['20, 120][DNC, 254]

Gila Valley, Globe & Northern

2 1/2 × 1/4	rnd I	stl (01)	08
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The GVG&N ran from Bowie, AZ (=Teviston) northwest to Globe, AZ. It was owned by the SP from 1901 until it was absorbed into the Arizona Eastern (also owned by SP) in December 1909. Mel Smith pulled this nail.

Charles Sebesta thinks this nail is really from the El Paso & Southwestern. I admit that attributing it to the GVG&N is problematic.

Grafton & Upton

1 1/4 × 3/16	rnd R gm	cop (60)	34-36,40,42,46-48
1 1/4 × 3/16	rnd I gm	cop (60)	34-39,41
2 1/2 × 1/4	rnd R	stl (08)	44:b
1 1/2 × 3/16	rnd R gm	cop (60)	49,50
<i>Probably from second hand ties</i>			
1 1/2 × 1/5	rnd R	stl (07)	44

The G&U is a Massachusetts short line which was electric from 1920 until January, 1947.

Grand Rapids & Indiana

2 1/2 × 1/4	rnd R	stl (07)	13,15-18,20
2 1/2 × 1/4	rnd I	stl (07)	18
2 1/2 × 1/4	rnd	stl (07)	blank

The GR&I was absorbed into the Pennsylvania RR in January, 1921.

In 1898 in western Michigan 11,117 untreated cedar and oak ties were placed under observation. ['16, 290]

Possibly some nails are from second hand ties.

...Grand Rapids & Indiana

The following BR&P letter nails have been found here:

2 1/2 × 1/4	rnd I	stl (05)	B #1,M #1,M #2,RO #3
2 1/2 × 1/4	rnd I	stl (07)	P #3

The (05) letter nails are no older than 1927 (see BR&P), so along with the (07) P, they found their way to the GR&I after the PRR takeover.

Grand Trunk

1 1/2 × 1/4	rnd R	stl (23)	26,33,34,34:b
1 1/2 × 1/4	rnd R	stl (01)	27-29,31
1 1/2 × 1/4	rnd R os cp	stl (38)	27,30,35,36,38,39,42,45,46
1 1/2 × 1/4	rnd R	stl (07)	30,46,47,57
1 1/2 × 1/4	rnd R	stl (06)	31,52,53,55,56
1 1/2 × 1/4	rnd R	stl (05)	32,36,36:b,44,44:b,44:c
1 3/4 × 3/16	cut R	stl (05)	34-36
1 1/2 × 1/4	rnd R	stl (39)	34:b,34:c
1 1/2 × 1/4	rnd R	stl (21)	35
1 1/2 × 1/4	sqr R	stl (07)	36
1 1/2 × 1/4	rnd R	stl (25)	37
1 1/2 × 1/4	rnd R cp	stl (25)	38
1 1/2 × 1/4	rnd R cp	stl (24)	39
1 1/2 × 1/4	rnd R cp	stl (05)	39,41,45
1 1/2 × 1/4	rnd R cp	stl (10)	40-42,44
1 1/2 × 1/4	rnd R	stl (10)	41
1 1/2 × 1/4	rnd R	stl (19)	43
1 1/2 × 1/4	rnd R	stl (09)	45-47,49,50,54,58-61
2 1/2 × 1/4	rnd R	stl (09)	45,48,51,60,62-65
1 1/2 × 1/4	rnd R ts	stl (37)	61

From poles

1 1/2 × 1/4	rnd R ts	stl (37)	61
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Prior to the early 1920's the Grand Trunk was a large system with trackage in Canada and the U.S. The Canadian part of the railroad was absorbed into the Canadian National in 1920 and 1923, after which the U.S. portion became two railroads, the Grand Trunk Western (in Michigan, Indiana, and Illinois) and Grand Trunk (in New England). Both GT and GTW were subsidiaries of CN. The nail sets for GTW and GT are identical except for a couple nails which can be regarded as regional variations. Here is one example: the cp (05) 39 is found in the west, while the cp (24) 39 is found in the East.

