

Of resinous wood, 192,000 cords were distilled in 1910, which cost £837,000, and resulted in products worth about £1,791,000. While the industry is comparatively new in the United States, and methods are not well standardized, it is attracting much attention, and promises to play a very important part in utilizing the waste occurring in the lumbering of southern pines. Two general classes of processes are used.

Destructive Distillation.—The largest portion of resinous woods at present used in the destructive distillation processes consists of "lightwood" from the long-leaf pine. Stumpwood from the same species has been used also to some extent, but the lightwood from dead trunks is commonly used, since the stumpwood is more difficult to collect and prepare.

Extraction.—Not only the highly resinous "lightwood," but also material such as sawdust, slabs, and other mill waste from long-leaf pine, which on account of its comparatively small resin-content cannot be economically used in the destructive distillation processes, may be extracted with steam for the recovery of turpentine and other volatile oils. Another method which has recently attracted considerable attention is extraction with a volatile solvent after steaming: this method recovers the rosin in addition to the volatile oils.

"Naval Stores," or Turpentine and Rosin.

Here the study of new species and the refinement of operations is the main purpose of the investigative work. The production of turpentine and rosin continues to be an important industry in the long-leaf pine region, the value of the products annually produced being in the vicinity of £5,000,000. Under the methods of operation most commonly used there is a considerable loss of possible products owing to unscientific methods of tapping the trees and collecting the gum. Other species than long-leaf pine may prove of value for the production of naval stores.

Other products which are derived from forest material are being investigated, such as the production of ethyl-alcohol, which is considered as one of the most promising means for profitably utilizing wood waste. It has long been known that wood cellulose can be converted into fermentable sugars by treatment with acids, and a number of attempts have been made and are being made to apply this principle commercially in the production of commercial alcohol from sawdust. From the commercial standpoint such a venture is highly speculative at the present time. For the purpose of ascertaining whether the production of ethyl-alcohol from sawdust is feasible commercially, and what are the best methods of procedure, apparatus has been installed to conduct experiments on a semi-commercial scale. A number of difficulties are encountered in the design of such apparatus because of the corrosive action of the chemicals which are employed, especially at the high temperatures necessary in the process.

ORCHARDING THE KAURI-TREE FOR RESIN.

In last year's report I gave it as my opinion that the bleeding or orcharding of the kauri in the State forests under proper management and on scientific lines offered a field for profitable exploitation. When in America last year I made it my business to acquire information having a bearing on the subject. I had also the opportunity of fully discussing the matter with the expert officers of the United States Department of Agriculture, who gave me the fullest information of what was being done in the orcharding or tapping trees in the United States for the production of rosin and turpentine. The result of my inquiries confirms the opinions expressed in my last report, and I propose during this year to submit for your consideration definite proposals with a view to giving the system a trial.

In another part of this report I have referred to the magnitude of the "naval stores" industry in the United States. Pitch and tar were the chief products of the industry up to the middle of the eighteenth century, and the extensive use of these products in the construction and maintenance of sailing-vessels caused them to be called "naval stores," the distinctive term now applied to the turpentine and rosin industry which has supplanted the production of tar and pitch.

The business of producing naval stores is somewhat unique among American industries, in the respect that there has been practically no change in the methods of production since the commencement of the industry over a hundred years ago. In this particular the industry bears resemblance to our kauri-gum industry.

Resin suitable for the production of naval stores is found only in coniferous trees; moreover, only pines yield resin abundantly, and of these only two species, long-leaf (*Pinus palustris*) and slash-pine (*Pinus heterophylla*) are "tapped" in the United States.

"No universally accepted theory dealing with the formation of resin has yet been advanced. It is generally conceded, however, that resin is formed as a *by-product during the transformation of food materials, such as starch, into woody tissue*. The resin is stored in two systems of elongated passages or resin-ducts. In one system the ducts are parallel to the pith of the tree; in the other they lie horizontally in radial planes. The ducts form in the growing tissue or cambium layer just beneath the bark, the two systems intersecting to form a continuous network of resinous passages." Here we have in the words italicized a declaration by eminent authorities that the resin is only a by-product formed during the transformation of food materials into woody tissue. This is of great importance in the consideration of the question of tapping the kauri for its resin.

It is often stated that bleeding the kauri would injuriously affect the timber if used subsequently for building purposes. The United States authorities before quoted in regard to this