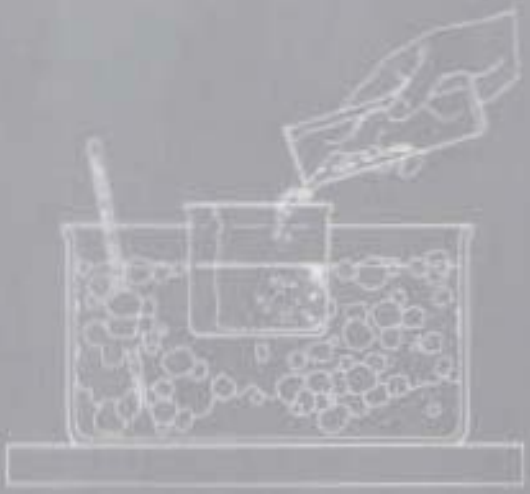
Ragnar's Guide to Home and Recreational Use of High Explosives



Ragnar Benson

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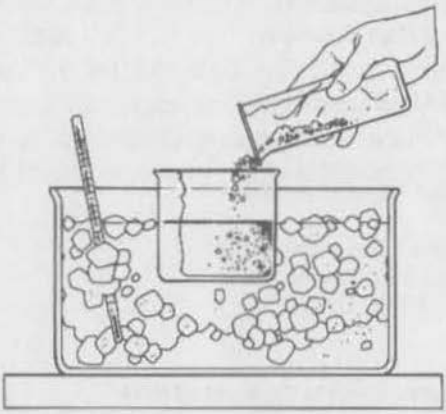

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PALADIN PRESS
BOULDER, COLORADO

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Ragnar's Guide to Home and Recreational Use of High Explosives
by Ragnar Benson

ISBN 0-87364-478-6
Printed in the United States of America

Published by Paladin Press, a division of
Paladin Enterprises, Inc., P.O. Box 1307,
Boulder, Colorado 80306, USA.
(303) 443-7250

Direct inquiries and/or orders to the above address.

Illustrations by Bill Border

Warning

The procedures discussed in this book and the resulting end product are extremely dangerous. Whenever dealing with high explosives, special precautions should be followed in accordance with industry standards for experimentation and production of high explosives. Failure to strictly follow such industry standards may result in harm to life or limb.

Therefore, the author and publisher disclaim any liability from any damages or injuries of any type that a reader or user of information contained within this book may encounter from the use of said information.

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Introduction

The summer I was thirteen I went to work as a roustabout for the local contract blaster. Like so many small, rural communities at the time, ours had the requisite resident powder monkey. My job was to lift and haul the things the old gent no longer could nor wanted to lift or haul.

Even in those pre-OSHA (Occupational Safety and Health Administration) days, the job was probably a bit more risky than those with which most thirteen-year-olds get involved. Our first piece of work was taking out some green stumps in the woodlot where the new church was going to be built.

My folks figured that since this was "church work," it couldn't come to naught. The fact that the powder monkey for whom I labored was an elder in the church made it even better.

Our first piece of church work just about wiped out our old '38 Chevy ton-and-a-half powder wagon. The incident could have been predicted but it wasn't, principally because I was inexperienced and my employer was tight as a turtle shell.

We used a long-haft, inch-and-a-half dirt auger to bore down under the stumps. The hot, sticky June days in Iowa made this the most disagreeable part of being a powder monkey. Sweat rolled off our brows in rivulets.

Once the bore hole was properly excavated down under the stump, we used an old rake handle to slide a capped

stick down to the bottom of the auger hole.

The charge was known as the *bore-hole* or *sprung-hole* charge. With it, we produced a chamber under the stump large enough to accommodate enough powder to throw the stump out on the ground. A single stick of 40-percent powder in the black, sticky, Iowa loam soil produced just the right sized hole into which to slide the main charge. One only learns this from experience.

Forty-percent dynamite throws more than it cracks or blasts. The exploding charge thumps rather than booms, even when six or eight half-pound sticks are detonated together. A boom signals excessive wasted powder, according to my powder-monkey mentor.

We fired the single charge by backing up the '38 Chev near the stump and using drop wires to electrically fire the cap from the truck's battery. It was a good enough system, since we always knew how well the battery was charged and the six-volt battery was safely sufficient for a single blasting cap (or even two or three caps if called upon).

The problems started when my mentor insisted on buying electrical caps with four-foot rather than six-foot leads, because they were a penny or two cheaper. He paid me twenty-five cents per hour. Obviously those pennies could really add up, especially when we did not invest in connecting wires, as was true in this case.

Sometimes the four-foot leads—which are no longer offered commercially—worked just fine. Sometimes, however, the blast chewed a bite of three or four inches off our drop wires.