In 1900 in Canada the GT laid 83,200 untreated cedar ties for which they presumably kept a record. [16, 290]

In 1903 they laid 255,574 Burnett treated red oak ties. These may have been treated at Ayer & Lord's Carbondale plant. The CB&Q also bought Burnett treated red oak ties from A&L in 1903. [AREA '09, 619][16, 310][20, 115]

The (38) 35, 36, 38, and 39 are all definitely Grand Trunk nails. Some of the other (38) nails may come from second hand CN ties.

Generally, to 1938 nails were driven between the rails, closer to one rail. In Falmouth and Yarmouth, ME they are closer to the west rail. From 1939 up nails were placed in the center of the tie. There are exceptions to this, as some nails from the 40's have been found closer to one rail.

Grasse River

From second hand ties

2 1/2 × 1/4	sqr I	stl (07)	13,19,22,23,30
2 1/2 × 1/4	sqr I	stl (05)	15,25-28,31
2 1/2 × 1/4	sqr R rs	mi (11)	16
2 1/2 × 1/4	sqr R	stl (07)	17,18

The GR was an Adirondack short line. Its tracks were mostly taken up in 1948. The last section, between Childwood, NY and Conifer, NY, was dismantled in April, 1959. All nails are ex-New York Central.

Great Northern

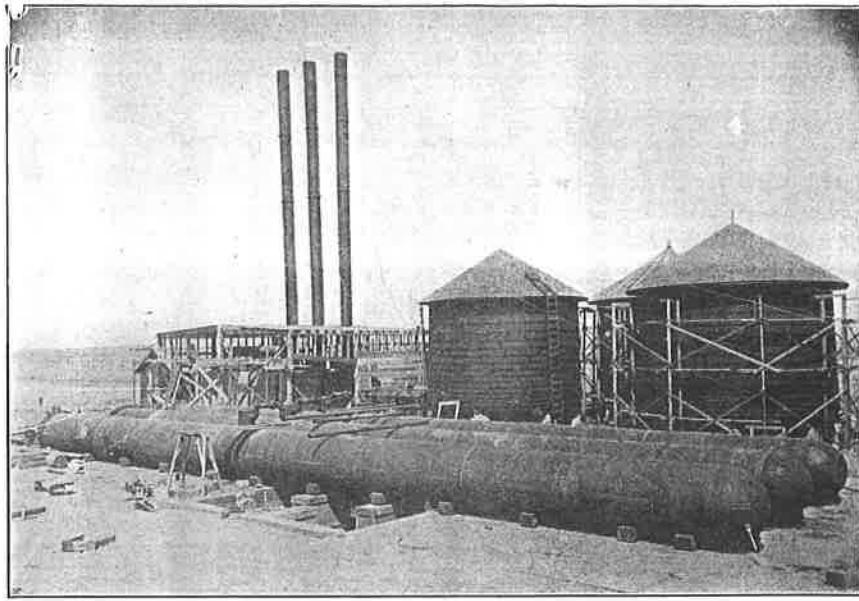
2 1/2 × 1/4	rnd I	stl (07)	99-08,08:b,09,09:b,10,10:c,10:f,11,27,41,F4-F10, F F, P4-P10, P, S4-S10, S, T4-T10, T, L8,L9 11,12
2 × 1/4	rnd R	stl (07)	24-30
2 1/2 × 1/4	rnd R	stl (07)	24,25,26:c,27-31
2 × 1/4	sqr R	stl (07)	24-29
2 1/2 × 1/4	rnd R	stl (06)	32-40,47,48,48:b,49,50,51:b,52-61,66-68,68:b,69
2 1/2 × 1/4	rnd R	stl (18B)	34,35
2 1/2 × 1/4	rnd R	stl (18C)	36,37
2 1/2 × 1/4	rnd I hs	stl (18B)	41
<i>From poles</i>			
2 1/2 × 1/4	sqr I	stl (05)	35,36,39,41-46,48
2 1/2 × 1/4	sqr I	stl (07)	37,43
2 1/2 × 1/4	rnd R	stl (06)	50
2 1/2 × 1/4	rnd I	stl (06)	54

