

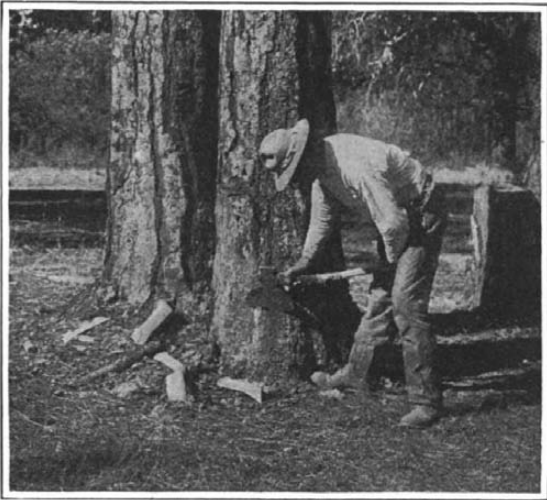
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CX]
NUMBER 9.]

NEW YORK, FEBRUARY 28, 1914

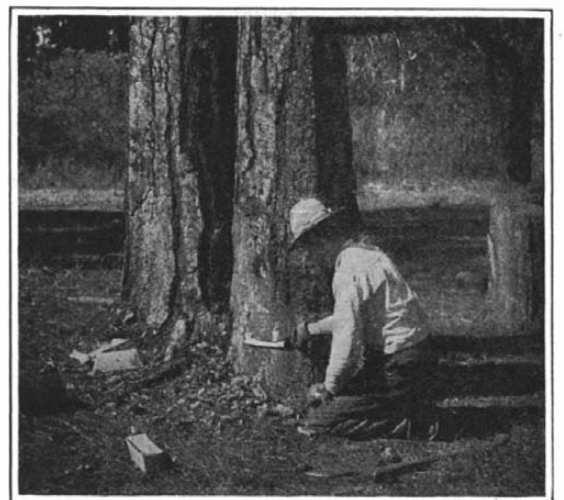
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Method of removing the outer bark in preparation for setting the apron and the cup for a flow.



Streaking or chipping. Starting the face. Note the nail (below the apron) upon which the cup is set.



Showing the method of setting the apron in orchard turpentine after removal of the bark of the tree.

Prolonging the Naval Stores Industry

By Samuel J. Record, Assistant Professor of Forest Products, Yale University

THE future of the naval stores industry in the United States is a matter of grave concern. Wasteful methods of boxing and chipping are carried on in advance of logging operations and no provision is made for continual production. Long leaf and Cuban pines of the South have long been the chief source of the world's resin supply, but the stands of these trees are rapidly being cut. The demand for naval stores, however, is increasing, and this has led to the boxing of smaller trees and of species which formerly were not considered worth while. With depletion of the forests the industry has advanced farther and farther west until practically the whole range of long leaf pine has been covered. There is no other region to exploit unless it be the far West. Investigations of the yield of resin from western pines indicate a possible future for the naval stores industry, but it can never approach conditions in the south Atlantic States.

Decrease in supply has also stimulated the distillation of pine wood and while there is considerable prejudice against the turpentine thus obtained it nevertheless has a promising future. Improved methods of distillation are coming into use which overcome most of the objections to wood spirit.

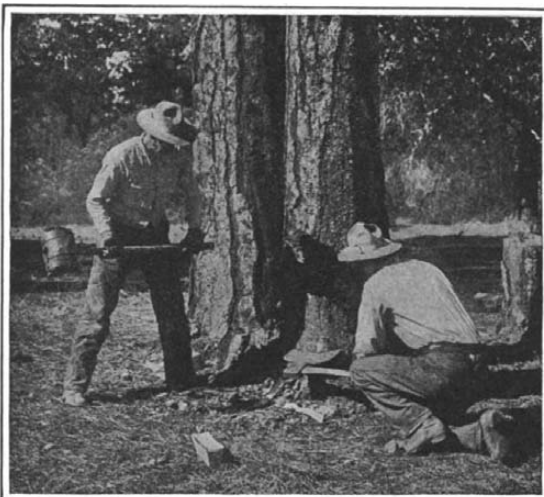
For ten years the United States Forest Service has been experimenting with improved methods of turpentine orcharding. Instead of the destructive box cut into the base of the tree, thereby weakening it and rendering it particularly liable to fire damage, a system of cups and gutters was shown to be successful. The adoption of this method has been slow and even at the present time the old way is still common.

The next important feature of turpentine presenting itself for investigation was in regard to the proper depth, width and height of the wound made on a tree in chipping. Some of the results of the comparative experiments conducted on a commercial scale under normal conditions demonstrate that combined shallow and narrow chipping increases the yield; that the number of trees killed is decreased; and that the damage to the lumber in the butt cut of chipped trees is reduced.