As a result, the drop wires got shorter and we had to back the flatbed Chev closer and closer to the blast site.

One of the problems faced by all blasters is plugging or stemming the charge hole. In this particular case, the charge hole was quite large because the small green piss-elm stump had not adequately contained the first bore-hole charge. We thought we solved the problem by rolling a huge rock over the carefully tamped bore hole. It took two of us with pikes just to roll that massive piece of granite to where we wanted it.

The powder monkey carefully backed the truck near the

set. He climbed out and propped open the heavy, bonnet-type hood with the steel rod provided by the maker.

Firmly gripping the drop lines, he crawled in under the hood to the location of the battery. The engine on that old truck was as huge as the hood covering it. He touched the wires to the battery.

At detonation, the charge thumped nicely, but that's all that went well.

The massive stone slowly rose into the air as if some giant hand had tossed it. After rotating once, it flew the fifteen or twenty feet back—landing squarely on the rear three feet of the flatbed.

Again, as if some ghostly hand had intervened, the front of the truck rose up off the ground four feet or more. When the truck slammed back down, the hood thundered down mercilessly on my diminutive employer, who ended up trapped between engine and bonnet hood of his self-propelled dynamite detonator.

The man lived through the episode. Now in his nineties, he still remembers the incident.

The good news, as he told it, was that the big old stone that we were going to have to break with a mud-cap charge was conveniently loaded all in one piece, saving the price of the powder, caps, and fuze and the work loading it.

Some glitches notwithstanding, being assistant powder monkey was a good job, lasting most of the summer. As a result of that experience, I have always had lots of powder around, as well as the expertise necessary to make it go off—usually when I wanted it to.

One day, when I was fifteen, good old Charlie Betten stopped by to tell me that a big flock of crows had become accustomed to sleeping in an old gnarled oak in the bayou by his river-bottom field. Charlie was wondering if the stories were true about stringing dynamite in a crow roosting tree and firing it off at night when the crows were all sleeping.

Being one who is always anxious to prove or disprove almost any good theory regarding explosives, I threw a case of dynamite and a roll of primer cord in good old Charlie's pickup truck. Primer cord is nylon rope-looking stuff that

explodes.

We motored back to the bayou and spent the day working in the hot sun until the big old oak looked like a Christmas tree. It was crisscrossed round and round with primer cord, to which we attached randomly placed sticks of Mr. Du Pont's finest.

By evening we were out of dynamite, primer cord, and energy—and we could hear the crows coming.

They squawked and hollered by the thousands 'til it was pitch dark. When they finally settled down, Charlie looked at me and I at him. By some now-forgotten, prearranged signal, we knew their time had come.

Not wanting to repeat my mentor's trick, I gingerly touched the ends of the two drop wires to the battery in Charlie's pickup. Even from our safe position three hundred yards away, the noise was deafening. It was worse for the crows.

At first light we were back in the bayou. We found out firsthand that the stories about dynamite and crows are absolutely true.

Not a leaf remained on the mighty oak, and only a few stragglers hung on some hapless elms that were so unfortunate as to have been standing nearby.

I don't know if any crows survived. If they did, they certainly were deaf. A huge number, as evidenced by the bodies scattered around the bayou, didn't make it through the blitz. We collected almost seven bushel baskets of the pesky critters.

Good old Charlie griped about having to dump the mess but later he was laudatory about the crop of mallards he got next spring without so many molesting crows around to bother the nests.

I don't immediately recall at which age we found out about using dynamite to fish with. The method was surely the most effective we youngsters knew about.

One time my brother and I got tired of Grandma griping about not having any fresh fish in the house. It was the middle of one of those god-awful Midwestern winters that only people who have endured one can really appreciate. We gathered up our gear anyway.

Back on the river, my brother and I chopped four small holes in the ten-inch ice. They were about thirty feet apart over a good fishing hole. On each stick we tied a rock with baler twine. We left about six inches of twine between the dynamite and the rock so the dynamite—which tends to float—could stand off the river bottom and have more concussion effect.

Brother started out lighting fuzes at one end of the string of holes and I at the other. The situation became ominous when Brother got one, two, and three going while I was still trying to light number four.

I finally got number four going. Desperately I threw the lighted charge at the hole. It missed and went skittering across the ice toward Brother, who calmly picked it up, carried it to the appropriate hole, and dropped it in.

As he did, number one went off, showering us with ice chips and freezing water. Desperately, Brother ran for shore. But it was not to be. Two and three went off, cracking the whole slab covering the fishing hole. Brother's weight tilted the slab so he was now trying to run uphill on the ice, which was threatening to dump him back on top of charge number four.

Just when things looked darkest, number four went off, throwing Brother ass-over-appetite into the shallow water. Fortunately he was able to walk through the smoking, roiled water to shore.