(Note: The 01 has a flag *and* foot, unlike the 01 pictured in Volume III. For a picture of the GN 01, see my web page at <http://facstaff.umd.edu/~oaks/NNFeb00.htm>)

Treatment plants

In a letter dated October 11, 1899 Octave Chanute estimated the zinc chloride consumption for 1900 for several railroads. In the list he wrote that the "Gt. Northern Ry" would need 600,000 lbs. for their plant "in Minesota". I have found no other information on this plant, which must have treated the GN's ties before the Somers plant began operating in 1902. Judging by the date nails, the Minnesota plant began treating ties in 1899. 600,000 pounds of zinc chloride translates into roughly 480,000 ties. [Fall 2002, 14-15]

The Great Northern's first treatment plant was a large, four retort facility located on Flathead Lake at Somers, MT, near Kalispell. Designed by Samuel M. Rowe with a capacity of 1,200,000 ties per year, it was completed in the Fall of 1901 and began treating ties, piles, and bridge timbers with zinc-tannin early in 1902. The woods used were bull pine, tamarack (=larch), fir, and spruce. Lumber was cut at the John O'Brien Lumber Co. saw mill a half mile from the plant. Probably the plant treated ties for lines west of Wisconsin and Minnesota only. [RG 3-8-01, 175][RG 5-30-02, 396ff]



The Somers plant during construction. In the foreground are three of the four retorts (treatment cylinders). Before construction was finished a building was built over them to protect them from the weather. Behind the retorts are storage tanks for treatment chemicals. [RG 5-30-02, 396]

In the mid 1920's the GN decided to split the duties of the Somers plant. In 1926 it was rebuilt with two retorts, and in 1927-28 a new two-retort plant was built at Hillyard, WA. It may have been at this time that the GN ceased to operated their own treatment works, leasing the Somers plant to the Somers Lumber Co. The Hillyard plant was operated by the Washington Wood Preserving Co., and at least in 1945 it was also treating ties for the Northern Pacific. [30, 423]

As of 1935, all ties on the GN were treated at one of these two plants except for those used in Wisconsin and Minnesota. Ties in these states were creosoted by the National Pole and Treating Co. at Fridley, MN (built 1921, enlarged 1928) and by the National Lumber and Creosoting Co. at Allouez, WI, near Superior, a suburb of Duluth (built 1928). [M-A '93, 3-4][44, 431, 433]

Treatment methods

On a page titled "What we have done" in Samuel M. Rowe's book *Handbook of Timber Preservation* is this line: "1899. Great Northern Ry., Kalispell, Mont., Plans, Supervision and Installation." [Rowe, 328] 1899 is the first year date nails are known from the GN, so either Rowe built a temporary plant which the GN used from 1899 to 1901, or the plans date from 1899 and the GN acquired its treated ties in those years from an outside company. The treatment method would have been either Burnett's or Wellhouse's.

The only other possible item I have found relating to pre-1902 treating on the GN is this statement made in January, 1902: "The Chicago & Eastern Illinois Railroad [1899], the Chicago, Burlington & Quincy Railroad [1899], The Great Northern Railway, the Missouri, Kansas & Texas Railway [1901], and some other lines, are also having ties treated; but their experience is yet too recent to be put on record at this time." [AREA '02, 97]

At Somers ties were treated by Chanute's three-step modification of the Wellhouse process beginning 1902, and in late 1903 or at the beginning of 1904 they switched to straight ZnCl_2 . [RG 5-30-02, 397] [AREA '09, 619]

Creosoted ties were tested in 1908-1909. These may have been treated by the Lowry process, and they may have received the nails L8 and L9. As of 1915 the Somers plant was using ZnCl_2 only. [15, 477] Sometime before 1927 creosote became as common as ZnCl_2 on the GN. They probably began using creosote regularly, along with ZnCl_2 , about 1924.

