THE
GOLF COURSE

A MONTHLY BULLETIN DEVOTED TO THE DISCUSSION OF MODERN METHODS AS APPLIED TO GOLF COURSE CONSTRUCTION AND UPKEEP

The Use of Dynamite in Golf Course Construction.

(The first installment of an article explaining where the use of dynamite will be found practical and economical in the building of Golf Courses. Thanks are due E. I. du Pont de Nemours & Co. for their assistance in its preparation and also for the cuts.)

I

Introduction

LANDS have been cleared, drained and tilled for many years by the prodigal use of labor or Man Power. Larger areas are yet to be cleared and further improvements must be made in millions of other acres in order to supply the ever-increasing demand for food and clothing, and also the growing demand for more and better golf courses.

Old methods of developing land by Man Power alone can be used no longer, for the greatest scarcity, at present, is labor. It is indeed so scarce and, when available, so expensive, that it is becoming increasingly difficult to make developments or to install labor-saving devices in order to effect a saving in the future.

But no matter how difficult it may be to get men, explosives are always available and the demand for increased amounts can be quickly supplied for the job. A saving in Man Power is a saving in money. Explosives are now included with horses, steam and gasoline as conservers of manual effort.

Explosives.—Explosives are solids or liquids which can be changed instantaneously by a spark, great heat or powerful shock into gases having many times the volume of the explosives in their original form. Coal and wood are changed slowly into large volumes of gas by burning; water is changed into a large volume of gas (steam) by heating. This is the whole theory of explosives; and much in their use, which would otherwise seem difficult to explain, is easily understood if this be borne in mind.

Blasting explosives are divided into two classes: "High Explosives" and "Low Explosives." High Explosives, more commonly known as "dynamite," include all of the explosives which can be properly fired or detonated only by means of an intermediate agent such as a blasting cap or electric blasting cap

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and not by simple ignition. Blasting powders are classified as low explosives and are exploded by a spark.

Blasting Powder.—Blasting Powder is produced in granulations or grains of various sizes. It is packed in bulk in steel kegs containing twenty-five pounds. Although it is invaluable for many kinds of coal mining, quarrying and general excavating, it is not generally applicable to blasting about the farm except for splitting logs for timber or rails. For this work blasting powder is fired by means of safety fuse or electric squibs.

Dynamite.—Dynamite differs from blasting powder in that it is more powerful, detonates with much greater rapidity, and has a greater shattering effect. The most important properties which contribute to the effect of dynamite are *strength or disruptive power* and *quickness or shattering power.*

Other factors in the usefulness of dynamite are its stability or keeping qualities and qualities that tend to make it safer to handle. The power to resist cold and water is also highly desirable.

These essentials can be secured and maintained only by the use of the highest quality of ingredients, greatest care and attention in manufacture, expensive and complicated machinery, skillful labor and supervision, long experience, and continued tests.

Responsible people can use and handle dynamite just as safely as they can handle gasoline, matches or coal oil. The energy of dynamite can be directed in the work to which it is adapted as well as the energy of steam can be directed in the work for which it is used.

Dynamite is a solid closely resembling fine, slightly greasy sawdust, and derives its explosive power from different compounds of nitrogen. It is packed in cartridges of heavy, paraffin-coated paper. The standard size of cartridges is 1¼ x 8 inches, each cartridge weighing approximately a half pound. Shipment is made in tight wooden cases which contain either twenty-five or fifty pounds of dynamite.

When dynamite or other high explosives detonate, the small volume of solid is converted immediately into a volume of gas many times greater than the solid. If the explosive is unconfined the expanding gases will waste themselves in the air, but if it is confined there is a great pressure exerted on the holding material, which if not too strong will be shattered or blown away.

The force of the gases is equal in all directions. If the desire is to blow a boulder or stump into the air the charge is placed below the object. The best shattering is obtained if the explosive is placed in the material to be broken so that the force is exerted on it equally in all directions. This is applicable in blasting soils and block-holing boulders or in splitting stumps.

While the gases exert an equal pressure in all directions they try to escape by the easiest route or along the line of greatest weakness. If the tamping is omitted or is insufficient the tendency will be to blow out through the bore hole. If a hole is placed to the side of a stump the tendency will be to blow out through the more easily lifted soil. The aim should always be to make the easiest way out directly through the material to be moved or shattered.

Dynamite is fired or "detonated" by means of the shock from a blasting cap or electric blasting cap, either of which is known as a detonator.