We gathered a couple of gunnysacks full of carp and suckers, which made Grandma smile. Later in life, when mortar rounds were dropping around him, Brother said he didn't mind a bit. "Just like fishing back on the farm," he always said.

As kids, most of our fish-gathering efforts weren't so fortuitous. Many of the Midwestern ponds we shot were crammed full of stunted, two-inch bluegills that were at least ninety-seven years old. We blasted pond after pond and got nothing but pound after unusable pound of those tiny bluegills.

At times, the situation was interesting. Old Man Terrel, for instance, had a large, deep pond hidden way back behind his north eighty that he swore housed dozens of

lunker largemouth bass.

One night, a bunch of us kids snuck back and tried to shoot the old curmudgeon's pond. We had to sneak in because of his shotgun, allegedly loaded with rock salt. We used primer cord with several charges hung on it, similar to the crow setup. To get the charge in the correct place in the pond, one brave lad stripped down and swam the line right down the middle of the water. There was really no risk from the explosives; the lad was brave because the mosquitoes were so bad. Everything was set up perfectly, except we had a misfire. No explosion and subsequently no fish. The explosives were too deep in the water to retrieve and recap. The whole episode was a dud.

Misfires have only happened to me three times during my long and fruitful life of handling explosives. Any misfire is tough, but this one was especially bad because we had invested so much time and work sneaking into Old Man Terrel's place. To this day, we still don't know if there are any bass back there.

Coon hunting with dynamite is certainly another sport that isn't all that it's cracked up to be.

One night, we ran a coon into a den dug under a big old walnut tree. I let the hounds dig for thirty minutes, but they couldn't get to the critter. They did, however, excavate enough of a hole that we were able to slip seventeen sticks of dynamite in and touch 'em off.

The blast reduced the coon to possession as well as reducing the hide from three dollars to fifty cents in value. It also threw all the dirt away from the tree roots. In the twilight, it looked like the poor old walnut was trying to do an impersonation of a huge spider.

After a lifetime of handling explosives, I have concluded that modern people are missing a lot of fun—not to mention the adrenalin rush from all the excitement—if they haven't experienced this pastime. This book is dedicated to those hardy souls who want to go back to a time when the use of explosives, and dynamite in particular, was a domestic necessity—not to mention a source of pleasure and recreation. The book will tell you how it was done.

Chapter 1

A Historic Perspective of High Explosives

The American Civil War had been over for only two years in 1867 when an otherwise obscure Swedish chemist discovered that mixing capricious, powerful, and dangerously unstable nitroglycerin oil with inert, otherwise innocuous, diatomaceous earth produced a reasonably stable material of immense benefit to mankind. The world named the stuff *dynamite*.

A highly unpredictable substance, nitroglycerin had been around since its discovery by Ascanio Sobrero, a ho-hum Italian chemistry professor who, in 1846, treated common glycerin with nitric acid. To produce an explosive, the challenges were to make the explosive substance pure enough so as not to self-detonate on the shelf and to stabilize it to the point that the explosive could be transported safely to the work site, where it could be detonated on command.

Because of its vastly superior explosive qualities vis-à-vis black powder, heroic attempts were made to use raw nitroglycerin oil for mining and, to a limited extent, for various uses during the American Civil War. The substance, however, had a maddening habit of going off prematurely without immediate, apparent cause other than a slight warming of the weather, and of being so sluggish at temperatures under 55° Fahrenheit that it could not be detonated under any circumstances.

Alfred Nobel's fortuitous mixture, in addition to numerous tangential discoveries he also made in the field of explosives engineering, led to the technological shifts that,

in economic terms, were of equal importance to the power loom, iron plow, or even the steam engine. In an economy that increasingly eschews the use of dynamite, a surprising fifty million pounds were used in the United States as late as 1985.

At this point, a good definition is in order. All chemical explosives are divided into two classes, high and low. Low explosives include black blasting powder of various types, chlorate powder, and other similar products that burn rather than detonate. Low explosives are seldom used to do commercial blasting.

High explosives decompose with high reaction rates having significant pressures. Conversion from solid to gaseous state is almost instantaneous. As a result, their shattering force is great. High explosives are used whenever large amounts of force are required. Dynamite is the best, most common example of a high explosive.

Without the shocking, tearing effect that is at least twenty times as great as that of dynamite's weak sister (black powder), societies and cultures cannot build roads, bore tunnels, extract minerals from deep in the earth, clear harbors, build railroad beds, or even perform such mundane tasks as laying sewer lines, digging foundation trenches, or excavating holes for outhouses.