Great Northern

In 1924 they tested ties treated with creosote, and a mixture of creosote and petroleum. In 1932 the GN began using ties treated with zinc-meta-arsenite.

Most of our information on later treatment comes from a 1935 analysis of GN's tie policies, supplied by Robert Eaton and printed in [M-A '93, 3-4]. Here are statistics for the years 1927-1935, showing the percentage of each treatment used.

Year	Creosote	ZnCl ₂	Z-M-A
1927	53%	47%	0%
1928	53	47	0
1929	53	47	0
1930	40	60	0
1931	25	75	0
1932	20	60	20
1933	12	58	30
1934	40	40	20
1935	26	64	10

By "creosote" they mean a 50-50 solution of creosote and crude petroleum, probably by the Lowry or Rueping process. In 1935 all three treatments were in use at the Somers plant. At Hillyard ties were treated with both creosote and ZnCl₂, and only creosote was used at the Fridley and Allouez plants. The expected life of creosoted ties in main tracks was 25 years and up, compared with 18 years for ZnCl₂ treated ties. Untreated cedar, used primarily on branch lines, gave 12 years or more.

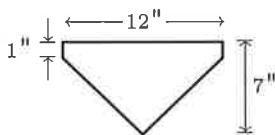
Woods

Beginning 1902 the Somers plant treated mainly "tamarack and bull-pine, with a small percentage of white spruce and Douglas fir". All these woods were still in use in 1913. Untreated cedar was also used. In 1908-1909 the GN began testing creosoted birch. [RG 8-7-03, 576]

In 1935 western ties were of tamarack (70%), fir (25%), and yellow pine (5%). Ties in Wisconsin and Minnesota were birch (60%), red oak (30%), and maple (10%). [M-A '93, 3]

Tie shapes

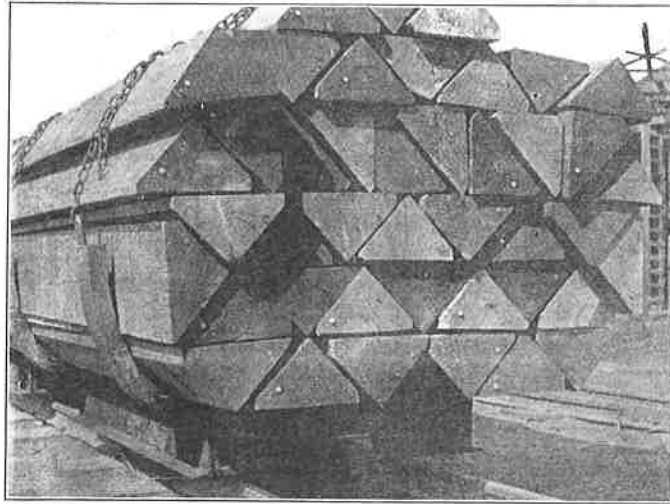
The O'Brien saw mill began cutting wood for the Somers plant in September, 1901. Various sizes of rectangular ties were cut, but most ties had a triangular cross section. Nail collectors often refer to these as "three corner ties." In 1903 fully 85% of the ties sawed were triangular. At that time they had all been used for renewals. "...ties are sawed this shape whenever the timber which comes in is of proper size, the different standard cross sections illustrated being used indiscriminately according to circumstances." [RG 8-7-03, 576]



Cross section of a triangular tie. The other standard cross sections were rectangular, including 7" x 7", 7" x 8", and 7" x 9". 7" was the thickness of all ties, which were either sawed or hewed. [Weiss, 132]

...Great Northern

The strange shape was designed to save lumber. "...the cross section of the stick [log] is either 10 in. × 10 in., furnishing two triangular ties, or 14 in. × 14 in., furnishing four ties. The amount of timber, b.m., in a triangular tie cut from either stick is approximately 32 ft." versus 42 ft. and 37 ft. for two standard rectangular shapes. Tie plates were used on all ties. [RG 8-7-03, 576]



A load of triangular ties on a retort car at the Somers plant. Note the date nails in the ends of the ties. The nails were driven before treatment.

