Pine Tar; History And Uses

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Few visitors to any ship which as been rigged in a traditional manner have left the vessel without experiencing the aroma of pine tar. The aroma produces reactions that are as strong as the scent; few people are ambivalent about its distinctive smell. As professionals engaged in the restoration and maintenance of old ships, we should know not only about this product, but also some of its history.

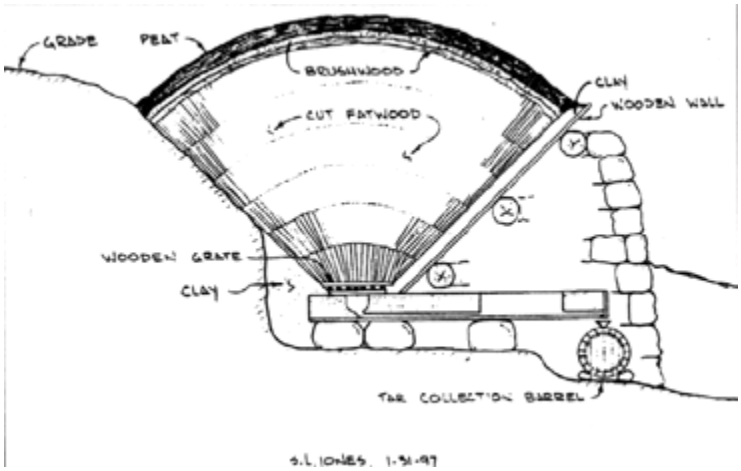
Wood tar has been used by mariners as a preservative for wood and rigging for at least the past six centuries. In the northern parts of Scandinavia, small land owners produced wood tar as a cash crop. This tar was traded for staples and made its way to larger towns and cities for further distribution. In Sweden, it was called "Peasant Tar" or was named for the district from which it came, for example, Lukea Tar or Umea Tar.

At first barrels were exported directly from the regions in which they were produced with the region's name burned into the barrel. These regional tars varied in quality and in the type of barrel used to transport it to market. Wood tars from Finland and Russia were seen as inferior to even the lowest grade of Swedish tar which was Haparanda tar.

In 1648, the newly formed NorrlSndska TjSrkompaniet (The Wood Tar Company of North Sweden) was granted sole export privileges for the country by the King of Sweden. As Stockholm grew in importance, pine tar trading concentrated at this port and all the barrels were marked "Stockholm Tar". By 1900, NorrlSndska TjSrkompaniet had lost its control of the pine tar export business, and other exporters were again working out of other ports and marking their product accordingly. Nevertheless, over the centuries "Stockholm Tar" has come to mean a high quality light colored wood tar.

Gamble[1] describes one of the earliest Swedish methods of making tar in Norrland (Northern Sweden). The peasants dug up and cleaned the roots of Swedish pine trees (Pinus silvestris) in the late summer. They then transported the roots to the burn site where they were split and stacked to weather during the winter.

" The 'dale' or burning ground, was built of logs in a scientific manner. It was built on a slope which sometimes forms one side, in the shape of a funnel, with a spout at the lower end of the slope. The outer walls of the 'dale' were built with logs split in two, and a layer of earth was then placed thereon before the interior was lined, either with clay, iron sheet, or thick cardboard."[2]



In the summer, the split roots or fatwood were stacked in the kiln and covered with peat and turf. Brush wood was used to provide heat, but the heat was controlled so that the remaining fibers were not burned and the roots give up their liquid. This tar was high in turpentine and was in great demand.[3] By the turn of the 20th century , this traditional way competed with more modern methods of production. Although it produced higher quality tar, it was labor intensive and could not be competitive in the world market.

From the beginning, Britain's colonies in North American were encouraged to produce pine tar and pitch, and to collect gum from pine trees for later shipment to England. These fledgling industries in New England and the Carolinas were encouraged by the Bounty Act of 1705. At that time England had been cut off from its Scandinavian supplies by Russia's invasion of Sweden-Finland. " By 1725 four fifths of the tar and pitch used in England came from the American colonies..."[4] This supply remained constant until the American Revolution in 1776, when England was again forced to trade with the Dutch for Scandinavian products. As the population of the United States grew and moved west, forests were cleared. The southern states began to monopolize the production, because of the type of trees in this reagon. By 1850 most of the U.S. production of tar and pitch was in North and South Carolina. As the 19th Century progressed the tar, pitch, and turpentine manufacturing spread south and west into the states of Georgia, Alabama, Mississippi, Louisiana, Texas, and Florida. By 1900, rosin and turpentine were the dominant products, and the states of Georgia, Florida, and Alabama were the three major producers.[5]