Eight ounces of high-tech dynamite stores the potential of about six-hundred thousand foot-pounds of energy. Properly harnessed and directed, that is enough to throw a ten-pound projectile eleven miles, or represents the total muzzle energy of two hundred 30-06 rounds fired simultaneously.

There is a modern tendency to dismiss the productive use of dynamite as unimportant in our society. Viewed in some perspectives, this assumption is understandable.

Substitutes such as ammonium nitrate and others have taken over much of the market for commercial, dynamite-type explosives. In another regard, the older high explosives have been dwarfed into obscurity by their superpowerful nuclear relatives. The Hiroshima bomb, for instance, contained in a cylinder ten feet long by little more than two feet in diameter the explosive equivalent of a

single stick of dynamite twelve yards in diameter and one hundred yards long.

A relatively small five-megaton nuclear weapon has the explosive equivalent of a fifty-story building covering a city block and crammed full of dynamite.

With competition like this, it is little wonder Americans forget about the role dynamite plays in our economy. Yet it is still true today that explosives use acts as a lagging indicator of economic activity. When the economy is buoyant, mines are busy, roads are being built, and airfields leveled. Explosives consumption is up. When the economy is in the doldrums, the line on the graph plotting consumption of powder angles sharply down.

By 1875, Alfred Nobel perfected the principle of initial ignition, wherein he used a small, protected charge of easily degraded black powder to detonate a more stable main charge comprised of high explosives. We use the concept every time we set up a cap and fuze to produce a detonating stick. The concept is revolutionary in its significance but was completely unknown before Nobel's time. He actually pioneered the concept of initial ignition before he developed dynamite!

Early explosives engineers even thought in terms of rigging up a mechanical hammer with which to detonate a primary charge. Like many simplistic technological jumps, the discovery of initial ignition tends to be lost in history.

Alfred Nobel made millions in his lifetime supplying good, reliable explosives to the world's economies. He was popularly pilloried as a "merchant of death," but contemporary records indicate that little use of dynamite was made in a military context.

Perhaps in response to the adverse P.R., Nobel funded the now widely recognized Nobel Peace Prize. Few realize the source and background of the prize that rewards outstanding work in the fields of physics, chemistry, medicine, literature, and fraternity between nations. Ironically, Nobel predicted that high explosives would eventually make wars so costly that wars would cease to occur. Technological advances in the field of high explosives in the late 1800s had a high price. Alfred's older brother was killed April 12,

1888, in an explosion at their dynamite factory at Helenborg, a few kilometers from Stockholm, Sweden.

The blast was the second death-dealing event in the Nobel family history. In September 1864, Nobel lost his younger brother Emil when his nitroglycerin factory went up, taking four employees and the young man with it.

Under pressure from the Stockholm city fathers, Nobel moved his factory onto a raft that he floated on a nearby lake.

The explosion was the first of many worldwide. Nitroglycerin factories are known to have blown up in Panama, New York, San Francisco, and Sydney. This did not seem to deter a rapidly industrializing world that saw these explosives as a good answer to reaching low-grade ore deposits deep underground and for ripping rock with which to surface carriage and railroad rights-of-way.

Managers of existing nitroglycerin factories that did not detonate prematurely quickly saw the value of the new Nobel process. By mixing nitroglycerin oil with commonly available diatomaceous earth, they found it absorbed three times its own weight of the hostile liquid. Only the most determined blow, or a most intense heat, could detonate the new form of high explosive.

Factory owners quickly added dynamite-processing lines on to their nitroglycerin factories. By 1873, there were at least thirteen major producers throughout the world, ranging from Japan to Finland.

Problems with the end product persisted, however. Watery sets tended to kill the early nitro dynamite by driving the oil out of the diatomaceous earth. Also, the product froze solid at 55° Fahrenheit and was extremely difficult to detonate.

The water problem was solved by judicious use of additives and by better use of cartridge wrappers. Modern dynamite is wrapped with a double layer of heavy bag paper impregnated with materials that keep water out and which assist with the overall detonation.

Ammonium nitrate, among others, was blended into the formula to give the cartridges an almost waterproof quality that is still in use today.

The problem of nitroglycerin's high freezing point was never really overcome. The solution that eventually emerged involved mixing ethylene glycol dinitrate, an antifreeze compound that is molecularly similar to pure nitroglycerin oil, with pure nitro. The result was a mixture that was much more usable at low temperatures.

There is no dynamite today that is pure nitroglycerin. Other compounds, such as calcium carbonate and nitrocellulose, were added to increase dynamite's stability as well as lower its freezing point.

Dynamite became so safe and so well accepted that virtually every rural hardware shop had at least a few sticks, a box of caps, and some fuze in its inventory. Farm-supply stores sold it by the piece to those who were too poverty-stricken to buy more than that for which they had an immediate need.

