

the last three years on some 80,000 trees.

"By this method it is calculated that:

"1. A crop of trees may be worked continuously for fifteen to twenty years, instead of, as at present, for four years. At the end of this period the same trees may be worked for another equal term of years, provided the utmost capacity of these trees needs to be made use of before lumbering.

"2. From 22 to 25 per cent of turpentine (the naval stores product of greatest value) is obtained, in place of from 19 to 20 per cent, yielded from present (old and new) methods.

"3. The vitality of the trees worked is conserved in the very greatest degree, because the injury from chipping or tapping is reduced to a minimum. Little injury to the trees is a factor in the greater production of turpentine, because the trees being more vigorous, yield a continuously strong flow of crude resin. The greater injury of the trees worked under the older system weakens their vigor and causes them to yield resin less and less copiously each succeeding year.

"This system consists in the use of clay receptacles and metal gutters for collecting the crude resin, and the application of uniformly shallow chipping in place of the generally practiced deep chipping.

"The three exceedingly important points of economy in this method are: (1) Greatly increased term of operation; (2) greatly increased product, and (3) the fullest possible conservation of the growth, energy and vitality of the trees.

"The high productiveness made possible and the practically indefinitely prolonged operation without change of base in one location are the principal factors sought in establishing permanent naval stores production. Both factors are commercially attractive to the individual operator who must realize profit in his own lifetime. A permanent industry and the greatest conservation of the forest under naval stores production are also directly effected.

"It is possible now to prolong the working period of the forest without change of base, because the new method requires the cutting away each year of only from three and one-half to four inches in height of the usable trunk, while in the older systems of chipping or tapping from fifteen to sixteen inches in height were cut away each season.

"It has long been believed by operators that severely deep chipping each week must be resorted to in order to stimulate the fullest flow of crude resin. The service's experiments have proven, however, that extremely shallow chipping gives the greatest possible flow of crude resin, while the crude resin from such shallow chipping yields a larger percentage (approximately 5%) of turpentine than resin from deeply chipped trees.

"By special training chippers can put very much shallower 'streaks' on the trees each week than are commonly cut with the ordinary 'turpentine hack.' The best possible saving with this tool is something over one year in three, or nearly two years in four, thus extending the usual working period of a forest from four years to six years. Even this shallow chipping was, however, found to be unnecessarily severe. But the limit of perfection is soon reached for this ancient tool because control of the cut is dependent entirely upon the personal skill of the chipper, and this cannot be made as perfect as is necessary for the

fullest economy in chipping.

#### How the Shallowest Chipping Is Accomplished by Use of a Newly Invented Hack.

"A new turpentine hack has been invented, through directions of Forest Service experts, which affords perfect control of the depth and width of the 'streak' cut. The skill of the chipper is not, as in the use of the old hack, a factor in cutting a shallow streak with this tool. A uniformly shallow chip can be taken off, thus making it possible to treat every tree alike and to cut the trees sufficiently only to stimulate each week a full flow of crude resin. Limited experiments indicate that a full yield of crude resin may be obtained by chipping the trees only from three-eighths to one-half of an inch in depth, and in height only from one one-eighth to three-sixteenths of an inch. The common practice is to cut a streak from one to one and one-half inches deep and from one-fourth to one-half of an inch high each week.

"An important feature of this tool is that, when it is fully perfected, it can be applied to the tree in practically the same manner as the old hack. This will make it unnecessary for chippers to acquire the use of a new instrument—a nearly impossible accomplishment because of deep prejudice among turpentine laborers.

"This tool is not in use by turpentine operators for the reason that, while the working principle of the invention is established, considerable experimentation is required to perfect the detail working of the tool. Moreover, the service has not yet published the practical results of its study of shallow chipping. The publication and distribution of these results is to take place shortly. With full knowledge, then, of the special advantages offered by the use of a shallow cutting hack it is moderately certain that the service's new and highly conservative method of turpentine will be generally accepted.

#### Further Conservation of Product Possible by New System of Gathering Crude Resin.

"Studies by the Forest Service indicate that from 5 to 6 per cent more turpentine is yielded by crude resin gathered every two weeks than from the resin gathered once in four weeks. When gathered once a month, the long exposure to the air results in an appreciable loss of turpentine by evaporation. The added expense of more frequent gathering is trivial compared with the percentage of profit added by the increased yield of turpentine. (These studies, only indicative now of probable results, must be carried further before a positive statement of the possible gain can be made.)

#### Increased Product by Consistent Use of All Naval Stores Producing Pines Not Now Employed.

"At present only two pines, the longleaf and slash pines, produce this country's naval stores. The service's study during the past three years of the distinguishing characters of the resins of native pines shows that three more forest-forming pines of the South (loblolly, short-leaf and Virginia pines) yield naval stores in quantities equal to those of the longleaf and slash pines. These untried species, generally held by operators to be non-producing, form large forests in the South Atlantic and Gulf States as far west as Eastern Texas and northward into Missouri. Their use for this production would augment the country's present resources very considerably, and would, in addition, extend

the industry into States never before yielding naval stores, and serve also to restore in some measure the industry to States which have ceased producing. It is impossible now to determine what percentage of increase this addition to the resources will add. With the very probable return, by encouraged natural propagation, of these untried pines to areas from which they have been lumbered—unquestionably a wise policy—a still greater naval stores resource will certainly be added in the future.