II

Blasting Stumps

The root systems of the different forest trees are subject to a considerable number of variations, due to the class of tree, the soil and the depth to sheet water. Ordinarily, forest trees

are divided according to their root systems into three classes. These are: Those having tap roots; those having no tap roots, but only lateral fibrous roots; and those having both a small tap root and many lateral roots. When trees that normally develop heavy tap roots are grown on soils where the ground water level is very near the surface, the tap root will be materially shortened or entirely wanting. Lateral-rooted trees growing in loose soils not troubled by bad drainage, may send heavy lateral roots to considerable depths.

Several factors very materially influence the blasting of stumps, notable of which are:

The character of the root, whether tap or lateral.

The nature of the soil, whether sand or clay, as the kind of soil has much to do with the resistance offered to the dynamite.

The moisture content of the soil.

The state of preservation of the stump, whether sound or partially decayed.

Freshly cut or green stumps are much harder to blast than those from which the small roots and bark have decayed.

Success in stump blasting is nothing but a matter of common-sense and discretion, and the work may be undertaken by anyone of reasonable intelligence, who will first try a few experiments on the small stumps, and follow out carefully the rules to be laid down later.

Blasting Tap-Rooted Stumps.—There are two distinct methods of blasting tap-rooted stumps. The charge can all be placed in a single hole bored into the root, or it can be placed in one, two or three holes alongside the tap root. When two or more holes are used, electric firing must be practiced. Each method has its advantages. Placing the charge in the stump requires more labor and a smaller charge, while the other method requires but little labor and a greater amount of explosives. The first method reduces the stump and tap roots to small fragments.

Loading in the Tap Root.—In placing the charge in the root a spade is used to remove a little soil so that the tap root is exposed to a depth of a foot or more. The hole is bored diagonally downward through the center of the root, using a heavy 1½ or 2-inch wood auger. This should reach well below any possible depth of subsequent till-

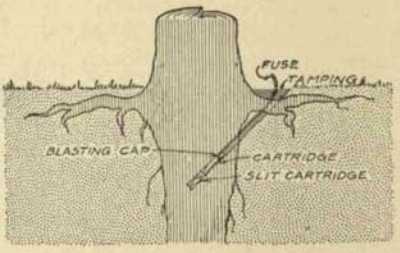


FIG. 1. METHOD OF BORING AND LOADING A TAP-ROOTED STUMP FOR A CAP-AND-FUSE BLAST. THIS LOCATION OF THE BORE HOLE IS BEST WHEN THE BORING IS DONE WITH HAND AUGERS.

age, and more than half way through the root.

In loading it is best to use a half-cartridge primer and remove the rest of the charge from the paper shell. Pack the charge firmly in the bottom of the hole and press the primer firmly against it. The hole should then be tamped tight up to the very collar. Better results will be obtained if the soil is pressed firmly back into the hole made to expose the tap root (Fig. 1).

The charge will vary from a half-cartridge primer for small roots to three or four cartridges for very large solid stumps. Stumps having decayed or hollow tap roots should not be loaded in this way, as they can be gotten out better by two or more charges placed around the tap root.

When for large tap-rooted stumps that are so firmly brace-rooted that the single hole method of blasting is ineffective, two or more charges are distributed around the tap root. The same care should be exercised in putting down the holes, and if the stumps are large the holes should be not less than

four feet deep. Only electric caps can be used. The charges will vary from 1½ to 2½ cartridges for each hole.

Blasting Small Lateral - Rooted Stumps.—When stumps have no tap root, but only lateral ones, the loading

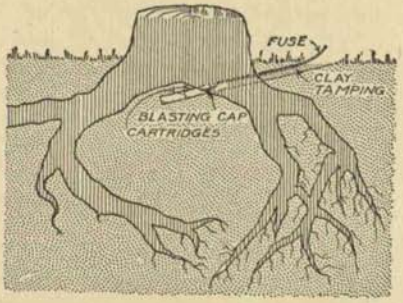


FIG. 2. CORRECT METHOD OF LOADING A SMALL STUMP FOR A SINGLE CHARGE BLAST. THE CHARGE MUST BE LOADED WELL UNDER THE HARDEST PART TO LIFT, AND WELL TAMPED.

will depend on the nature of the soil and the size and state of preservation of the roots. When they are small or the roots are partly decayed the charge can all be placed in a single hole started a little way back from the stump and sloped under the part of the stump that will be hardest to lift (Fig. 2). The charge will run all the way from less than a cartridge to several cartridges.

