

**THE NAVAL STORES INDUSTRY.**

BY DAY ALLEN WILLEY.

The Naval Stores industry is one of the most recent in the United States. It is only during the last decade that turpentine and rosin have been produced in considerable quantities. In 1890 Florida, one of the leading States in the industry, produced less than \$200,000

It is needless to say that the site of this industry is confined to a very small portion of the United States, a great majority of the stills being located in Georgia and Florida adjacent to the forests of yellow and loblolly pine which yield most of these products. While South Carolina contributed a large proportion of the product during the first few years of the industry, its

being made much deeper than actually necessary. In the effort to improve this process, the Bureau of Forestry has introduced what is known as the "cup and gutter" system, by which more sap is saved and the tree less mutilated. Readers of the SCIENTIFIC AMERICAN are familiar with the efforts which have been made in this direction. The Bureau is also making a

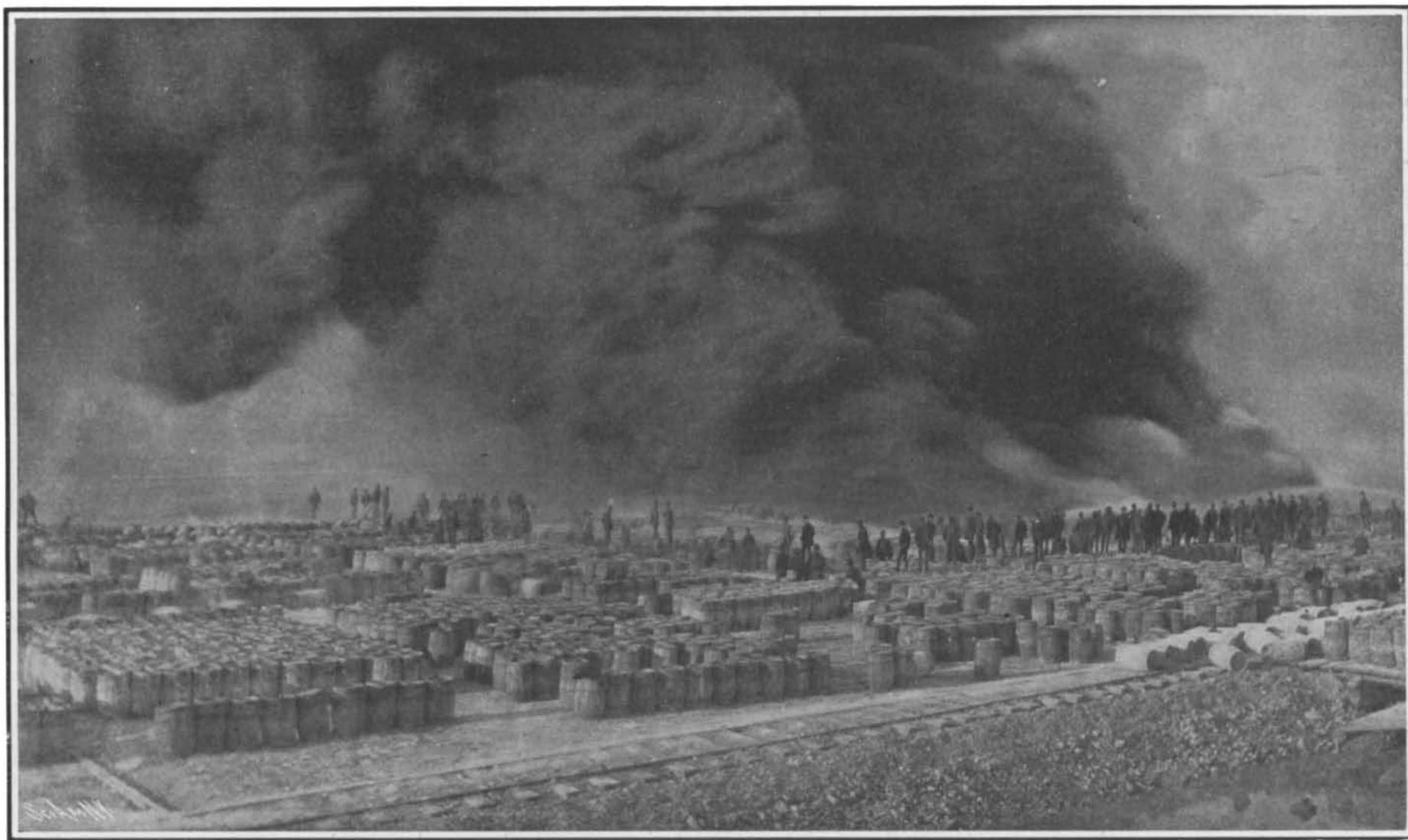
**A Turpentine Forest.****Turpentine and Rosin Ready for Railway Transportation.****Scene at a Turpentine Distillery.**

