CLEARING PINE LANDS.

By E. B. FERRIS.

Fig. 1.—The Day Boring-Machine.

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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 similar pine forests. The clearing of these lands for agricultural purposes is quite a problem in this state at the present time when such large areas 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 this area, when cleared and properly handled, will make some of the most valuable farm land in the state, but the cost of clearing (largely the removal of 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, for 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 harvesting
his crops and the day is past when the hoe and scythe can compete
with the cultivator and reaper.

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 fifty square feet is easily 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 additional 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 con-
clusion, 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 proven 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
the stumps are partially decayed. In clearing land here we have
found many stumps on every acre that would require five hours each
to dig around and cut them off eight inches beneath the surface of the
ground.

Burning.—We believe the best method of removing stumps at
the present time is to burn them. This will likely remain true until
the crude products in the stumps will pay for pulling them and getting
them to the factory. The common method of burning these stumps
is to dig a hole about twelve inches deep with spade or post hole digger
on one side of the stump, 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 dirt 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 dirt. Burning stumps by this method is rather a slow
operation, but in the hands of careful workers is practically as cheap as pulling them, besides it can be engaged in by a single individual without the expenditure of more than two dollars for purchasing the necessary implements. In burning the stumps by this method the object should be to keep the fire going in each furnace by using as little wood as possible and this to consist as largely as possible of knots that furnish a high heat, are entirely consumed, and consequently do not fill up the hole beside the stump as the bark and trash would do. After the stumps are thoroughly heated and 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 hole and well against the stump at the lower end and keeping them pushed down as this end burns 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 a little beneath 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 flames pass out of the furnace, heating the stump to its ignition temperature in less than one-fourth the time required without it. 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 or cultivators. A machine that puts a two-inch 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, Mississippi, and may be constructed at a cost of $25.00 or less. This machine is shown in the accompanying figure.

A two-inch ship auger is welded on 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, with a fly wheel fastened on the opposite end. It works through two boxes fastened to the movable frame and 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 the hole 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 most any farmer who had the auger, rods, gears, and oil boxes. Removing stumps by this method has been decidedly cheaper than by any other method tried, 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.

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 nitro-glycerine 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% of nitro-glycerine. 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. With each charge of dynamite a blasting cup 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 one 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 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 on all sides of 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 effectually 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 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 liable 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 required 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 likely 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 good 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 $155.00. 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 the medium-size stumps without first digging around them and cutting the lateral roots, so after two weeks the machine was sent back 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 stump 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, 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 writes that he is now burning out his stumps by digging a posthole by the side of them and thinks this method cheaper than pulling, especially where the land has trash on it with which to burn the stumps.

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 Mr. W. R. Wilkinson, of Claxton, Ga., is said to move any size 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 up, 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 capstand. The machine is quite a simple one and is made by taking two pieces of 4x8 × 18 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, and on the opposite end a cap-stand is securely fastened and turned by a lever about ten feet long. The writer has never seen the machine at work, but has understood that with a few simple improvements now being made it will be worked 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 disadvantage in 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.

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 extremely 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 engaged in 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 this hole with strong acids, such as nitric and sulphuric. We hardly think either of these methods practical. Nitrate of soda will only rot a long leaf-pine stump slowly, if at all, and an experiment tried here with it 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 was being burned, and the auger hole 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, 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.