The first year Nobel sold dynamite, he peddled about twenty-two thousand pounds of the stuff. The price was $1.75 per pound. On a relative productivity scale, it was much cheaper than black powder, so marketing the product was not a particularly difficult chore.

By the 1950s and '60s, annual consumption of dynamite in the United States alone was hovering around the one-billion-pound mark. The price had fallen to ten cents per pound or, if one bought in fifty-pound case lots, the price was four dollars total.

The Romans knew how to build roads and, to an extent, how to surface them with an asphalt-like material. It took Nobel and his invention, however, to produce cement (dynamite was necessary to blast huge stones out of the earth in small enough pieces to crush to make the cement). At the time, the United States was starting in on the largest road-building program ever to be undertaken in human history.

During the fifties and sixties, this country was evolving out of being a rural society. It was during this time that America learned to be afraid of explosives. That fear has been translated into vendor regulations and restrictions that have raised the price of powder dramatically.

Modern explosives cost about one dollar per pound or

fifty cents per stick. Unfortunately, there is no longer a single-stick price. Fifty-pound cases run a minimum of fifty dollars!

To some extent, dynamite is priced on the basis of grade and strength. The strength of straight nitro dynamite (of which there is virtually none remaining today) is evaluated by its explosive oil content. For example, if the dynamite contains 40 percent explosive oil by weight, it is said to be "40-percent dynamite." Mixtures are graded by tests that establish their strength as compared to an imaginary benchmark of straight dynamite.

Grades run from the relatively tame 20-percent stuff on up to 85-percent dynamite, known as *Hy-Drive*. Hy-Drive is used to detonate blasting agents such as ammonium nitrate.

Lower-strength powder in the 40-percent range is used to push and throw, as in removing stumps and rocks from the earth. The plan with this material is to keep the object being shot intact so it can be hauled away after it is torn loose from its mooring. Finishing the work with as small a crater as possible is another advantage of lower-strength powder.

Higher-strength 60-percent and 70-percent grades are used to shatter rock into pocket-sized pieces and to reorganize ice jams.

Some very high grades of dynamite are used to blast channels in wet marshes because these grades will *propagate*, meaning that, set in a row, one charge will set off another on down the line by hydraulic shock.

It does not take a huge amount of experience to learn what strength is proper for a given application.

In the final analysis, doing the work was what Alfred Nobel had in mind when he first perfected his blasting systems. With them, a single individual can dig a disposal pit or dry well in otherwise impenetrable ground, set posts, remove large boulders, redirect creeks, cut drainage ditches, unclog duck ponds, or blow up bad guys, as well as perform a host of otherwise impossible chores of immense benefit to mankind.

Chapter 2

Obtaining Dynamite and Other Explosives

Purchasing commercial high explosives is either so ridiculously easy it is almost criminal, or has become so tough that the restrictions are strangling the economy. One or the other of these statements is true, depending on whom one talks to.

Pressure for more stringent laws covering commercial explosives generally comes from within the industry. As a general rule, those who now have the right to use them seem in favor of a permit system to limit the number of other users with which they will have to compete in the marketplace.

Federal rules and regulations exist pertaining to storage and transport of explosives between states, but as long as there is no blatant misuse, the feds generally relegate the day-to-day regulation of explosives to the states. Some states have virtually no laws concerning explosives; others regulate them tightly. As a general rule, agricultural states stay out of the explosives-control business.

Between states, the cleavage is generally between those east of the Mississippi and those west, until one gets out to Oregon. Oregon and California are no longer western states. Politically, socially, and economically one is going east again when one gets that far west.

Pennsylvania is a good example of an eastern state with stringent—many would say punitive—regulations.

Everyone who handles explosives in Pennsylvania must be licensed by the state. The blaster himself must be certified and always prepared to present his special registra-

tion number when doing any explosives work. The certification requirement is so restrictive that small coal mining and pit operations and farmers construe the statutes as undue harassment.

Licenses are very tough to get. An extremely comprehensive training course including questions on procedures, techniques, safety, storage, and federal and state regulations is mandatory for those wanting to use explosives. The course is culminated by a rigorous four-hour exam.

On the other end of the spectrum, Montana is fairly typical of western states that take a fairly laid-back attitude regarding explosives, if they even have an official attitude at all. They have a licensing requirement on the books, but it effectively excepts farmers, loggers, and small pit operators. The only class of users who must attend classes and receive a state user's license are contractors.

In most states, it is wise to claim you are a farmer when applying to purchase high explosives. At a minimum, the potential farmer must be twenty-one years of age, as well as sufficiently literate to fill out a Bureau of Alcohol, Tobacco and Firearms Form #5400.4. Form 5400.4 asks the usual questions about sex, age, weight, place of birth, and social security number. If one applies to buy in the name of a corporation, an employee identification number will be requested.