Here, again, the depth of the holes will play an important part. If they are too shallow the blast will only split the stump and fold the parts back without blowing them out. Shallow loading is advisable only when the stump is to be split and then pulled. It is seldom for blasting the stump out entire, that the loading should be shallower than 30 inches, and, if the stumps are hard to blast, 4 feet is better.

Blasting Large Lateral - Rooted Stumps.—The use of electric blasting is essential to the best success in blasting large stumps or those having wide-spreading roots. If the charge is confined in a single bore hole, as in Fig. 18, the effect will be to split and not lift the stump, but if the same or a smaller charge is distributed in several well-located holes, the blast fired by electricity will lift the stump perfectly. The number and location of the holes must be governed absolutely by the individual stump. For stumps slightly larger than can be lifted by a single charge, two holes will usually be sufficient. These should be on opposite sides of the stump, and should be inclined under the stump. For larger stumps three or more holes should be used. One of these should be under the center of the stump and the rest so placed around the outer edge as to form a circle under and around the holding roots, as is shown in the two accompanying cuts (Figs. 3 and 4).

Care should be exercised to get the center or main charge well under the stump. This is needed for lifting and

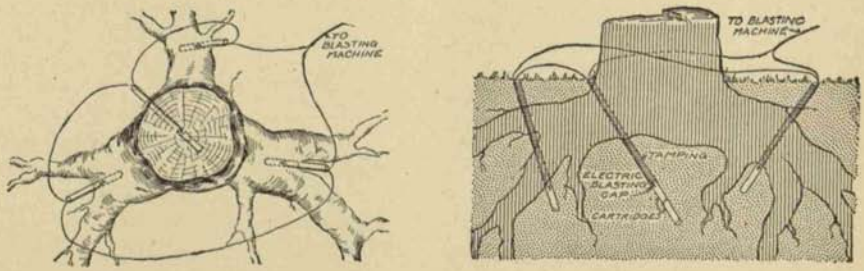


FIG. 3. METHOD OF LOADING LARGE LATERAL STUMPS WITH DISTRIBUTED CHARGES, OR AN ELECTRICALLY-FIRED BLAST. "A" SHOWS WHERE THE HOLES SHOULD BE STARTED AND, IN A GENERAL WAY, HOW THEY SHOULD POINT, AND HOW THE WIRES ARE CONNECTED IN SERIES TO THE LEADING WIRE. "B" SHOWS THE LOCATION OF THE HOLES UNDER THE STUMP.

splitting the heavy part. The other charges should be distributed under the large roots, and may be some distance away from the stump. For this kind of blasting only electric-blasting caps can be used.

As in all stump blasting, the holes should be well down into the subsoil—not close up to or in contact with the wood. The best tools for making the

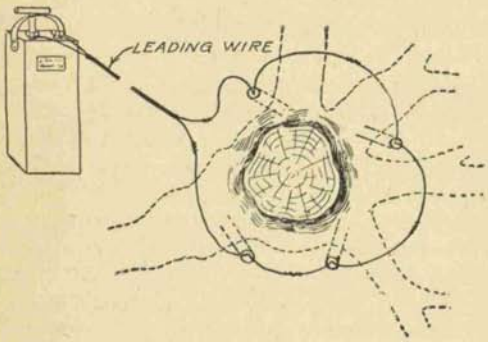


FIG. 4. SHOWING FULL DETAILS OF LOADING DISTRIBUTED CHARGES, UNDER AND AROUND A LARGE STUMP FOR AN ELECTRICALLY-FIRED BLAST. THE LEADING WIRE SHOULD NOT BE LESS THAN 250 FEET LONG.

holes are the crowbar and the subsoil punch. Soil augers are sometimes used.

Each separate charge, or hole, is primed with an electric blasting cap. The wires to these caps are connected as is shown in Fig. 4, and to the leading wire, which is in turn connected to the blasting machine. Several stumps can be wired into the same blast and fired together.

Blasting Stumps From Very Soft Soil.—For cypress, willow or other stumps in very soft, swampy soil, modification must be made in the methods of loading on account of the poor resistance offered by the soil and the enormous number of spreading roots. The holes must be so distributed that not only the stump, but all of the main-spreading roots will be blown out down below plowing depth. Quicker-acting dynamite of 40 or 50 per cent gives best results. To insure the most efficient use of the explosives the shots should be fired as soon as possible.

Blasting Hollow Stumps.—Many of the stumps are found to be only shells, the heart having been entirely rotted away. To blast these successfully drive a bar or rod into the soil down through the hollow, and tamp the stump full of moist soil, remove the stake and load in the hole left by the post and tamp solid. Additional charges placed under the spreading roots should be used, and fired electrically.