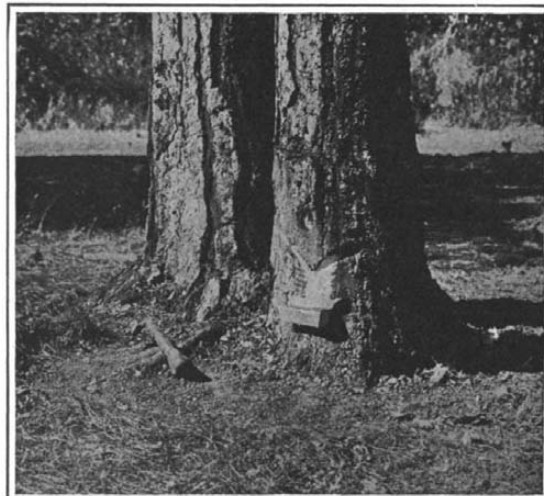
Light cupping, that is, restricting the operation to timber over twelve inches in diameter, and closely limiting the number of cups per tree, has proved to be highly advantageous since it prolongs the period during which a crop can be worked and by exempting the young trees prevents the exhaustion of the timber available for turpentine in future, thus assuring stability and perpetuity to the naval stores industry.

Resin will not continue to flow indefinitely from a cut, hence frequent chipping (once a week or oftener) throughout the season is necessary to maintain the flow. Cuban pine bleeds much longer than any others, producing almost no "scrape." The thickness or rather the height of the chip taken off determines the rate of advance of the face up the tree. The more cut off at a

time the sooner the face will get beyond the reach of the chipper. It has been demonstrated that a thin shaving will accomplish as good or even better results than a heavy cut. With the ordinary hack, however, this is difficult to regulate, and a new hack has been invented which works on the principle of a safety razor. The thickness of chip can be gaged accurately even



The operation of making the groove in the tree. The concave ax employed for setting the apron.



A fairly typical face. The hack, which shaves on the principle of a safety razor, lies beside the tree.

after repeated sharpening of the hack blade. It is so made that the inside edge is flat instead of curved, thus leaving the cut face smooth instead of scalloped. This facilitates the flow of resin into the cups.

The question of running the face spirally instead of straight up the side of the tree is being considered. The advantage of the spiral would be in extending the

length of time a tree could be chipped before the face got beyond reach of the long-handled hack. It might at first appear that the effect of a spiral face would be to girdle the tree as soon as it had extended entirely around. Such is not the case, however, since the movement of the sap is not in straight lines, but from one cell to another through pits in the side walls. The sap stream would accordingly follow the spiral of uninjured wood without material interruption.

A method of resin gathering for which a great deal has been claimed consists of boring slanting holes in the sapwood and draining the resin into a closed cup. This was supposed to prevent the closing of the resin ducts by oxidation of the resin, thus permitting a continuous flow. This and similar methods fail to take into account the physiological processes involved in resin formation.

Resin is a waste product resulting from the vital processes of growth. It is not, as many assert, a healing balsam especially produced by the tree to protect wounds; such a function of it being purely incidental. In the change of starch into exactly the kind of food the plant wants a complex substance is left over as a by-product. This is called resin and is found in parenchyma cells since they alternately store up and give out starch and other plant food, according to the season.

If several resin cells or parenchyma cells are close together the amount of by-product (resin) becomes too large to be contained in the cells and is excreted into intercellular spaces. Such spaces are known as resin ducts and are characteristic of the wood of our pines, spruces, larches and Douglas fir. Most of them extend up and down the stem, but many occur in the large medullary rays. These ducts are for use in the storage of resin and not for its transfer from one part of a tree to another. In this function as well as the absence of a wall of their own they differ from the vessels of hardwoods. None of our hardwoods contain resin ducts in the wood, though many species of *Dipterocarpaceae* in the Philippines are so characterized. The milk of dandelion, of milkweed, and the latex of rubber trees is also a by-product similar to resin in formation.

In tapping a tree comparatively little resin is actually secured from the ducts already in the wood. The main flow is not out of the old ducts like sap out of cut vessels, but is from new ducts which arise as a consequence of the injury. Wounding, such as chipping, stimulates the vital processes at the seat of injury and greatly increases the by-product, resin; and in consequence there is an increase in the number of ducts necessary to contain it. It is from these secondary ducts that most of the commercial yield of turpentine is secured.

The first wound results in the formation of a number of new or secondary resin ducts from both above and below the injury, the length of those above being greater than those below. Subsequent chipping of course affects only the upper edge of the first wound. The first wound is usually made in winter when all hands are engaged either in placing the cups on the

(Concluded on page 186.)