"Similar studies by the Forest Service have recently determined that the forest-forming Western yellow pine yields naval stores in quality and quantities comparable with the standard long-leaf and slash pines of the South. The addition of this tree, which forms extensive forests both in the Rocky Mountain and Pacific Slope States, as a producer will give to Western

United States a new industry, the value of which cannot be adequately estimated. Development of it will require demonstrations by the Forest Service of a special method of tapping the trees and the amount of commercial product obtainable. This work is distinctly for the Forest Service to undertake on a sufficiently large scale to show what may be expected in that region, which in topography and in the character of its resin-producing pine

is so different from the South that the system of turpentine now practiced in the latter region will require special modifications for application in the West.

#### Future Stability of Naval Stores Industry.

"Future stability of the naval stores industry in this country depends upon three factors:

"1. Complete application in all naval stores producing forests of the most conservative system of exploitation.

"2. Use throughout the country of all naval stores producing pines.

"3. Systematic working of forests for naval stores in co-ordination with lumbering operations.

"4. Effective fire protection.

#### Complete Application of the Most Conservative System of Exploitation.

"Experience of the last half century has shown clearly, in the case of Virginia, the Carolinas and Georgia, that application of so wasteful and severely injurious a system of turpentine as the ancient box method results in exhausting the producing forest at such a rapid rate and in such a short period as to preclude all possibility of permanent naval stores production under that system in any given region. Under such a short-sighted policy and system continuance of the industry is clearly a question, not of established permanent production throughout the regularly maintained forest of the country, as in the case of wheat and other staple productions which become fixed resources of suitable sections of the country, of how long the country as a whole will continue to produce naval stores. Continuance of production is then dependent chiefly upon how long the suitable species of virgin timber of the country will last.

"The center of greatest production, beginning at the northeast part of the southern pine forest, has gradually proceeded southward in the Atlantic region to the working limit of this turpentine pine belt. The center of greatest production has, to be sure, gone southward with the development of the southern country, but its progression had been like that of a great and consuming forest fire. A stable industry—a resource—naval stores production

has not been left along the line of its march. Like the forest fire, it has been transient, flourishing only so long as round virgin timber remained to feed the flames of its turpentine 'stills.' The timber exhausted—worked out—new stills sprang up farther and farther southward in the great pine belt. New centers of business activity were formed and those in the rear died out. The forest that once gave support is gone or depleted beyond profit for the turpentine operator using the old system. Just as the lumbermen of the Great Lakes pine belt have been forced to go to the untouched forests of the Northwest, so the naval stores producer of the South has gone farther and farther southward. The Georgia operator is now in Florida, the center of greatest supply, where he is producing heavily. Soon he will be obliged to look westward to the end of the Gulf pine forest.

"The production by so wasteful a method that permanency is impossible, and through which the end of production for the country can be so clearly seen, is inconsistent with the possible permanent development of one of the South's greatest resources.

"Use of the most conservative system of turpentine is imperative, therefore, for two reasons:

"1. To build up a permanent local production wherever a wise forest policy for that section makes it advisable to maintain continuously naval stores and timber producing forest.

"2. In order to prevent degradation, through the present too rapid exhaustion of existing old forest, of a first rank industry to a position of unimportance.

"Approximately 20 per cent of the sound timber of the South is still unworked for this purpose. Application to this timber of the latest improved system of turpentine will permit it to be worked for twenty-five years before lumbering and will go far toward staying the present rapid and premature exhaustion of a great naval stores resource. Continued local production, which is greatly needed for the permanent upbuilding of otherwise resourceless sections, will also be encouraged and eventually established.

#### Use of all Naval Stores Producing Pines.

"Just as in the sphere of agriculture, there exists, for the sake of the highest economy in production for every region, the necessity of growing as many different kinds of useful crops as possible, so in the field of naval stores production it is imperative that all producing pines and other conifers be fully exploited for this product. In bringing this about, the most important principle of industrial economy would be fulfilled—the utmost development and utilization of existing resources.

#### Systematic Working of Naval Stores Forests in Co-Ordination with Subsequent Lumber Operations.

"Co-ordination of naval stores operations with the lumber operations which follow is looked to but little at present in the exploitation of pine timber forests capable of yielding two such valuable products. That by careful attention to the proper sequence of rotation of these industries in a given forest the fullest economy in productiveness can be practiced is not to be questioned.

"The presence of apparently unlimited timber supplies for pursuing both industries independently has been sufficient justification in the past. Now, however, with greatly decreased supplies of naval stores forests and enormously increased annual