Approximate Charges for Blasting Stumps.—No absolute rule can be laid down giving the required charge for blasting stumps of different sizes, but the following, which is based on old but solid stumps in firm, dense soil, can be used as a basis, making variations either way as may be required:

Diameter of Stumps in inches	12	18	24	30	36	42	48
Number of Cartridges of Red Cross Farm Powder	3	4	6	7	8	12	15

If the stumps are green, or if the soil is loose or sandy, these amounts must be increased, but if the stumps are partly decayed, lighter loading will do the required work.

These approximate estimates, of course, are based upon the idea that the stump is to be blasted out entirely. If the object is to merely break or loosen the stump before or after pulling it

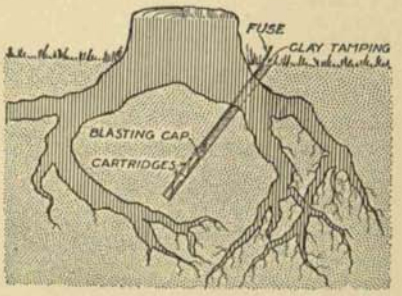


FIG. 5. LOCATION OF A SHALLOW BLAST FOR SPLITTING A STUMP FOR PULLING. THE CHARGE SHOULD BE PLACED CLOSE UP TO THE WOOD AND SHOULD BE JUST HEAVY ENOUGH TO SPLIT THE STUMP.

with a stump puller, then, of course, these estimated charges can be reduced to one-third or one-half.

Each operator can easily determine for himself, by making a few experimental shots, what the proper charges will be. Of course, the aim should be to do the work with the least possible amount of powder. As a starting point, we would suggest using the charges mentioned in the table above. They can be increased or decreased in keeping with the results of the test shots.

Felling Trees.—The loading for blasting down standing trees is the same

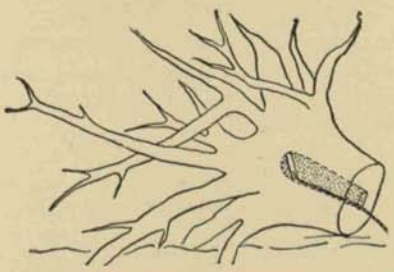


FIG. 6. SHOWING LOCATION OF A CHARGE OF EXPLOSIVES IN A HOLLOW-PULLED STUMP.

as for stumping, with the important difference that heavier loading is required, because of the greater weight to be lifted. If this work can be done during

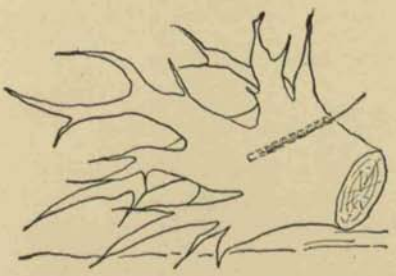


FIG. 7. LOCATION OF A HOLE BORED INTO A PULLED STUMP FOR SPLITTING. SOME PREFER TO BORE SUCH A HOLE IN THE SAME DIRECTION AS THE NATURAL HOLLOW (FIG. 6).

a high wind, the wind load on the tops of the trees will materially assist in investment in a puller, explosives and a good machine work nicely together. All men have their individual tastes and preferences. Some swear by explosives and others by stump pullers. A third class takes the middle ground, bringing them down. *When a tree is valuable for saw stock it should not be blasted down,* as the blast may split the trunk in such a way as to ruin it for the sawmill.

Combination Methods of Stumping.—Stump pullers are on the market operated by hand power, horse power, gasoline engines and steam. On clearing jobs large enough to warrant the and uses both in conjunction. On the large jobs a saving in time and money is effected by the combination; the stumps are well shattered; the holes are small; and the final fitting of the land made easy.

This combination method makes use of dynamite for splitting the stump and freeing the roots of dirt either before or after pulling. The puller is used to draw the roots or stump, the final object being to clear the land and dispose of all stump fragments. A large number of tests, chief of which are those recently conducted under the direction of the University of Wisconsin, have proven that on large areas the use of this method is better than either pulling or blasting alone.

The advantages of using a puller and explosives in conjunction are:

(1) A saving in explosives;
(2) A saving in time;
(3) A saving in labor;
(4) Less strain on machinery, horses and harness;
(5) Greater ease in handling the stump after it is out;
(6) Does away with the disagreeable and time-consuming work of clearing dirt off the roots;
(7) Does away with a large part of the work of filling the hole.