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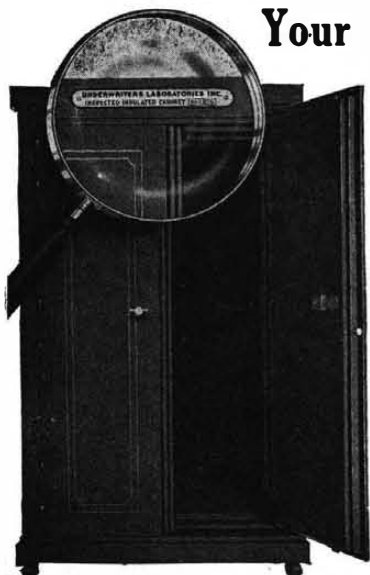
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A Triumphant Struggle With a Beetle

(Concluded from page 180.)

proportion of infections was very small. If 100 sound larvæ were imprisoned in a salmon case with say 20 infected ones and fed on rotting materials, no more than six or eight of the sound larvæ would, during these early days of experiment, be attacked by the fungus. From his own experiences with these beetles, and with this fungus, Dr. Doane did not see much relief in that direction, and so reported. However, Dr. Frederichs continued his patient labors and eventually he bred new habits into the fungus, created a new appetite for the living larvæ of the beetle, and at last produced such a virulent fungus, that when five or six infected beetles are confined with one hundred sound ones, 98 per cent or more will soon find themselves in trouble.

It has now become the custom in German Samoa to carry infected rubbish and beetle larvæ to the outdoor "Tumus," and deposit it in them, and as one of these is placed on every acre of coconut lands, and as the mother beetles are very fond of these artificial nests, nearly all of the eggs deposited come to nothing at all.

The strength and efficiency of this fungus has now so greatly increased that many of the mother beetles coming to oviposit are themselves attacked and they fly away with enough of the infection to poison the galleries in the coconut trees and spread the contagion among their neighbors.

The Samoans who under the law gather beetles and larvæ every Monday morning are now bringing in quantities of fungus-fed beetles, and the plague is very much abating.

Here in the islands we regard this achievement as a remarkable one; and as this means of combating the greatest enemy the coconut tree has, ought to be known in all tropical countries, we send it to the SCIENTIFIC AMERICAN, which circulates everywhere, and whose word is taken as emphatic and dependable.

Prolonging the Naval Stores Industry

(Concluded from page 173.)

trees or in cutting the boxes preparatory for the next season's flow. As a result of this work a certain amount of crude turpentine is collected during the winter, but it is almost entirely from ducts already in the wood and not from secondary ones. The flow of this resin does not continue very long, for the wound becomes clogged, presumably from oxidation and crystallization of the resin, and the flow ceases.

The secondary resin ducts formed above the wound are filled with resin which has no opportunity to escape until a thin chip is cut off. When this is done the flow is much more vigorous than from the original wound. In about a week, however, clogging up occurs again and another chip must be removed. As this wound extends slowly up the tree new or secondary ducts keep pace with it. If too large a chip is cut the productive secondary ducts are cut off and the run materially lessened.

Failure to understand the physiology of resin formation and to adjust the methods of turpentine orcharding to it has resulted in untold losses and a very serious depletion of a valuable resource. It is also responsible for one of the chief criticisms against the cup and gutter system. It is a common experience that, although the total yield from the first year of the operation is greater than under the box system, nevertheless an unusually large number of weekly chippings has been found necessary to secure the first dipping from cups—six to seven chippings as compared to four under the box system.

In the light of the above explanation of the formation of secondary resin ducts this shortcoming is readily explained and avoided. Under the box system the boxes are cut during the winter and the trees are "cornered," that is with the upper edge of the face ready for chipping. The new ducts form, the first chip opens them up the full length of the cut and a good run is at once secured. In placing cups, however, the common practice has been

LEGAL NOTICES

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If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

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Inquiry No. 9355. Wanted the name and address of the maker of triplex glass.

Inquiry No. 9356. Wanted the name and address of a manufacturer who can build an automobile wheel, also a cigar vending machine. Concerns in the middle West preferred.

Inquiry No. 9357. Wanted the name and address of a manufacturer of a machine for scalloped paper favors and cups.

Inquiry No. 9358. Wanted the name and address of maker of a machine to cut all granulate leather.

Inquiry No. 9359. Wanted the name and address of a firm that makes razor blades for all makes of safety razors.

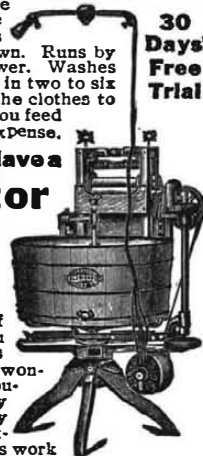
Inquiry No. 9360. Wanted the name and address of parties making pipe fittings such as ferrules, stems and bowls such as could be used in the making up of calabash pipes for smoking.