After this, the customer must check off a few obligatory boxes regarding his status as a felon, substance abuser, etc., that will be recognizable to anyone who has purchased a firearm. A copy of the form is included on pages 19 and 20.

There are also questions regarding the type of magazine the powder monkey will use, date of intended use, and place of use. Selections under the heading of intended use of the explosive materials include coal mining, other mining or quarrying, agriculture, construction, road building, oil-well drilling, seismographic research, fireworks display, and specified other.

Sellers and their employees vary greatly from state to state and from business to business. Nevertheless, the buyer will have to give the impression that he knows what he is

doing. A buyer who appears flaky to the dynamite-store clerk will probably walk away empty-handed. As a general rule, it is best to claim a specific agricultural use for all the explosives (i.e., the user intends to use everything up this day and the next shooting stumps, rocks, or whatever).

Completing the form takes at most ten minutes, if all goes well. As far as I can determine, the seller retains the forms in a permanent record similar to those collected by gun dealers.

Even in relatively relaxed states, the seller may make an issue out of the customer's means of hauling the explosive. The days of pulling up and throwing a case or two of powder in the back of a pickup appear to be gone forever in most places.

One can still use a pickup, but be prepared to face a seller who may check to see if the vehicle is properly licensed and insured, contains an approved storage magazine, and carries fire extinguishers, spare fuses, and road-hazard markers on board, as well as a proper Department of Transportation warning sign. Often these signs can be purchased from the explosives dealer.

Caps should not, as a practical matter, be transported in the same vehicle, even if the seller forgets to check and will permit it. The only possible exception that I allow for myself is if I purchase only a few caps and have a special wooden box that will fit in the cab of the truck well away from the powder carried in the back of the bed.

Some sellers will also ask for evidence that the buyer has planned out a route to his destination that does not go through heavily populated areas. Sellers will at times make an issue of the transport arrangements when they would otherwise not like to sell to that particular customer—the next guy who comes into the shop might be a long-time regular customer who will simply take the cases of dynamite off a pile, put them in the truck, and drive away.

Theoretically, the seller can demand that the truck be fairly new or, if not new, in perfect working condition. He can also specify that powder be hauled in a proper wooden box. In all cases, the tailgate closure must be operating properly.

The pickup magazine box generally must be of solid wood built out of two-by-fours. It must be anchored to the pickup, having a solid top with leather hinges in good working condition.

Many places require that a fire-resistant tarp also be tied down over the load.

It is impossible to predict rapidly changing nuances of state and federal laws pertaining to explosives. The best bet for the new purchaser is to study up on the subject of high explosives, dress up like a gentleman farmer, and then go to the nearest dealer to make inquiry as to what exactly will be required.

Fewer explosives dealers exist today than at virtually any time since the founding of our nation. If one includes deflagrates (such as black powder) as explosives, this is certainly true. Yet, as pointed out earlier, our economy depends on the ready accessibility of explosives more than most people realize. Dealers are around; the trick is to find them. Obviously they are not going to advertise warehouse specials in the Sunday paper.

For starters, check under "explosives" in all the regional yellow pages that you can reasonably lay your hands on. In mining, logging, and farming communities, something will turn up with surprising speed.

If that fails, talk to contractors; road builders; large farm owners; oil drill-rig, heavy-equipment, or quarry operators; or any other possible consumers of explosives in your area.

At times it was a chore but, in spite of all the moving around I have done, I have always found someplace to buy powder. At times it was from a powder monkey, other times a heavy-equipment operator, and others a large, wholesale peddler.

I have even known people who had road crews leave cases of powder and primers for them in trade for the cases of whiskey left for them. It is important to exercise some determination, originality, and diligence in the search for commercial explosives. It may even be necessary to have someone from an adjoining state come over and purchase the goods for you.

Regulation of the use, and especially the criminal

misuse, of explosives falls under the jurisdiction of the FBI and BATF (Bureau of Alcohol, Tobacco and Firearms). They roughly split the duties but cooperation between the two agencies is said to be strained and "reserved" at best.

According to the present split in priorities, the FBI will investigate incidents involving explosives on national forest land, on federal property such as military bases, and in post offices. BATF takes everything else.

During a typical year, BATF looks at about two thousand incidents involving "misuse" of explosives. Some of these are thefts of explosives. Of the approximately twenty tons of filched dynamite taken each year, most is said not to be recovered.

The FBI looks at about half this many cases in a given year. A large number of the illegal uses investigated involve the loss of life. These total about two hundred Americans per annum.

Each agency runs its own explosives training program. The FBI Hazardous Devices School is in Huntsville, Alabama. BATF has its Bomb Investigation Techniques Center at Glynco, Georgia. Very few people know that these centers exist or what exactly is taught at them.

