CLEARING PINE LANDS.

By E. B. FERRIS.

Fig 1.—The Day Boring Machine.

AGRICULTURAL COLLEGE, MISSISSIPPI.

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C. T. AMES ............................................................... Assistant Director, Holly Springs Station
G. B. WALKER ............................................................ Assistant Director, Delta Station
CLEARING PINE LANDS.*

By E. B. FERRIS.

Introduction—Practically one-third of the area of Mississippi is embraced in what is known as the Long-Leaf Pine Belt, so called because the soils have now, or once had, a growth of long-leaf pine on them. Large portions of many of the other states bordering on the Atlantic Ocean and Gulf of Mexico are, or once were, covered with this long-leaf pine. The clearing of these lands for agricultural purposes is quite a problem in this state at the present time when so many of them have been denuded of their growth of timber and await development at the hands of the farmer. There is no longer a doubt but that the most of them, when cleared and properly handled, will make among the most valuable farm lands in the state, but the cost of clearing (largely that of removing the stumps) has discouraged many a prospective settler.

As a rule it is quite an easy matter to get these lands free from logs and tree-tops, the saw mills use everything that will make merchantable lumber and in many instances, when the lands are reasonably near a railroad, the wood and charcoal men will use everything else, leaving practically nothing in the way of the plow except the stumps. The removal of these stumps is really the serious problem about clearing pine lands, for unlike the hardwoods and many other pines, the stumps of the long-leaf pine do not decay very fast, many of them being almost as resistant to decay as bronze.

Cultivating Pine Lands.—Heretofore a great deal of the land in this section of the state has been cultivated without first removing the stumps. The surface roots of the pine are very brittle and except for the stump and its tap root it is comparatively easy to cultivate pine lands even for the first year. As a rule the majority of the small farmers in this section depend on a single mule and Georgia stock to do their breaking and cultivating and have not been handicapped by the stumps as they will be when more up-to-date methods are adopted. If, however, the farmer considers his own and the labor of his family as being worth very much, he will find that he cultivates stump lands at a great sacrifice and that there is nothing more than a bare living to be made at it. There are several reasons why this is true, as follows:

1. He cannot by the use of improved implements and machinery substitute mule power for man power in cultivating and har- 

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vesting his crops and the day is past when the hoe and scythe can compete with the cultivator and reaper even in the South.

2. Yields will be reduced each year from ten to twenty per cent by space lost on account of the stumps. The average land in this section will have about one hundred stumps to the acre and a space of easily fifty square feet is lost around each stump.

3. Grass is sure to grow around these stumps unless hoes are used to remove it during the entire year, and in doing so grass seeds are scattered over the entire field, necessitating a lot of hoe work with every crop.

Removing Stumps—The McNeill Experiment Station has removed the stumps from one hundred acres of land, using all known methods, and keeping sufficient data to determine approximately the cost by each method. Fifty acres of this land was cultivated several years before removing the stumps and this experience led us to the conclusion, expressed elsewhere, that it is far better to remove the stumps before the land is put into cultivation. This is true because the lands cannot be cultivated economically with the stumps on them and also because the tree-tops, knots, etc., on the uncleared land will serve as fuel for burning the stumps and save the cost of hauling it.

Digging and Cutting.—This is a sure method of removing the stumps if persisted in, but under our conditions has proved the most expensive one except for stumps ten inches or less in diameter, or for certain lands that have been in cultivation a long time and are partially decayed. In clearing land here we have found many stumps on every acre that would require five hours to the stump to dig around and to cut off eight inches beneath the surface of the ground.

 Burning.—So far the methods that have been used most successfully in getting rid of these stumps necessitate the use of fire to destroy them, for while the potential value of a fat pine stump is considerable, the cost of getting them to a still and of converting them into turpentine and other by-products is generally greater than the business will stand. Doubtless the time is not far distant when these lands will be cleared of stumps at little or no cost to the owner by disposing of them to these distillation plants.

The common method of burning these stumps is to dig a hole twelve or more inches deep with spade or post-hole digger on one side of the stump and as close to it as possible and to use this as a furnace for firing the stump. In digging these holes it is necessary
that the soil be removed from as much of the surface of the stump as possible so as to allow the fire to come in direct contact with the side of the stump for at least six inches. An ordinary turpentine dipper on a suitable handle makes one of the best implements for removing this soil and exposing the side of the stump. Burning stumps by this method is rather a slow process, but it necessitates no outlay of money and in the hands of careful workers is practically as cheap as pulling them, and besides it may be carried on by a single individual, while to pull them would require a force of several men and a team. In burning stumps by this method the object should be to keep the fires going constantly in each furnace by using as little wood as possible and this wood to consist as largely as possible of knots that furnish a high heat, are entirely consumed, and consequently do not tend to fill up the furnace as the bark and trash would do. After the stumps are thoroughly ignited we have found it very helpful to use ordinary poles of any kind to assist in burning them, standing the poles diagonally into the furnace and well against the stump at the lower end and keeping them pushed down occasionally as they burn away.