Triangular ties were used at least through 1911, but maybe not in great quantities much longer after that. They are usually found with early dates, but Dale Jones found a 24 in one. [Spring 2000, 18] In 1903 and 1904 the CB&Q tested a few thousand triangular ties in Wyoming and Colorado, treated with ZnCl_2 . They may have been cut at the O'Brien mill. ['15, table]['16, 295]['17, 222][AREA '30, 867]

All Great Northern ties were eight feet long.

Record keeping

The Great Northern began using date nails in 1899. If they used nails earlier, it was in small enough quantities to account for the fact that none have been found. The nails from 02 up were used in ties treated at the Somers plant. The nails 99 through 01 were driven into ties treated at a temporary plant or by an outside company. See above under "Treatment methods".

The Sorensons and Dick Gartin found ties stamped 02 and 03 in the ends, along with others with date nails 00, 01, and 04. [J-A '85, 2-4]

The letter-number nails (like "F7"), used mainly 1904-1911, indicate the species of wood and the year of treatment. One of these nails was driven into the end of the tie before leaving the treating plant, and a regular date nail (like "07") was driven into the top of the tie when the tie was installed in the track. Sometimes the second nail was of a later date than the first. ['14, 405]

Though extensive testing of zinc treated ties began in 1902, the date nails indicating the species as well as year have been found only back to 1904. The letters on these nails stand for the following:

F	Fir	P	Pine	S	Spruce	T	Tamarack.
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"L" might stand for "Lowry", to distinguish ties treated with creosote by the Lowry process at a commercial plant from those treated with zinc chloride at Somers. This is only a guess. The nails 00 to 09 do not stand for "Oak 1900", etc. They are the nails driven at the track.

(continued)

...Great Northern

Originally the GN kept a record of all ties, but sometime before 1914, probably 1911, they followed the lead of many other railroads in abandoning such massive record keeping in favor of test sections. They "Usually select new track for test sections." [DNC, 290]['14, table] These test sections probably consist of only the Belt-Gerber 1911 test, which was quite extensive. Afterwards date nails were not used on the GN until probably 1924.

Nails were reintroduced in 1924, with both round and square heads. Square nails may have indicated treatment with creosote or creosote-petroleum, judging from the two tests conducted that year. However, the difference between round- and square-nailed ties may have held some other significance.

Jerry Penry reported that nails were placed inside the north rail to 1928. From 29 up they were placed outside the north rail. [J-F '90, 6]

Test sections

Unless noted otherwise, whenever tamarack, pine, fir and spruce were used in a test, the species were predominantly tamarack and pine.

