

## EXPLOSIVES.

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(Continued from page 534, last issue).

After the hole is loaded, or nearly so, put in your fuse and see that the powder in the fuse is exposed and dry. After placing the fuse in the powder, put in some more powder to insure ignition and tamp in the usual way, using wood or copper rammer. If the hole is deep, use double fuse, place the end in a cartridge of powder and see that it is tightly tied on.

Powder does not require a detonator or cap. It ignites from a spark. Powder will not explode if wet.

When a shot has to be set off at cross-roads, or where the traffic is heavy, men should be sent out along the different roads to stop the traffic. They should have a flag and signals should be arranged so that the powderman could be warned when everything is clear. Even with this precaution the usual calls of alarm should be given.

**Electricity and Wire Fuses.**—When using electricity, or a battery and wire fuse, in setting off shots, never connect up the wires to the power wires or battery until every one has gone to a safe place as there may be a leakage and a premature shot follow. Platinum electric fuses can be procured almost anywhere for black powder, and combination fuse and detonator for dynamite. Be very careful that you get the very best and be sure you keep them dry.

I am convinced that in quarry work and heavy blasting, wire fuses, cable and battery, is the safest method of exploding powder or dynamite, because immediately you disconnect the wires of the cable from the battery there is no danger from fire in the drill hole, as there would be from ordinary fuse, even in case of misfire. If you have a misfire you can go over your wires immediately after without danger. Wire fuses are placed in the charges the same as other fuse and the same care exercised when tamping so as not to cut the wire. In making your connections, see that the ends of the copper wires are clean and bare, raise every connection thus made from the ground by placing a dry piece of wood or stone under, as the damp soil may ground the current, and be sure you do not allow two connections to touch or else you will cause a short circuit.

**Mis-shots.**—Mis-shots are shots that have failed to explode. The causes are manifold. It may be faulty fuse, poor detonators, carelessness in pulling the fuse out from the cap or charge. Or in electricity, it may be from overcharging your battery, that is, having more shots connected up than your battery can stand. It may be the platinum in the cap, broken wires, grounding or short circuit. But whatever the cause, care should always be exercised in returning to the shot if ordinary fuse is used. Several hours should always elapse between the time of lighting and returning in such cases, as there may be smouldering, and catch the powder in the fuses again. In electric fuses, it may be better to allow a few minutes, but be sure you disconnect the battery. If you cannot find the cause and have to put down another primer or fuse in the drill hole, be very careful not to remove all the tamping, and, in the case of dynamite, it is a dangerous practice at best. In black powder, use a copper picker used for the purpose, and be sure you moisten the tamping.

It is also dangerous to drill a new hole near the misfired one, that is, within two feet, hoping that it may explode the other one, when it (the second shot) explodes, as the shock from the drilling may set it off prematurely.

**Taking Out Charge.**—Always follow the safest way, and that is, drill a new hole several feet away from the one that has misfired, never closer than three feet, drilling down to about the level of the charge in the other. Then load lightly and fire. Then you will be able to get a new primer down to the misfired charge in the other.

In partly exploded shots, do not try to drill the hole out to make room for another charge. Simply put in some more explosive, another primer, with no tamping, and set off. Care must be used not to put in too much dynamite to spoil the hole for further use.

There are three or four practical ways to break boulders. The first is by drilling a small hole called a plug and putting in the necessary charge. But this is slow, if it is simply to remove the boulder. The second way is by bulldozing. This is done by placing several sticks of dynamite on top of the boulder on the flattest part near the centre, and covering with fine moist clay to exclude the air. But this is very expensive as to powder. The third way is to dig a hole with a bar under the boulder, and always try to get the charge under the concave part near the centre and never on the round or bulge side. This is the cheapest and best method.

**Hardpan.**—In blasting hardpan drill holes horizontally into the bank about eight to ten feet apart and six to seven feet deep, with bars or spoon shovel for the purpose. These holes can be sprung by a high explosive to make room for the charge, about one stick of 60 per cent. dynamite is sufficient for the first time. This gives you an idea how it will work and what powder you may require to get a pot-hole sufficiently large enough to receive the full charge. Be careful not to reload before all chance of fire from the fuse has gone and in springing use no tamping, as confining the charge will break the wall of the bore hole. After springing and before placing the final charge, clean the hole well out, removing all loose material with the spoon shovel. Then load according to what you want done. This has been found a very successful way.

Holes can be widened in hardpan in the following way: Drive your bar-drill to above twelve to fifteen inches into the bank, then use a primer, of about one-third or half a stick of 40 per cent. dynamite, according to solidity of material, clean out and repeat, driving the bar or drill twelve inches further and charging again, and so on. Six feet is about the distance most successfully done in this manner, and the hole is anything from three to five inches wide.

This method suits best where two men are working, but in case of a whole crew with horses, etc., causes the others to lose more time than anything gained. However, a good foreman can easily regulate this. Do not use a high explosive for the final charge, as it is too quick, and therefore local. It is better to use black powder, which is slower in action, or Judson powder of low grade. Judson powder is highly recommended for that particular, because it is almost as slow as black powder and has double the power.

**Blasting Stumps.**—In blasting stumps, take your bar and spoon shovel and drill a hole under the stump and close to the main root. If the stump is large, you may have to spring the hole to make room for the charge. After charging, tamp well. In wet ground be careful about greasing your primer and see that you use waterproof fuse. Water makes good tamping for dynamite, but not for black powder, excluding the air, but you must see that it comes up to the surface level at the stump. If the stumps are in very soft ground, it will be deemed advisable to place a flat rock