**Boring and Burning.**—The burning of stumps by the above method may be greatly hastened and facilitated by boring an auger hole diagonally through the stump from the surface of the ground on one side into the post-hole or furnace on the opposite side. This serves as a flue through which the heat and flame pass out of the furnace going through the stump and heating it up to its ignition temperature in one-fourth the time required without the hole. After a stump thus treated becomes thoroughly heated it usually burns out with very little more effort on the part of the attendant and in most instances to a sufficient depth beneath the surface to be out of the way of plows and cultivators. A machine that puts a two inch auger hole through a stump at the rate of twelve inches per minute while actually boring has been invented by J. W. Day, of Crystal Springs, Miss., and may be bought for about twenty-five dollars. This machine is shown in the accompanying figure.
A two-inch ship auger is welded to one end of a three quarter inch iron rod six feet long. Four inches from the other end of this rod a collar is welded and the end of the rod passed through an iron box fastened to a movable frame about eighteen inches square. A bevel gear is then fastened to the extreme end of this rod either by a key or set screw and works into a second gear of the same kind fastened on a horizontal shaft. This horizontal crank shaft is made of one-inch iron rod bent at one end to form a handle and with a fly wheel fastened on the opposite end. It works through two boxes fastened to the movable frame which slides down the main frame as the auger bores into the stump. The upper end of the machine is elevated about five feet and stands on two cart wheels on which it is easily rolled from stump to stump or from field to field by a single individual. This elevation of the frame helps to brace it against the stump in boring, raises the crank shaft to a height at which it can be most easily turned, causes a slight pressure to be constantly exerted against the auger and makes it possible to bore diagonally into the stump. At the extreme upper end of the frame is a small windlass with ropes attached which is used for pulling the auger out of the stump. This machine is quickly adjusted to the stump and in a test made here one laborer in five hours bored through twenty-seven stumps that averaged eighteen inches in diameter at the top and twenty-two inches diagonally through as bored.

The machine just described and illustrated is an exceedingly simple one and could be duplicated by almost any farmer who had the auger, rods, wheels, gears, and oil boxes. Removing stumps by this method has been decidedly cheaper than by any other method tried here, and, as it requires only a small expenditure for machinery, practically no repair bills, and can be operated by a single individual, it ought to appeal strongly to the small farmers of this section who do their own work largely. While a number of small farmers owning these machines speak of them in the highest terms of praise, the writer has known of several instances where they have not given satisfaction to men who were clearing land on a large scale and depended on hired help almost entirely. Considerable judgment has to be exercised in boring these holes in just the right place in the stump and it is difficult to get the average wage hand to exercise any judgment in this direction.

Blasting.—A quick and fairly satisfactory method of removing stumps is by first blasting them with dynamite and then burning
the shattered remains. As most people know, dynamite is a preparation of nitroglycerine mixed with sawdust so as to get it into the form of a solid. It is mixed in several proportions, but the kind most used for blasting stumps is that containing 40 per cent nitroglycerine. This dynamite is moulded into sticks which are one and one-quarter inches in diameter by eight inches long, each stick containing about one-half pound and costing about seven and one-half cents each. With each charge of dynamite a blasting cap must be used which costs about three-quarters of a cent and also from six to ten inches of fuse which costs about sixty-five cents per hundred feet. It requires from one-quarter to one pound of dynamite to shatter the general run of pine stumps, making the cost of blasting alone from five to twenty cents per stump.

In order to shatter these stumps with this amount of explosive it is necessary to place the dynamite into holes bored well into the body of the stump and to tamp same thoroughly with sand or clay. One and one-half inch augers have been used here to bore these holes, starting them at the surface of the ground on one side and boring them diagonally down into the stump from ten to twenty inches, depending on the size. Effort should be made to so place these holes that the pressure from the explosion will be exerted equally in all directions in the stump, otherwise it will simply blow out the weakest side and fail to shatter the stump. The Day boring machine recently mentioned can be used very effectively for boring these holes, reducing the cost over hand boring at least fifty per cent. There is an element of danger in the use of dynamite, but a very slight one if even ordinary precautions are used. The Station has used thousands of pounds of it within the past seven years in clearing the lands here without the slightest accident, the only disagreeable feature of the work being frequent headaches caused by inhaling the fumes from an explosion or by allowing the dynamite to come in contact with any part of the mucous membranes. The greatest danger in handling dynamite is in cold weather. It freezes at a temperature considerably above that of water and in the process of thawing is likely to explode accidentally.

