

STUMPING and LOG-SPLITTING with EXPLOSIVES

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General Principles.

The method employed in the removal of stumps varies according to the age, size and type of stump, nature of the soil ground conditions, character of root system and equipment available. All these factors must be taken into consideration when determining the best and most economical method of removing stumps by blasting.

Type of Stump.

Stumps vary according to their root systems and the degree to which the roots have decayed. Some have heavy tap roots; others only lateral spreading roots, while some have both kinds. The explosive charges must be located to suit the nature of the roots and be placed so as to break their hold in the ground.

Green stumps have a large mass of small tendril roots so interwoven with the soil that a relatively heavy charge of explosive is required to dislodge them.

Soil Conditions.

The nature and condition of the soil is of considerable importance in stump blasting. The more resistance the soil offers to the force of the explosion, the greater will be the force exerted against the stump. Loose, sandy soil, which is dry, is far less efficient in this regard than firm, heavy soil, which is wet. Light, sandy soils provide a ready escape for the explosive gases; therefore, it is always advisable to blast when the soil is wet. As a rule, charges should be placed deeper in light soils than in heavy soils.

Blast Effect.

When a charge is concentrated some feet below the surface, the resultant blast should form an inverted cone, the top of which is a little less in diameter than twice the depth of the

hole. The charge should therefore be deep enough to ensure that the cone includes all of the stump and part of the main roots, and is strong enough to remove the stump completely, or, where the roots are particularly strong, to split the stump, loosen the roots from the soil and turn the pieces back from the hole so that they can be easily removed.

Tools.

An earth auger having a bit diameter of $1\frac{1}{2}$ inches to 2 inches is recommended for boring holes in hard clay. Where the soil is stony a driving bar may be more useful. The addition of water to dry sand or crumbly earth will sometimes prevent the holes from caving in when the auger or bar is withdrawn. For boring into wood, a $1\frac{1}{2}$ inch wood auger or power driven wood drill is required. A probe made from $\frac{3}{8}$ inch reinforcing steel is very useful for finding the position of roots. It can be about three feet long with a handle at one end and an enlarged point at the other.

Explosives.

The type of explosive to use is "Polar" A.N. Gelignite 60. It is usually sold in 50lb. cases each containing 130 cartridge 8in. x $1\frac{1}{8}$ in. and weighing approx. 6ozs.

Method of Firing.

For the removal of stumps and trees of small diameter, where one charge is sufficient, the Safety Fuse method of firing is suitable. The electrical method of firing could be used where the simultaneous initiation of two or more charges is necessary, but as most farmers do not possess electrical firing equipment, this method is not described in this bulletin. Instead it is recommended that farmers use "Cordtex", which is a continuous detonator

and is very safe to handle. It detonates at the rate of 20,000 feet per second and must be initiated by means of a detonator and safety fuse.

As an alternative to simultaneous firing of two or more charges, large stumps can be removed with one concentrated charge placed to advantage below the stump. In order to do this, the hole must be enlarged or "bulled" by the firing of one or two ounces of Gelignite. This small charge is pushed to the bottom of the hole and fired unconfined, and the hole allowed to cool off before recharging.

Charging the Boreholes.

When charging the boreholes with explosives, a wooden tamping stick should be used to press the cartridges to the bottom portion of the hole. The primer cartridge should be carefully inserted last, or second last, with the detonator pointing towards the main charge. The hole must then be stemmed to the top with sand or soil free of stones. Press the first few inches of stemming material nearest the primer lightly, then tamp the remainder firmly. No explosive exerts its full force unless it is well confined. Generally, when the charge consists of more than four $1\frac{1}{8}$ in. diameter cartridges, the hole should be "bulled".

Charge Quantities.

For dead stumps up to three feet in diameter, measured one foot above the surface, about 12 ozs. of explosive per foot should be sufficient under average conditions, but for stumps of a larger diameter 1 lb. per foot, or even more, may be required. Green stumps may require double the amounts given, and stumps in sandy soil an increase of fifty per cent. above normal.

Placing the Charges.

The proper placing of a charge or charges requires some judgment and experience on the part of the operator, but the following brief details and illustrations will serve as a general guide.

Lateral-rooted Stumps.

Figure 1 shows the proper location of the charge for an evenly rooted stump. With this type of stump the roots often offer more resistance than the stump itself. Generally, the centre of resistance will be at the centre of

the stump, although it often happens that there are heavier and stronger roots on one side than on the other, such as in Figure 2. In such cases the charge should be placed slightly off centre under the largest root.

The depth of the hole will vary with size of the stump. Figure 3 shows a charge placed too deep, consequently more explosive would be required to remove it satisfactorily. On the other hand, charges placed too shallow will split the stump and fail to remove it properly.