- Conrad, MT, 1902.
One mile west of Conrad 2,601 triangular ZnCl_2 treated (not zinc tannin!) tamarack, pine, fir, and spruce ties were laid. ['16, 317]['17, 210]['20, 126]['24, table][AREA '17, 1279]
- Granville, ND, 1903.
One mile north of Granville 2,848 $7" \times 9"$ ZnCl_2 treated tamarack, pine, fir, and spruce ties were laid (primarily tamarack and fir). No tie plates were used. ['16, 327]['17, 222][AREA '17, 1278]
- Glenburn, ND, 1903.
Two miles east of Glenburn 2,580 ZnCl_2 treated tamarack ties. No tie plates were used. ['16, 327]['17, 222][AREA '17, 1278]
- Moravia, ID, 1903.
2,916 triangular ZnCl_2 treated tamarack, pine, fir, and spruce ties were laid a mile west of Moravia. All were removed by 1917. ['17, 212]['20, 126]['22, 114]['23, 166][AREA '17, 1284]
- Mohall, ND, 1904.
A mile east of Mohall 965 $7" \times 8"$ untreated cedar, and 1,575 $7" \times 8"$ untreated tamarack ties were laid.
Five miles west of Mohall 2,824 $6" \times 7"$ untreated cedar and tamarack ties were laid. ['16, 290]['17, 108, 222]['20, 96, 128][AREA '17, 1279]
- White Fish, MT, 1904.
2,708 ZnCl_2 treated triangular tamarack, pine, fir, and spruce ties were laid on the main line one mile east of White Fish. All were removed by 1920. ['16, 327]['17, 222][20, 126]['24, table][DNC, 254][AREA '17, 1279, 1284]
- Columbia Falls, MT, 1904.
On the main line two miles west of town 2,823 triangular ZnCl_2 treated ties were inserted. Among them were 871 spruce, 643 fir, 105 pine, and 15 tamarack. What were the other ties? Untreated cedar? ['16, 293, 329]['17, 218]['20, 99, 127][AREA '17, 1279]
- Fortine, MT, 1904-05.
2,168 untreated tamarack, pine, fir, and spruce, predominantly tamarack and fir. ['16, 327]['20, 128]['22, 114]['23, 166][AREA '17, 1284]
- Hobson, MT, 1907.
A mile east of Hobson 2,562 $8" \times 12"$ ZnCl_2 treated tamarack (733 ties), pine (1,169), fir (535), and spruce (125). ['16, 317]['17, 210]['20, 126][AREA '17, 1279]
- Newport, WA, 1908.
In the main line one mile east of town 2,894 unseasoned and untreated tamarack, pine, fir, and spruce ties were laid. Some were sawed $7" \times 9"$, others hewed $7" \times 7"$. All were removed by 1918. [DNC, 254]['16, 327]['17, 220]['20, 128]['22, 114]['23, 166][AREA '17, 1284]

...Great Northern

- Judith Gap, MT, 1908.
One mile east of town 2,989 7" × 8" untreated tamarack, pine, fir, and spruce ties were laid. [17, 222][20, 128][AREA '17, 1279]
 - Rimrock, MT, 1908.
"At Rimrock" 2,916 7" × 9" untreated tamarack, pine, fir, and spruce were inserted. [16, 327] [17, 222][20, 128][22, 114][23, 166][AREA '17, 1279]
 - Several divisions, 1908.
9,527 creosoted white birch ties were laid in various places on the GN. The ties were 7" × 7". These may have been treated by the Lowry process at a plant of the American Creosoting Co. The division names, with quantities of ties, are

Mesabi	1,410
St. Cloud	1,400
Dakota	1,400
Minot	1,391
Montana	1,070

 (The Montana total was reduced 370 on account of ties removed from the Scao, MT siding with abandonment of tracks in 1916.)
 Branch lines:

St. Cloud (Princeton line)	1,419	
St. Cloud (Park Rapids line)	1,447	[30, 296][48, 211][AREA ?, 687]
 - Brevator, MN, 1909.
Cedar ties intermingled with tamarack and treated birch were laid in the vicinity of Brevator. Probably the cedar was untreated, the tamarack treated with ZnCl₂, and the birch creosoted. [RAG '17, 608]
 - Butte division, 1911.
1,066 rectangular ZnCl₂ treated tamarack, pine, fir, and spruce. These do not seem to be part of the Belt-Gerber test, though they are on the same division. [17, 212]
 - Belt, MT to Gerber, MT, 1911.
43,138 ties, of pine, fir, and tamarack, were treated in 1910 and laid in the Spring of 1911. Treatments included 4% ZnCl₂, 6% ZnCl₂, creosote 12lb., and untreated, and the ties were either sawed or hewed. Only fir was creosoted, with 12 lb/ft³ (probably full cell). The shape of the ties are given for all but creosoted fir. 15,096 out of 34,244 ties were triangular, or about 44%. "Dating nails applied in end of tie showing year and species of wood..." The type of treatment was also marked on the ties somehow.