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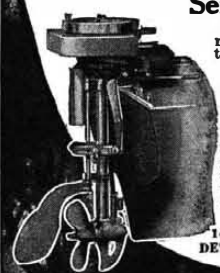
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3 H.P.
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to make with the broad ax two flat faces, meeting at the center, on which the cuts for insertion of the gutters are made. The upper portions of these faces have oval outlines instead of straight as in the preceding case. The resin ducts formed follow the curved upper edges of the faces. The first chipping is made from each side to the center, and the result is that instead of the new ducts being opened up along the entire cut, only those near the middle of the face are cut. Naturally the flow at first is considerably less than where the trees are "cornered."

The solution of the difficulty presents itself immediately the cause is understood. During the winter months, when the gutters are placed upon the trees, the chipper should make a regular chipping the full width of the face. Secondary resin ducts will form along the entire length of this cut and the first application of the hack in the spring will start them all to flowing at once. Actual tests have demonstrated the correctness of the theory and resulted in a gain of one extra dipping or about thirty barrels of crude turpentine per crop of 10,000 cups. The saving to the entire industry is enormous.

French turpentine is considered superior to American. It is obtained from maritime pine (*Pinus maritima*), which produces a resin yielding 25 per cent turpentine as compared to 17 per cent for long leaf pine. The tree has the ability to grow rapidly on poor sandy soils. The United States Forest Service is now experimenting with it in Florida, and the prospects are so far very promising. Maritime pine grows more rapidly than loblolly and produces more resin than long leaf. It attains size large enough to cup in thirty years as compared to one hundred years for long leaf. There are large areas of cheap land in the South which are well adapted to its growth in case the experimental plantations fulfill their present promise of success.

The Heavens in March

(Concluded from page 182.)

The Planets.

Mercury is evening star until the 10th, when he passes through inferior conjunction and becomes a morning star; but he can only be well seen at the very end of the month, when he rises an hour before the Sun.

Venus is evening star, and is coming into sight again, so that by the end of March she sets an hour later than the Sun, and is easily seen.

Mars is in Gemini, long past opposition, but still about as bright as Procyon. During the month he moves eastward about 10 degrees, and his motion can easily be followed with the naked eye, even from night to night, especially on about the 8th, when he passes about 1 degree north of the third magnitude star ϵ Geminorum.

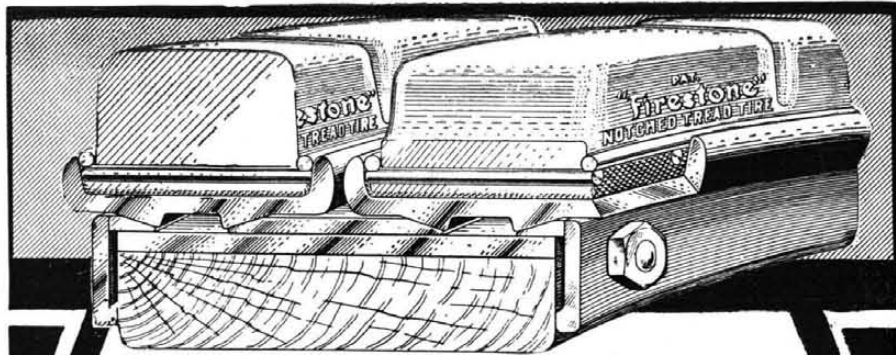
Jupiter is a morning star in Capricornus, rising about 4:30 A. M. in the middle of the month. Saturn is in quadrature with the Sun on the 2nd, and after this counts as an evening star, though he remains visible till about 1:20 A. M. at the beginning of the month, and 11:30 P. M. at its close.

Uranus is a morning star in Capricornus. At 4 A. M. on the morning of the 4th he is in conjunction with Jupiter, being south of the brighter planet, at a distance of only nine minutes of arc. The two planets will be separable only with the aid of a field-glass, and Uranus will appear about as near Jupiter as his own satellites, but in quite a different direction. Unfortunately, this interesting conjunction can only be observed under rather unfavorable conditions, at about 5 A. M.

Neptune is in Gemini, and crosses the meridian a little after 8 P. M. in the middle of the month.

The Moon.

First quarter occurs at midnight on the 4th, full Moon at 11 P. M. on the 11th, last quarter at 3 P. M. on the 18th, and new Moon at 1 P. M. on the 26th. The Moon is nearest us on the 12th, and remotest on the 27th. She is in conjunction with Saturn on the 4th, Mars on the 6th (pretty closely), Neptune on the 8th, Uranus on



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