of spirits and rosin. The latest statistics show the total value of naval stores sent to market in the United States to be about \$25,000,000, which will give an idea of the rapid expansion of the industry since its inception. At the present time about 30,000,000 gallons of spirits of turpentine are being distilled annually, and 3,500,000 barrels of rosin are sent to domestic and foreign markets. While the production of rosin has largely increased, the production of turpentine spirits has been decreasing steadily since the year 1900, when the total output was 38,500,000 gallons, showing an annual falling off of 22 per cent.

quota has been rapidly decreasing. The decline in South Carolina is principally due to the extensive lumbering operations which have stripped the State of the trees especially utilized in turpentine production.

The processes for securing turpentine have been so crude and wasteful that they also form one reason for the large decrease in the quantity of spirits distilled. The method employed in obtaining the turpentine is to make incisions in the trunk of the tree, gathering the sap in the same manner as the sap of the maple is secured. The incisions are frequently so long and deep that the vitality of the tree is greatly affected,

series of elaborate experiments in Florida with the view of ascertaining the effects of various kinds of incisions. These experiments, which were begun in 1905, are being made upon different forests, and already much valuable information has been obtained as to the kinds of incisions which are least injurious and at the same time will permit the maximum quantity of sap to be secured. A certain number of trees under inspection have been cut on one side of the trunk, another series on another side, while incisions have also been made of varying length and depth. As a result of these tests, it has been demonstrated that



**A Turpentine Conflagration in the Shipping Yard.**  
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usually the incisions are much longer and deeper than necessary to obtain the desired flow. Owners of turpentine forests, especially in Florida, have been closely observing the work referred to and already many of them have adopted the government process, while the cup and gutter system is being substituted on a large scale for the former methods.

The many beneficial properties of the sap of the yellow and other species of pine have greatly extended its use in recent years. At the present time about seventeen million gallons are utilized in varnishes and other compounds for covering material. Only in recent years has it been utilized extensively for soap, but now a number of the principal varieties of toilet soap are composed largely of some form of turpentine, while it may be called one of the necessary ingredients of some of the most popular patent medicines.

The advance in the price of pine lumber caused by the great demand for this material for building and other purposes has checked the turpentine industry to a certain extent. Up to ten years ago the comparatively low price obtained for the lumber induced the turpentine farmers to operate very extensively. Since the extraction of the sap from the tree not only hinders its growth, but injures it in other ways, much of the turpentine secured at present comes from the poorer grades of pine, such as the loblolly, and care is taken to save the larger trees of yellow pine from being tapped.

It is interesting to note that in this connection a process has apparently been discovered by which a large quantity of the waste material of pine sawmills can be utilized for the production of turpentine. If the experiments now under progress are successful, the industry may be revolutionized and the direct extraction of sap from trees abandoned. A lumbering company in Florida claims to have secured spirits of turpentine from sawdust and other waste at a maximum cost of thirty cents per gallon. The process of securing the liquid is as follows: First, the small pieces of pine are run through what the lumbermen call a "hog," which grinds the material so that it becomes practically sawdust. With the dust from the other machinery, this material is carried by means of an endless conveyor through the upper part of a still and dropped automatically into the series of retorts. As fast as each retort is filled, steam is applied in such quantities that the turpentine in the form of crude spirits is secured after an hour's treatment. The liquid then passes into a tank with condensed steam, the oil rising to the top. Conveyed to a second still, it then passes through a cooling worm to prevent it from evaporating, and is finally purified in vats especially designed for the purpose.