Casual users of explosives are best advised to go out of their way not to attract the attention and scrutiny of either group. One way of doing this is to use blasting agents such as ammonium nitrate fertilizer whenever possible rather than the traditional commercial dynamite. Another way is to stay away from home brews.

Ammonium nitrate fertilizer is easily available from a multitude of agricultural supply houses scattered in every corner of the United States. One need do little more than call farm and feed stores in rural agricultural regions to locate an abundance of dealers selling ammonium nitrate.

No obligatory form must be signed, no record is kept, and there are no transportation problems or requirements. The weak link is the fact that blasting agents such as ammonium nitrate are not particularly cap-sensitive. Also, they only really work in relatively large sets of twenty-five pounds or more. These are fine as frog hair for making duck ponds, but not so fine for stumping, fishing, rock

removal, or Fourth of July activities.

Since blasting agents require dynamite to get them going, it's back to the commercial dealer for caps, fuze, and powder, as well as the Achilles' heel of forms and regulations handled by doubtful store clerks.

The alternative is to make caps and fuze plus some booster explosives at home. I have done this, but have always found it safer and more convenient to buy the stuff commercially. Of course, I don't live in a restrictive eastern state, either.

DEPARTMENT OF TREASURY - BUREAU OF ALCOHOL, TOBACCO AND FIREARMS

EXPLOSIVES TRANSACTION RECORD

(NONLICENSEE OR NONPERMITTEE)

(Prepare in duplicate - Type or print in ink)

NOTE: Please read and care fully follow the instructions attached

TRANSACTION SERIAL NO. *(Begin with "1" and number sequentially)*

NOTICE TO DISTRIBUTEE (BUYER)

1. Explosive materials must be stored in conformance with regulations set forth in 27 CFR Part 181. It is unlawful for any person to store any explosive material in a manner not in conformity with these regulations. If the distributee (buyer) will store explosive materials, he should familiarize himself with the store requirements before he stores such materials.
2. Section 842(k), 18 U.S.C. Chapter 40, provides "It shall be unlawful for any person who has knowledge of the theft or loss of any explosive materials from his stock to fail to report such theft or loss within twenty-four hours of discovery thereof, to the Secretary and to appropriate local authorities." To meet this requirement, any theft or loss must be reported within 24 hours by telephone and in writing to the nearest Bureau of Alcohol, Tobacco and Firearms office shown on the attached sheet and to the appropriate local authority. Telephone ATF (Toll-Free) 800-424-9555 to report all losses or thefts of explosives. For Alaska, Guam, Hawaii, Puerto Rico, or Virgin Islands call collect 202-566-7143.
3. Each business entity acquiring explosive materials shall furnish a current certified list of the names of representatives or agents authorized to acquire explosive materials on behalf of such business entity.

SECTION A – STATEMENT OF DISTRIBUTEE OR BUYER

1. DISTRIBUTEE *(Buyer)*	2. HEIGHT	3. WEIGHT	4. RACE
	5. SSN *(Mandatory)*	6. DATE OF BIRTH	7. PLACE OF BIRTH

8. ADDRESS *(No., Street, City, County, State & Zip Code)*

9. SHOW WHAT USE WILL BE MADE OF EXPLOSIVE MATERIALS

☐ COAL MINING *(Including construction on coal mining property)*	☐ AGRICULTURE	☐ SEISMOGRAPHIC RESEARCH
☐ OTHER MINING OR QUARRYING	☐ CONSTRUCTION	☐ FIREWORKS DISPLAY
	☐ ROAD BUILDING	☐ OTHER *(Specify)*
	☐ OIL WELL DRILLING	

10. EXPLOSIVE MATERIALS WILL BE USED AT *(Show complete address, including county)*	11. EXPLOSIVE MATERIALS WILL BE STORED AT *(Show complete address, including county)*	12. DATE OF INTENDED USE 13. TYPE OF STORAGE MAGAZINE(S) ☐ INDOOR ☐ OUTDOOR

14. DATA OF CORPORATION OR OTHER BUSINESS ENTITY	15. DATA OF AGENT OF CORPORATION OR OTHER BUSINESS ENTITY	
a. PRINCIPAL PLACE OF BUSINESS *(Address)*	a. NAME AND RESIDENT ADDRESS	
b. LOCAL PLACE OF BUSINESS *(Address)*		
c. EMPLOYER IDENTIFICATION NO.	b. PLACE OF BIRTH	c. DATE OF BIRTH

16. CERTIFICATION OF DISTRIBUTEE *(Buyer)* – An untruthful answer may subject you to criminal prosecution. Each question must be answered with a yes or no.