<u>Treatment</u>	<u>Fir</u>	<u>Tamarack</u>	<u>Pine</u>
Untreated	3,318	3,349	3,155
4% ZnCl ₂	3,849	4,478	6,629
6% ZnCl ₂	3,081	3,517	3,371
Creosote	6,391		
- By October 6, 1916, practically no tie removals had occurred, except creosoted fir, which suffered from crushing and checking due to excessive steaming prior to treatment. [17, 120, 130, 132, 210] [20, 100, 102, 126, 128, 129][31, 30][22, table][23, 167][25, 164][41, 297][RAG '17, 672] [AREA '40, 501][DNC, 37, 252]
- Near Quincy, WA, 1924.
498 7" × 9" cresoil treated Douglas fir ties were laid in March, 1924 "Starting 450 ft. E of MP 1613. 2 1/2 miles east of Quincy, Wash., extending east about 1/2 mile." The ties were treated by the Lowry process with cresoil, a mixture of cresylic acid (some 10%, others 5%) and petroleum oil. "All ties are marked with a 1 1/2 in. by 3 in. copper number plate." Has anyone recovered one of these plates? [DNC, 251][41, 296]

...Great Northern

• Minneapolis, MN, 1924.

At Stone Arch Bridge, 1,296 ties on the eastbound track and 1,047 ties on the westbound track were laid in October, 1924. The ties were white birch, 7" × 9", and were treated with a 50-50 solution of creosote and petroleum by the Lowry process. Ties were dated with 1924 date nails. A remark states that 222 tamarack ties were eliminated from the test. Maybe other woods were involved, also. [’41, 296][’48, 210]

Comments on the nails

Leon Sorenson’s set is pictured in [N-D ’86, 8-9]. Mike Hanson’s set appears in [S-O ’85, 8-12], and with an article in [Oct ’75, 2, 5-6]. See also the newspaper article in [Dec ’75, 6-7]. In [Oct ’75, 6] Mike wrote of two P10’s which he found in ties never used in the track, and on that page is a photo of a triangular tie.

Besides finding the stamps 02 and 03 (see above), the Sorensens and Dick Gartin found nails 00, 01, and 04 in fence posts. Some farmer had reused the nails in his fenceline. The article and a photo of the 00 appear in [J-A ’85, 2-4].

2" versions of some early dates have been found. These include 02 and 05, and were probably just cut too short at the nail factory.

Mel Smith [M-A ’86, 5] found T6 and T7 in rectangular ties.

About six hybrid gripper mark T10’s have turned up on the Santa Fe—these have a Great Northern head and a Santa Fe shank. [J-A ’98, 7]

The ^C₁₈, once reported to be a GN nail, is probably really a pole nail.

Mike Hansen and his dad Bob have pulled an impressive collection of GN nails. They have found a number of NP nails from the teens in GN track. Mike maintains they are GN, but he is the only one to my knowledge who has pulled them, and they contradict the contemporary documentation. I cannot explain them. Also, other collectors have reported 2" rnd R (07) 21-23, which are really UP nails. Still questionable are the rnd I (07) 27 and 41, the (18B) 34, 35 and (18C) 36, 37.

The sqr R 29 is very rare, and one 2" sqr R (07) 31 has been found, location unknown. It may not belong to the set.

Fifteen 2" sqr R (07) 30’s were found in bridge timbers piled in a salvage yard located near the Milwaukee Road yard in Farmington, MN. The nails were found by Larry Harvey and Larry Fister in the ends of the dimension lumber. The only railroads in Farmington were the Rock Island and Milwaukee Road, but the nail matches the GN set best, so some collectors have this nail in their GN sets.

Mike Hansen pulled one hand stamped 41, and recently Charles and Cheryl Johnson found two in a bag of GN nails they acquired. [S-O ’85, 11][Fall 2003, 7-9]

The following nails were reported by one collector (Leon Sorenson?), but have not been found by anyone else. They are probably not GN nails.

2 1/2 × 1/4	rnd R	stl (18C) 42,45
2 1/2 × 1/4	rnd R	stl (06) 43,46,47
2 1/2 × 1/4	rnd I	stl (06) 44,45,47

John Winkowitsch found a 2 1/2 × 1/4 rnd I stl (07) ^N_{TC} on the GN. For a photo see [S-O ’86, 10].