It is claimed that the quality of the turpentine is such that it can be utilized for practically all purposes for which the spirits obtained in the ordinary way are employed. Apparently the experiment is successful, for at this plant about 4,000 gallons are now produced monthly. Calculations which have been made of the quantity of material required for a gallon of turpentine show that the waste of 500 feet board measure of lumber is sufficient for this quantity. The manufacturers estimate that a cord of low grade pine sawmill dust will yield from five to ten gallons. Trials that have been made with fat light wood show that a cord of this material produced from fifteen to twenty gallons, while yellow pine stumps yield from twenty to thirty gallons to the cord. These figures are of more than passing interest, since they show very clearly that a large amount of stumpage which has been left in the pine forests as practically valueless can be utilized by the process we have described. While the present cost of manufacture is thirty cents a gallon, in all probability this expense can be considerably reduced by the introduction of more improved apparatus.

By far the most significant feature, however, is the fact that such an enormous quantity of waste material instead of being thrown away may become an exceedingly valuable asset and that every sawmill in the yellow pine district of the southern States of this country can have its auxiliary plant if it so chooses for manufacturing turpentine, just as so many cotton gins now have cotton seed oil and fertilizer mills in connection with them for treating what was also a few years ago considered a waste product.

#### More About the \$25,000 Mathematical Prize.

Some months ago we published a brief article in which we called attention to the prize of 100,000 marks (\$25,000) offered by the late Dr. Paul Wolfskehl of Darmstadt for a solution of the Fermat theorem. The prize is to be awarded by the Koenigliche Gesellschaft der Wissenschaften, of Goettingen, Germany. Since many readers of the SCIENTIFIC AMERICAN have expressed a desire to compete for the prize, we publish the following additional and more exhaustive information: Dr. Wolfskehl stated in his will that Fermat (see "Œuvres de Fermat," Paris, 1891, t. I, p. 291, observ. II) had formulated the law that the equation  $x^{\lambda} + y^{\lambda} = z^{\lambda}$  cannot be solved for whole numbers for all exponents  $\lambda$  which are odd prime numbers. This theorem of Fermat's is to be proved either in the general way intended by Fermat or as an extension of Kummer's studies (Crelles Journal, 40, p. 130ff; Abh. der Akad. d. Wis. zu Berlin, 1857) for all possible exponents  $\lambda$ . Additional references are the following: Hilbert's "Theorie der algebraischen Zahlkörper," Jahresbericht der deutschen Mathematiker-Vereinigung IV (1894-95), § 172-173, and Encyclopædie der mathematischen Wissenschaften, Bd. I, teil 2, "Arithmetik und Algebra" (1900-1904), I C 4b, p. 713.

The prize is to be awarded solely by the Koenigliche Gesellschaft der Wissenschaften of Goettingen. Manuscripts will not be accepted. The solutions must be printed either as monographs in periodicals or in pamphlet or book form, so that they can be purchased by any competitor. The Koenigliche Gesellschaft must be provided by the author with at least five such printed solutions. No solution will be considered which is printed in a language unfamiliar to the judges. Translations will be accepted for consideration. The rules do not state that the solutions must necessarily be written in German, and since most scientists are familiar with English we presume that printed Eng-

lish dissertations will be considered. Should the successful solution be the work of several collaborators or inspired by the work of several mathematicians, the Gesellschaft will divide the prize as it may deem advisable.

The prize will be awarded not sooner than two years after the publication of the successful solution by the Gesellschaft. This period of two years is stipulated in order that the mathematicians of the world may have an opportunity of verifying the correctness of the solution which has won the prize.

If the prize is not awarded by September 13, 2007, no further claim will be considered.

Since the solutions must be submitted in pamphlet or periodical form, the Editor of the SCIENTIFIC AMERICAN SUPPLEMENT has decided to open his columns to those contestants whose solutions have not already been printed and who may wish to submit copies of the SUPPLEMENT containing their solutions to the Gesellschaft. His space is so limited, however, that he cannot promise to publish all solutions sent to him.