As the maritime uses of pine tar deminished over the latter half of the 19th century so did its production in the U.S. During this time technological advances had taken place which made it possible to produce tar, but as a by product. The process of destructive distillation was incorporated to manufacture soft wood charcoal and the by products of pine tar in kilns using Long-leaf or Cuban pine.[6] These kilns or retorts "... varied in capacity from one to ten cords. They were usually horizontal, cylindrical, steel vessels set in brickwork, with the fire box at one or both ends, and are charged and discharged at one or both ends. ...By this plan fat wood is piled in a pit or brick kiln, so arranged that the tar, when formed, runs to a point where it may be collected, and dipped into barrels."[7] The term " fat wood" or "light wood"[8] refers to yellow pine that is devoid of its bark and growth wood. Prior to the mid-twentieth century, stumps and blow downs were used to make this type of product because of their relative low cost. "If a pit is

used, the wood is covered with earth, and if a brick kiln this is closed nearly air tight and the wood burned very slowly until charred. In this process nothing is recovered but tar and charcoal."[9]

Many different heat sources were used to produce distillation. At some works gasses and oils were collected from the top of the kiln and run through a condenser to produce "wood turpentine" and "pine oil". The average yield for one cord (4,000 lb.) of "light wood" might be:

Wood turpentine	8 to 15 gal.
Total oils; including tar	65 to 100 gal
Tar	40 to 60 gal.
Charcoal	25 to 35 bushels or 403 to 564 lbs.[10]

Because of its strong odor, wood turpentine was used as a substitute for second grade gum turpentine in exterior paints and varnishes. Tar and tar oils were added to paints, stains, disinfectants, soaps, and floating oils. The oakum and cordage industry used the majority of the pine tar produced.

At Mystic Seaport Museum pine tar is used for protective coatings on both cordage, oakum, and wood. Standing rigging is inspected regularly and replaced when necessary. When it is wormed, parceled, and server; a mixture of pine tar and varnish[11] is used between the layers to protect the natural fibers, and a final coating is applied which will become hard and shiny when dry. We have also had success re-tarring oakum which has partially dried out.

"Our intent was to create a solution that would be absorbed into the fibers of the oakum in order to preserve the fibers. The mixture also had to be able to dry out sufficiently in the open air and not be "sticky" to the touch.

To a quart of pine tar, add approximately one gallon of paint thinner (we used 'Thin-X' by SCL Sterling Corp. '100% mineral spirits') or more, and thoroughly mix until the tar is good and thin. Into a 5 gallon metal pail, the thinned pine tar was mixed with turpentine - enough added to fill the pail.[12]"

The Museum's use of pine tar as a wood preservative is limited. A soaking oil of turpentine,[13] boiled linseed oil, pine tar, and Japan dryer[14] is used on some work boats and collection vessels. This mixture has been called "Old Down East Deck Coating" by some people. A variation of this coating for a wood preservative below ground eliminates the Japan dryer, and the other three ingredients are of equal measure by volume.

For at least the past decade, we have been purchasing pine tar from Natrochem in Savannah, Georgia. Natrochem's supplier is Auson Chemical Industry, Gsteborg, Sweden. We learned from Auson that they make many grades of pine tar for many different uses, but the product exported to the U.S. is EU-588 [15] (Natrotar 588), and is a "so-called old fashioned type of tar", and is a byproduct of soft wood charcoal production.[16] Today, Auson makes tar mostly from ordinary pine wood, and controls the amount of phenolic substances (pitch, water, acetic acid, and impurities such as

soot and cellulose) by using vacuum distillation which operates at a temperature range of 175-2800 C. Soft wood tars contain resinous, fatty, terpenic ingredients which, when applied on wood, allow the wood to breathe and not rot from within. [17] Auson also receives every year limited quantities of "peasant tar"[18] produced in old fashioned dales. In Sweden, this tar is twice the price of the next lower grade, and it is not usually exported due to the domestic demand.