It was found near Belt Creek, Montana, near a tie with a P4. The nail may stand for “Nebraska Telephone Company,” making this a very misplaced nail. It could be the result of a factory mix-up.

For pole nails see the article by Charles and Cheryl Johnson in [Spring 2003, 9-12]

Nail articles: [Dec ’74, 4-5], [Oct ’76, 3-4], [M-J ’77, 6], [S-O ’77, 6] reprinted [J-F ’86, 8], [Jan ’87, 9], [M-J ’87, 2-3], [S-O ’88, 3], [J-F ’90, 6-7], [J-A ’90, 1], [J-F ’92, 2-3]. The [M-J ’77] article reports 99’s near Osnabrock, ND.

Great Northern

The Wenatchee Valley & Northern

This Washington short line was sold to the GN in 1916. The following test is from this line.

- Delmont, WA, 1910.

64 unpeeled, untreated Douglas fir ties.

15 unpeeled, untreated lodgepole pine ties.

15 unpeeled, untreated western yellow pine ties.

6 white fir ties, boiled in zinc chloride.

At least the untreated ties were all seasoned for one year. ['16, 294, 321, 325]['17, 196]

['20, 102, 103, 122, 126]

Great Western

From second hand ties?

2 1/2 × 1/4 rnd R stl (18B) 27-29,33

2 1/2 × 1/4 rnd R stl (07) 30-32

Lowell Hard pulled the nails.

The Great Western Sugar Co. incorporated the Great Western RR in 1901. It operates about 42 miles of track in Colorado and connects with the CB&Q, the C&S, and the UP.

Green Bay & Western

2 × 1/4 rnd R stl (21) 36

1 1/2 × 1/4 rnd R stl (21) 38-41

From second hand ties?

1 × 1/4 rnd R stl (17) 35

1 1/4 × 3/16 rnd R gm cop (60) 37:b,39

The GB&W connected with the C&NW, Milwaukee Road, Soo Line, CB&Q, and the Ann Arbor.

This list is taken from DNC. Some may be from second hand ties. The 35 may be an MK&T nail, and the copper nails may be from the Milwaukee Road.

Greenwich & Johnsonville

Probably all are from second hand ties

2 1/2 × 1/4 rnd R stl (07) 25,26,35-41,43,44:b,45-54

2 1/2 × 1/4 rnd I stl (07) 27-31,34,40,42-45,50,52

2 1/2 × 1/4 rnd I stl (01) 30

2 1/2 × 1/4 rnd I stl (05) 34

2 1/2 × 1/4 rnd R stl (06) 34

2 1/2 × 1/4 rnd R stl (17) 49

2 1/2 × 1/4 rnd I stl (06) 52

The G&J, a 24 mile New York short line, was controlled by the D&H until 1982. Many nails are from the Erie and D&H. The (17) 49 has turned up in second hand ties on other NY shortlines.

The (05) 34 is in Penry's collection. It may come from a second hand CNS&M tie.

Guatemala

See International Railways of Central America.

Gulf Coast Lines

See Missouri Pacific.

Gulf, Mobile & Northern

2 1/2 × 1/4 rnd R stl (19) 35-38

The Birmingham & Northwestern became part of the GM&N in May, 1927. The GM&N was absorbed by the Gulf, Mobile & Ohio in August, 1940. These nails were found on the B&NW portion of the GM&N.

Hillsboro & Northeastern

From second hand ties

1 3/4 × 5/16 rnd I GM stl (07) 26

The H&NE, until abandonment in 1992, was a 5 mile short line in Wisconsin.
The 26 is from an ex-C&NW tie.

Honolulu Rapid Transit

Test sections

- 1900-1903.
Some Carbolineum-Avernarius treated cedar ties were tested. "Decay around spike holes."
[16, 289]
- 1903.
1,200 feet of Carbolineum-Avernarius treated California redwood ties were laid. [16, 329][20, 127]