Stump-Pullers.—There are two kinds of stump-pullers, those that pull the stump to the side and those that lift it vertically out of the ground. As many of the tap roots of these pine stumps are as much as ten feet long and taper gently from the surface of the ground to the end under the ground, it seems evident that the force required to lift them vertically would be much less than that re-
quired to pull them from the side. Whether the application of the force to the vertical pull can be made as economically as that to the side pull I do not know. It is certain that the most of the stump-pullers on the market pull from the side. These, however, have been made for pulling other than tap-rooted stumps and this probably accounts for this fact. The Station bought a stump-puller at one time on trial; it was a heavy machine, so much so that it was difficult for two good mules to move it from one anchoring stump to another. A first class machinist was put in charge to operate it with two good mules to do the pulling and several additional hands to handle the cable, pulleys, etc. The machine was a No. 2 "Faultless" manufactured by a firm in Cresco, Iowa, and cost about $150.00. It was, however, too light to do the work, though in every other respect a most excellent machine. With it we were not able to pull even medium-sized stumps without first digging around them and cutting the lateral roots, so that after two weeks' trial the machine was returned to the factory. A machine constructed on the same principle as the one used here, but one size larger, has been used successfully to pull pine stumps in this section. Such a machine costs about $200.00, requires from two to three yokes of oxen and four or five men to operate it, and will pull an average of about fifty stumps a day.

Mr. P. M. Ikeler, of Moselle, Miss., has cleared a lot of land using the stump-puller shown in the accompanying illustration. He found it advisable to blast his largest stumps rather than take the
chance of breaking a cable in attempting to pull them. Mr. Ikeler abandoned the stump-puller for the method of burning the stumps with a hole dug beside them and thinks this method of burning cheaper than pulling, especially where the land has trash on it with which to burn the stumps.

Mr. James Hand, of Purvis, Miss., has recently cleared a lot of cut-over land and has largely done the work by contract, paying fifteen cents a stump, the laborers removing them as they choose, which is largely by burning the larger stumps and cutting the smaller ones. The work cost him an average of about fifteen dollars an acre.

A machine to pull long-leaf pine stumps must be very heavy and therefore difficult to move from place to place. A stump lifting machine made by W. R. Wilkinson, of Claxton, Ga., is said to move any sized stump. It lifts by screw power, weighs 2,500 pounds, and sells for $200.00. It requires two men to operate it, one mule to pull the stump, and two mules to move the machine from one stump to another. With this force from twenty to thirty stumps are said to be pulled per day, the holes being filled as the stumps are lifted out of the ground.

A machine has recently been invented by Mr. J. T. Purvis, of Purvis, Miss., that lifts the stump out of the ground by means of a wire cable working through a system of blocks and pulleys and wound around a capstan. The machine is quite a simple one and
is made by taking two 4x8 timbers 18 feet long and placing them on
the ground parallel to each other and about six and one-half feet
apart. These serve as runners on which the machine is moved from
place to place. On one end of these runners a derrick about twelve
feet high is built of 4x4 timbers, and on the opposite end a cap-
stan is securely fastened and turned by a lever about ten feet
long. The writer has never seen the machine at work, but has un-
derstood that, with a few simple improvements, such as a chain
that can be made to hold under the tremendous force exerted, the
machine may be made to work successfully.

Machines that lift the stumps vertically have to be moved
every time a stump is pulled, while those that pull from the side
have a decided advantage in this respect. Another decided disad-
antage of the vertical lift is the difficulty of getting a hold on the
stump to pull by, and this difficulty will be increased with either
kind of stump-puller as the saw-mill men come more and more to
cutting their stumps at the surface of the ground, rather than three
foot or more above it as has been the case in the past. Then, too,
after the stumps are pulled, unless they can be sold for distilla-
tion purposes, they are still very hard to pile and burn.

After stumps are pulled they are still quite as much in the way as
they were in the ground and their ungainly shape makes them ex-
tremely hard to handle. They are very heavy and it will require a
team of four mules or six oxen to move and pile them. All such work
is very slow and admits of much idling on the part of those en-
gaged in it.