Large Tap-rooted Stumps.

Large tap-rooted stumps may be removed in three ways:

(i) By placing the charge in the tap-root itself, as shown in Figure 4. The soil should be removed on one side of the tap-root to a depth of one foot, and with a $1\frac{1}{2}$ in. wood auger, a hole should be bored into the root at an angle of 45 deg. to a point slightly beyond the centre. The hole is charged in the usual manner, and fired with Safety Fuse.

(ii) One heavy charge is concentrated against the tap-root at a depth of not less than two feet, as in Figure 5. In this case, it may be more convenient to make the hole with a shovel or post-hole digger.

(iii) Two or more charges are placed around and against the tap-root, as shown in Figure 6. The holes should be three feet deep at least, to accommodate the necessary charges, and the charges should be fired by the Cortex method.

Of these methods, the second requires the greatest amount of explosives, and the first requires the least. More labour is involved with the first method.

Large Heavily Rooted Stumps.

Large, heavily rooted stumps will necessitate several charges which should be placed where they will be most effective. Usually one charge is placed beneath the centre of the stump to split it, and others underneath the larger roots, as shown in Figure 7. If one charge is to be used, the hole should be placed beneath the centre, and "bulled" to form a cavity large enough to hold several pounds of explosives. A cavity in excess of requirements should be avoided.

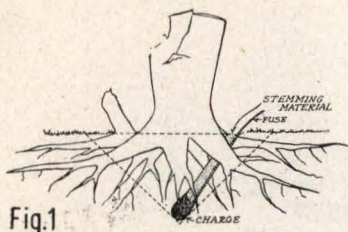


Fig.1

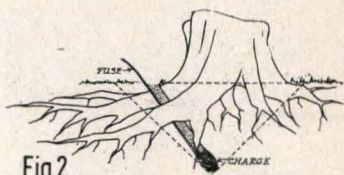


Fig.2

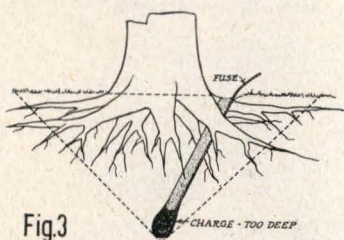


Fig.3

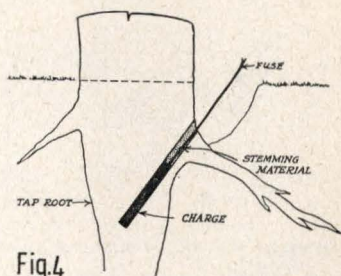


Fig.4

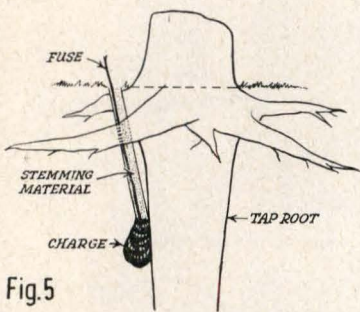


Fig.5

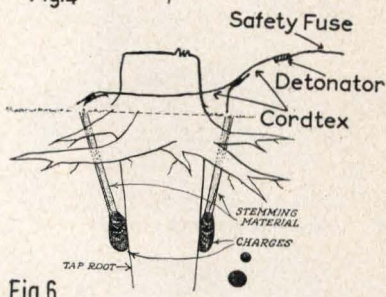


Fig.6

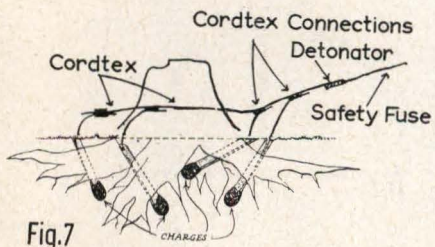


Fig.7

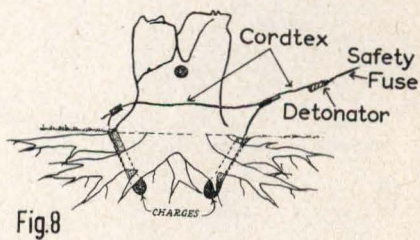
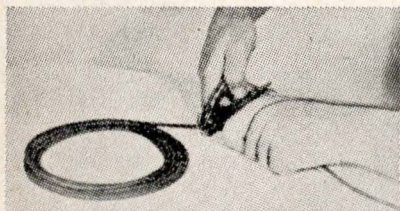
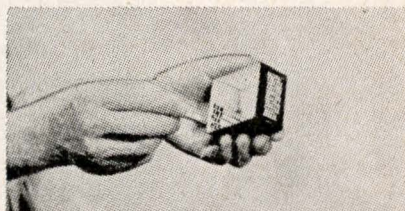