When to Pull Stumps.—When horse or other power is available, and large numbers of small stumps are to be removed from sandy soils, the puller, alone or with a minimum of dynamite, is

better and more economical than blasting.

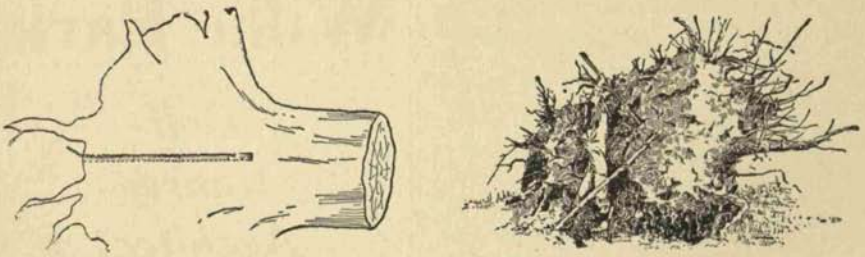
When to Blast Stumps.—When the stumps are scattered, as in old cultivated fields; or when there is but a small amount of clearing to do in any one place, as in clearing up small wood lots or corners, the advantage is undoubtedly with explosives used alone.

Dynamite, loaded well below the ground level, should be used without heavy pullers for clearing stumps out of orchards.

When to Use Combination Methods.—The use of combination methods is recommended for general clearing operations, not covered in the two general recommendations just made, where the stumps are either large or green, for under these conditions the most careful work must be done to get the desired results with either individual method. Occasional failures to blast the stump out entirely and the balls of earth on the roots lifted by the pullers are both objectionable.

Blasting Before Pulling.—Perhaps the most satisfactory general application of the combination method is to blast the stumps and then pull the fragments. The loading is done in keeping with Fig. 5. The object is to split the main part of the stump and loosen the brace roots from the ground so that a minimum of earth is pulled out. The loading should be shallow, so that the hardest blow of the blast is directly against the forks where the roots branch out from the stump. The charge, which is usually fired with a blasting cap and fuse, should be just sufficient to split and loosen the stump.

This method is highly satisfactory for green stumps or those having heavy spreading roots, especially on silty loams and heavier soils.



A B

FIG. 8. PUNCHING A HOLE FOR A SPLITTING CHARGE THROUGH THE EARTH CLINGING TO THE ROOTS OF A STUMP. "A," LOCATION OF BORE HOLE; "B," LOADING THE CHARGE.

Pulling and Blasting.—In this application of the combination methods the stumps are first pulled and then blasted to free the roots of dirt and to split the stumps so that they can be piled and burned or used for other purposes. It is not so well suited to extremely large stumps or those having heavy spreading roots as is blasting before pulling. It finds its chief use on stumps that have large single roots or on sandy land.

Blasting Pulled Stumps.—There are three methods of blasting pulled stumps:

(*a*) Any cavity or hollow in the stump can be loaded (Fig. 6). The hole should be well tamped.

(*b*) A hole can be bored into the thick part of the stump near the original ground line (Fig. 7).

(*c*) A hole may be punched through the mass of earth, on the bottom of the stump, to the forks of the main roots (Fig. 8).

Disposal of Stump Fragments.—Land is not cleared when the stumps are simply out of the ground, for they are frequently more in the way when

lying on the ground than they were when in the ground. All blasting tends to split stumps into fragments that can be more easily handled. If the stump wood is of value for fuel, or for distillation, it should be saved and hauled to market as soon as possible. Small fragments are naturally much easier to handle. Stone boats or sleds can frequently be used for short hauls and are easy to load and unload. For longer hauls wagons are better.

In many localities stump wood is simply waste, as there is no market for it either for fuel or for distillation. In such cases the easiest and quickest method of burning is to be desired. There are many methods of piling for burning. Each method has its advantages under peculiar circumstances. The selection of method should be made in accordance with the individual needs.

Building Small Piles.—On small stumping jobs, especially where there is a considerable amount of trash to be burned, the building of small piles, including only two or three stumps, is found very satisfactory. The largest stump fragments can be used for the base of the pile, and the smaller fragments piled on top by hand, or by means of teams or pullers.

Building Large Piles.—Frequently, especially on extensive clearing jobs, it is better to build large piles. When it is necessary to leave the stumps for some time to allow them to dry out, this is an excellent method. Some claim that the stumps burn much better when piled in this way.

It also allows the free cleared ground between the piles to be plowed and worked while waiting for the piles to dry out sufficiently to be burned.

(To be Continued)