The continuation of pine tar in the American market place is not dependent on its maritime uses. If it were not for soaps, shampoos, veterinary medicines, and tree limb treatments there would not be enough of a demand for Natrochem to import pine tar in bulk just for maritime uses. Many products which were used only for the repair and maintenance of vessels have been lost forever because the demand for them is not sufficient to keep them in the marketplace. We can only try to support , through use, products that we feel are essential to our field.

FOOTNOTES

[1] Gamble, Thomas. Ed. "How The Famous "Stockholm Tar" of Centuries of Renown Is Made," a 1914 Report. Naval Stores: History, Production, Distribution and Consumption. Savannah: Weekly Naval Stores Review, 1921. 47
[2] ibid. Pg 47
[3] ibid. Pg. 47
[4] Burke, James , Connections. Boston: Little Brown and Company: 1978. 195.
[5] Gamble, Thomas " The Production of Navel Stores in the United States" Thomas Gamble. Ed. Naval Stores: History, Production, Distribution and Consumption. Savannah: Weekly Naval Stores Review, 1921. 78
[6] Hawley, I.F. "The Distillation of Resinous Wood in the Southern States." Thomas Gamble. Ed. Naval Stores: History, Production, Distribution and Consumption. Savannah: Weekly Naval Stores Review, 1921. 251.
[7] ibid. Pg. 251
[8] ibid. . Pg. 251
[9]Smith, Eugene B. "Destructive Distillation of Wood as Applied to the Naval Stores Industry." Thomas Gamble. Ed. Naval Stores: History, Production, Distribution and Consumption. Savannah: Weekly Naval Stores Review, 1921. 253
[10] Hawley, I.F. "The Distillation of Resinous Wood in the Southern States." Thomas Gamble. Ed. Naval Stores: History, Production, Distribution and Consumption. Savannah: Weekly Naval Stores Review, 1921. 251.
[11] 4 parts tar to 1 part varnish by volume[12] Hambidge, Roger ,"Vessel Recaulking June-November 1994" Unpublished notes in Shipyard Documentation Shop, Mystic Seaport Museum.
[13] Type 1, Class 1 - Pure Spirits of Gum Turpentine
[14] 1qt. turpentine, 1 qt. boiled linseed oil, 1/2 pt. pine tar, 1/2 pt. Japan dryer
[15] See appendix for technical data
[16] Auson AB. Product information sheet with Technical data --10-1-1993
[17] Auson information sheet ; 9308/RS
[18] See appendix for technical data

APPENDIX

All information in this appendix has been supplied by Auson AB, Goteborg , Sweden

Wood Tar - Pine Tar General

Wood Tar is a viscous, blackish brown liquid, translucent in thin layers. It has an empyreumatic odor and sharp taste. The chief constituents are volatile terpene oils, neutral oils of high boiling point and high solvency, resin and fatty acids. The proportion of these vary in the different grades of tar, also according to tree species and the part of the tree used, type of carbonization oven ect.... Fat wood tar made from stumps of the pine tree has always been recognized as the best tar, since it contains much of the ingredients which protect the living tree. However, stumps are hard to find and expensive, so ordinary pine wood is mostly used nowadays.

Genuine Pine Tar 588

General: A dark colored, old fashion type of pine tar obtained as a byproduct through destructive distillation of pine wood in the manufacture of charcoal. Thinned with turpentine to a standard viscosity.

Technical data

Density at 20^{o}C	1.05
Water content:	max. 0.5%
Volatile matter	max. 6.0%
Ash content:	max. 0.5%
Viscosity at 50^{o} C	approx. 380 cP
Acidity (as acetic acid)	max. 0.3%
Flash point:	approx. 120^{o}C
Thinner:	Turpentine

Kiln burned Pine Tar 773

General: Golden brown pine tar produced according to the old kiln method from stumps of the pine tree Pinus Silvestris,. Also known as "peasant made" tar. This type of tar is characterized by high resin content (rosin acids and retene), low content of pitch and high purity, i.e. free from soot and other impurities.

Technical data:

Density at 20^{o}C	approx. 1.05
pH value:	approx. 3.5
Reaction with Ca (OH)2	positive
Water content:	approx. 1%
Solubility:	soluble in ethanol, ether and in fixed and volatile oils; slightly soluble in water