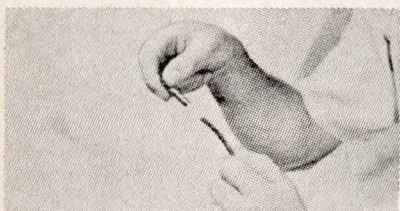
Fig.8



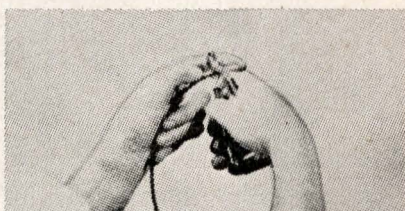
a CUTTING THE FUSE



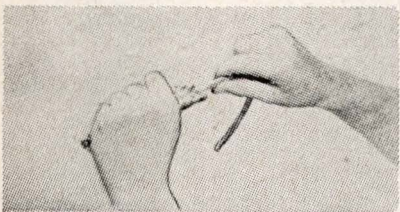
b TAKING OUT THE DETONATOR



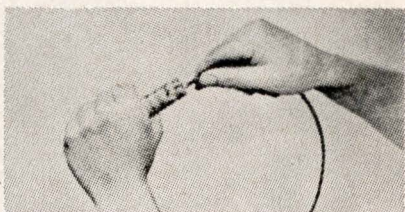
c INSERTING THE FUSE INTO THE DETONATOR



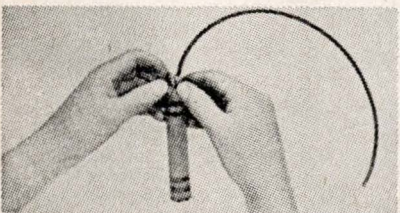
d CRIMPING THE DETONATOR



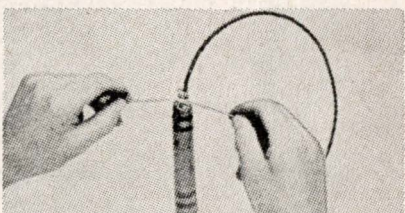
e MAKING HOLE IN TOP OF CARTRIDGE



f INSERTING FUSE AND DETONATOR



g FOLDING CARTRIDGE PAPER ROUND FUSE



h TYING CARTRIDGE PAPER ROUND FUSE

g
Fig. 10

Hollow Stumps.

Hollow stumps are dealt with as suggested in Figure 8.

Log Splitting.

Probably the most economical method of splitting logs up to three feet in diameter is to use a "Log-splitting Gun", various types of which are on the market. Essentially, it consists of a mild steel cylinder 14 to 18 inches in length, by $1\frac{1}{2}$ in. in diameter, tapering down in the last 6 in. to a diameter slightly over $\frac{5}{8}$ in. At the tapered end is a $\frac{5}{8}$ in. hole, 7 to 8 inches in length, into which, at the closed end, is drilled a touch hole for the Safety Fuse. The hole is filled to within half an inch of the top with Blasting Powder (approximately $1\frac{1}{2}$ ounces), the tapered end of the Gun is then driven into the end of the log for an inch or two, and the charge of powder touched off with the Safety Fuse. The log is split by the gases developed from the ignition of the Blasting Powder.

For logs over three feet in diameter and five feet in length it may be necessary to bore one or more holes into a side of the log and charge them with Gelignite or Blasting Powder. It is important that the depth of the holes should be almost two-thirds of the diameter in order to locate the charge near the centre of the logs. Logs three feet in diameter and five feet long can be split in four sections with one 4 oz. charge, whereas a log four feet in diameter and 12 feet in length will require a total charge of 12 to 16 ounces spread over three equally spaced holes. The holes must be charged and stemmed in the usual manner.

In hard wood, the above method involves considerable labour in boring holes unless a power drill is available.

PREPARATION OF CAPPED FUSE:

Where Safety Fuse and Detonators are used for priming charges in land clearing operations, cutting the fuse and crimping the detonators thereto should be carried out as follows:

The implement for cutting the Safety Fuse should have a clean, sharp blade to avoid smearing the waterproofing material over the powder train with consequent trouble from mis-fires. The fuse should be cut **squarely across** to the desired length