Pope Method.—Mr. W. W. Pope, of Tylertown, Miss., has pat-
ented a method for burning pine stumps by means of a clay furnace
which has proved quite popular with the small farmers of certain
sections of the pine belt where it has been tried and where the farm-
ers themselves do their own work to a great extent and as a con-
sequence put more intelligence into it than is possible to get out of
the ordinary laborer working for wages. This method is quite sim-
ilar to the one just described under the head of "burning" except
that instead of leaving the top of the furnace uncovered, he uses
damp earth or clay for covering this furnace and at the same time
piles soil around the entire circumference of the stump. Sheets of
iron or tin are used for covering the top of this furnace while the
soil is being packed over it and two tubes of iron or tin, one placed
vertically over the furnace and the other laid horizontally, are used
for molds around which the moist soil is packed. When this is
done the tubes and pieces of sheet iron are withdrawn carefully so as not to disturb the furnace, leaving a perfect fire-box next to the stump with a horizontal opening for getting air and a vertical outlet for carrying off the smoke and products of combustion. Fire started in such a furnace soon eats its way into the stump, while a large per cent of the heat is held within and not dissipated into the surrounding air as would be the case with the open furnace. The heat being held on the inside in this manner consumes the tap root much more completely and follows up the lateral roots for a considerable distance from the body of the stump, at the same time leaving the land in much better shape than by any other method tried here. If purchased, the necessary apparatus for burning stumps by this method will not cost over one dollar while the ingenious farmer can make it himself at no cost at all except his labor. Mr. Pope sells the right to use this method at a very small cost and gives thorough instruction to those who purchase this right. He recommends the making of these furnaces during wet spells of weather when there will be enough moisture in the soil to cause it to pack just right in making the furnace.

The writer has burned out a number of stumps by this method and has found it difficult to get the ordinary farm laborer, without the closest supervision, either to make the furnaces properly or to burn the stumps when made, the trouble being that in starting the fire and in feeding the same the soil caves into the furnace and fills it up. A careful hand, however, can avoid a lot of this trouble and, as stated, the method has worked well in the hands of individuals who exercise the proper care and is popular with many of the small farmers who have tried it.

Other Methods.—Several other methods of removing stumps have been suggested as being practical and have been tried here. One of these was to bore an auger hole into the stump and fill it with nitrate of soda, another to fill such a hole with kerosene oil, and still another to fill such a hole with strong acids such as nitric and sulphuric. We hardly think any of these methods practical. Nitrate of soda will rot a long-leaf pine stump slowly, if at all, and an experiment tried here apparently showed no advantage whatever from it. As a rule these stumps are full of crude turpentine and are very inflammable when enough air can be gotten to them to support combustion. It would seem, therefore, that the logical end to work to would be to get a free circulation of air through the stump while
it is burning, and the auger hole through the stump accomplishes this result as nothing else has done.

Cost.—It is usually cheaper to clear the land of stumps before it is put into cultivation and before the tree-tops, knots, etc., have been removed, because by any method, even though the stumps are pulled, it will require more fuel to burn them than is contained in the stumps themselves. In 1902 this Station removed the stumps from thirty-five acres of land, largely by blasting and burning. This was before the land had been brought into cultivation and all the fallen timber was used to pile around the stumps after they had been blasted and the roots exposed by digging around them. The cost of clearing this thirty-five acres ready for the plow was at the rate of about seventeen dollars per acre. This was before we got a boring machine, when the cost of boring for blasting averaged well above two cents per stump.

We did not get one of these boring machines until the spring of 1908 and soon after that began an experiment to determine the cost of removing stumps by boring and burning. The land selected had been cut over about seven years before and the most of the sap wood had decayed, but the balance of the stump above the ground and all of it beneath the ground was as solid as when the tree stood on it. There were 2.3 acres of this land selected for the experiment and on it there were 158 stumps that had to be bored and 65 that were small enough to be removed with spade and axe. The 158 stumps averaged 13.6 inches in diameter at the top and the diagonal holes that were bored through them averaged 19.7 inches. It required about three days for one man to bore the 158 stumps, about half this length of time for another hand to dig the post-holes and prepare the stumps for burning, and about five days for one hand to burn out the stumps. It required at least a day and a half to cut out the small stumps, and about another day to cut off the corky parts of the stumps that failed to burn. A little wood had to be hauled too, but the most of the burning was done with the stumps that were cut up and the tops of others that had burned off beneath the ground. Reduced to cost per acre this amounted to less than eight dollars allowing $1.50 a day for the labor. As stated before the cost of removing stumps by this method has been decidedly cheaper than by any other method tried.