#### Sugar as a Disinfectant.

In many parts of Europe it is customary among the people to burn sugar in sick rooms, a practice which is considered by physicians as an innocent superstition, neither beneficial nor harmful. Prof. Trilbert, of the Pasteur Institute at Paris, has, however, demonstrated recently that burning sugar develops formic acetylene-hydrogen, one of the most powerful antiseptic gases known. Five grammes of sugar (77.16 grains) were burned under a glass bell holding 10 quarts. After the vapor had cooled bacilli of typhus, tuberculosis, cholera, smallpox, etc., were placed in the bell in open glass tubes and within half an hour all the microbes were dead. If sugar is burnt in a closed vessel containing putrid meat or the contents of

rotten eggs, the offensive odor disappears at once. The popular faith in the disinfecting qualities of burnt sugar appears, therefore, as well founded.

#### Coal Mining in China.

Interesting information about Chinese coal mines is contained in a report by the commercial attaché of the British embassy at Peking.

Little is known concerning the operation of the Manchurian mines granted by Japan to the South Manchurian railway company. The fact that no coal from these mines reaches Newchang indicates that their entire product is taken by the railway and local consumers. This coal is of excellent quality. A great deal of coal is mined by the Chinese in the province of Shansi. Coke made at one of these mines is used in the mint at Tientsin.

The three mines of the Chinese Engineering and Mining Company, northeast of Tientsin, produced nearly one million tons in 1906. These mines supply the Northern Railway and steamers and local consumers throughout northern China and part of Manchuria.

In 1905 a mine in Honan, in which a vein thirteen feet thick had been opened, was flooded so badly that it was necessary to send to England for additional pumping machinery. The coal of this vein proved too friable for use, but a vein of good quality ten feet thick was found at a lower level. In 1906, the Shantung Mining Company extracted 163,000 tons of coal from its Fang-tzu collieries. This company operates a briquette factory and one of the few coal washers in the Far East, with a capacity of 150 tons per hour.

In Kiangsi are hundreds of coal mines operated by the most primitive methods. Near the Hunan frontier, however, are mines operated under the direction of German mining engineers and connected with the Siang River by a railway 200 miles long. These mines were opened in 1908 for the purpose of supplying the forges and steel works of Hangang, which had been greatly developed under German management. Their output, which can be increased to 3,000 tons per day, is now 1,000 tons, most of which is converted into coke. The main shaft is 13 feet in diameter and 375 feet deep. Two veins are being worked, at depths of 160 and 320 feet. The main gallery is 3,000 feet long and the hauling is done by electric locomotives. It is estimated that this district of Ping-siang contains 300 million tons, of which the greater part can be extracted through

galleries and the remainder can be reached by a shaft 650 feet deep. Attached to these mines are 174 coke ovens, a briquette factory, a fire-brick factory, a foundry, coal washers, etc. From the railway terminus at Chuchow the coal and coke are conveyed to Hangang in towboats and junks. The Ping-siang Coal Mining Company has achieved a brilliant success in the face of enormous difficulties, and it deserves great credit for the introduction of European methods into a primitive land.

The following table of the annual production of coal in China is condensed from a table compiled in 1906 by Prof. Drake, of the Imperial University of Tien-tsin.

Province.	Annual Prod. in tons.		Total.
	Mines owned by Europeans.	Mines owned by Chinese.	
Chili . . . . .	1,200,000	1,000,000	2,200,000
Shansi . . . . .	—	3,000,000	3,000,000
Shantung . . . . .	300,000	500,000	800,000
Honan . . . . .	100,000	700,000	800,000
Other Prov. . . . .	230,000	1,860,000	2,090,000
Total . . . . .	1,830,000	7,060,000	8,890,000

#### Lower Postal Rates to England.

October first witnessed a heavy increase in mail for Great Britain and Ireland, the rate changing from 5 cents to 2 cents an ounce at midnight. It is too early as yet to tell what the volume of increase will be, as there are always large accumulations of mail matter held back when there is any change in a postal rate. A big annual saving will be effected in thousands of concerns who do a large foreign business. It is hoped that other countries will fall in line, and make similar arrangements.



**Turpentine on the Wharf Ready for Shipment.**  
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