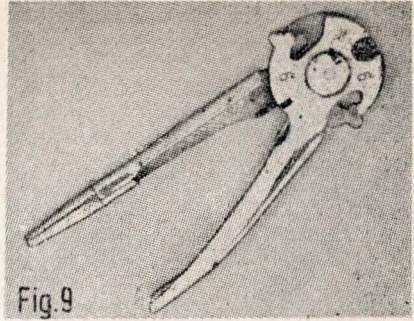


Fig. 9

by means of the cutter on the hand crimper or a knife. Detonators for use with Safety Fuse are packed 100 to a tin and the tin filled with sawdust. Before use all the sawdust should be removed from the inside of the shell by gentle tapping, since even a trace of sawdust may be sufficient to cause a mis-fire. It is also important to keep the end of the fuse and the inside of the detonator free from foreign matter as it would be very hazardous to insert a fuse into a detonator if any hard or gritty substance were present. The fuse should be gently pushed into the detonator until the composition and fuse are in contact, but should never be screwed into position. The detonator should then be gently, but securely crimped to the fuse with an approved crimping tool. Crimping can be accomplished successfully only by the use of an instrument made especially for the purpose, such as illustrated in Figure 9. Take care never to crimp the detonator on the part which contains the detonator composition. The crimp should be about $\frac{1}{8}$ in. to $\frac{1}{4}$ in. from the open end of the tube.

Emphasis is placed on the necessity for exercising care to see that the powder in the end of the fuse is in actual contact with the detonating composition. Fuse, in burning, generates gas which is forced in advance of the flame into the detonator, and, if a space or gap occurs owing to the fuse not being seated against the composition, a back pressure may be built up against the fuse spit and seriously interfere with its effectiveness. This is particularly true where certain types of crimpers are used which give an airtight crimp, or in cases where water-

proofing material is used to waterproof the crimp.

The making up of a primer with Safety Fuse is shown in Figure 10. In lighting the Safety Fuse it is best to hold it against the match head and rub the striking surface of the match box against the latter.

In the Cordtex method of simultaneous initiation of two or more charges, the primer cartridge for each charge is made up as follows: Cut off from the reel of "Cordtex" with a knife a short length sufficient to attach the primer cartridge and still leave about 12 inches protruding above the surface when the primer cartridge is lowered into the hole. Pierce a hole in the primer cartridge at right angles with an ordinary meat skewer, thread the "Cordtex" through, and then tie a knot at the loose end. "Stem" the hole as described above. Cut off from the reel of "Cordtex" a "main line" long enough to enable each primed charge to be connected by means of a clove hitch or by placing the short length protruding from the hole along the "main line" and tape them together. To one end of this "main line" you attach the capped fuse which is the detonator, with a length of Safety Fuse, inserted prepared as shown in diagrams a., b., c., and d. in Figure 10. The detonator is then taped to the "main line". Ensure when connecting primed charges to the "main line" that they are pointing along the "main line" towards the detonator.

In this method of firing the Safety Fuse burns until it explodes the detonator which detonates the "Cordtex", which with a detonation rate of 20,000 feet per second, explodes the charges practically simultaneously.

Precautions.

Properly treated, explosives are safe, but in careless or inexperienced hands they can be very dangerous and can cause needless death and destruction. As only small quantities of explosives are in use at one time on a farm, special storage magazines are not usually provided. Explosives, Safety Fuse and Cordtex should be stored in a dry, well-ventilated locked shed. Detonators should be stored under lock and key separate from the explo-

sives and kept dry. They should never be carried in pockets or left lying around so that children can get at them. They should never be put near flame or fire, nor should sawdust be picked from them with a pin, pencil, nail or piece of wood or knocked with a hammer or stone. Detonators and blasting powder are particularly susceptible to initiation by spark or flame.

Cold Temperature Precautions.

All explosives at present marketed in New Zealand are known as "Polar" explosives and will withstand temperatures as low as -10°C . without freezing, therefore there is not the necessity to take precautions against freezing as was done before the introduction of "Polar" explosives.

If gelignite cartridges require to be divided to make a small charge, they can be cut with a wooden "knife". Metallic equipment should never be allowed to come into contact with explosives. Avoid touching the cut surface of the gelignite, as it can cause headaches.

The Safety Fuse available in New Zealand burns at 90 seconds per yard, with a tolerance of plus or minus 10 seconds. Enough time should be allowed for the person lighting the safety fuse to retire at least 150 yards from the explosion and preferably behind cover so as to be safe from flying debris. See that all possible approaches to the site by persons on foot or vehicle are well guarded and that stock are removed to a safe distance. Smoking or the use of naked lights must be avoided.

Check to see that there is no risk of damage to buildings, and also services such as water pipes, drains, power lines and telephone cables.

Should a mis-fire occur, i.e. the charge failing to explode, wait at least two hours before approaching the charge, then deal with the mis-fire in the following manner: if it is possible a fresh hole should be drilled at least 2 feet away from and parallel with the mis-fired hole, then fire a relieving shot in the new hole. If this is not possible then the stemming material should be washed out with water and a fresh primer inserted and the charge fired again.