a. Are you a fugitive from justice?		d. Are you or the corporation or other business entity under charges in an indictment or information in any court for a crime punishable by imprisonment for a term exceeding one year? (Note: "Information" means a formal accusation of a crime made by a prosecuting attorney as distinguished from an indictment presented by a grand jury.)	
b. Are you an unlawful user of, or addicted to marijuana or a depressant, stimulant, or narcotic drug?			
c. Have you or the corporation or other business entity been convicted in any court of a crime punishable by imprisonment for a term exceeding one year? (Note: The actual sentence given by the judge does not matter – a yes answer is necessary if the judge could have given a sentence of more than 1 year. Also, a yes answer is required even if a conviction has been discharged, set aside, or dismissed pursuant to an expungement or rehabilitation statute).		e. Have you been adjudicated mentally defective or have you ever been committed to a mental institution?	

I hereby certify that the answers to the above are true and correct. I understand that a person who answers any of the above questions in the affirmative is prohibited by Federal law from shipping or transporting any explosive in interstate or foreign commerce or from receiving any explosive which has been shipped or transported in interstate or foreign commerce. I also understand that the making of any false oral or written statement or the exhibiting of any false or misrepresented identification with respect to this transaction is a crime punishable as a felony. I also certify that I have a legitimate use for the explosive materials for the purpose stated in item 9 above and that the explosive materials hereby obtained will be use in such lawful activity at the location stated in item 10 and will be stored at the location specified in item 11, and that I am familiar with all published Federal and State laws and local ordinances related to explosive materials for the location in which I reside and in which I intend to use these explosives.

DISTRIBUTEE'S *(Buyer's or agent's)* SIGNATURE	TITLE	DATE

ATF Form 4710 (5400.4) (8-80) EDITION OF 4-75 MAY BE USED

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NOTICE TO DISTRIBUTOR (SELLER)

1. Under 18 U.S.C. Chapter 40 of the Organized Crime Control Act of 1970, explosive materials and certification on this form are designed so that a licensee or permittee may determine if he may lawfully distribute explosive materials to the purchaser or nonlicensee identified in Section A of this form, and to alert such distributee (buyer) of certain restrictions on the receipt of explosive materials.

2. Explosive materials shall not be distributed to a business entity on the order of a person whose name does not appear on a certified list required by regulations to be furnished by such business entity and containing the names of representatives or agents authorized to acquire explosive materials on behalf of such business entity.

3. Prior to the delivery at the distributor's premises of explosive materials to an employee of the distributee or to an employee of a carrier transporting explosive materials to the distributee, the distributor so delivering explosive materials shall also obtain an executed ATF Form 4721, Explosives Delivery Record, from such employee before releasing the explosive materials.

4. This form must be kept for not less than five years.

SECTION B – STATEMENT OF DISTRIBUTOR OR SELLER

17. The Person Whose Signature Appears in Section A Is (Check One)		18. The Person Whose Signature Appears in Section A Is (Check One)	
	a. The distributee shown in item 1, Section A.		a. Is known to me.
	b. Listed as a representative or an agent authorized to acquire explosive materials for distributee shown in item 1, Section A.		b. Has identified himself to me as indicated in items 19 and 20, Section B.

19. TYPE OF IDENTIFICATION *(Driver's license, etc. Positive identification is required. A Social security card is not positive identification.)*	20. NUMBER ON IDENTIFICATION

On the basis of: (1) the statements in Section A; (2) the verification of identity noted in Section B; and (3) my knowledge of Federal and State laws and local ordinances relating to explosive materials, it is my belief that it is not unlawful for me to sell, deliver, or otherwise dispose of the explosive materials described in item 21 or on the attached list to the person identified in Section A.

21. IDENTIFY QUANTITY, SIZE AND TYPE OF EXPLOSIVE MATERIALS INCLUDING NAME OF MANUFACTURER AND ALL MANUFACTURER'S MARKS OF IDENTIFICATION, IF ANY. *(If more space is required, attach a list identified by the Transaction Serial Number)*

22. *(Check appropriate box(es))*

☐ THE EXPLOSIVES MATERIALS WERE DELIVERED AT DISTRIBUTEE'S PREMISES.

☐ THE EXPLOSIVES MATERIALS WERE DELIVERED AT DISTRIBUTOR'S PREMISES.

☐ ATF FORM 4721 ☐ WAS ☐ WAS NOT COMPLETED

23. SELLER'S BUSINESS NAME AND ADDRESS	24. SELLER'S LICENSE OR PERMIT NO.

25. SELLER'S SIGNATURE	26. TITLE	27. TRANSACTION DATE

Form #5400.4, page 2 of 4

(It is suggested that one copy be given to distributee (buyer) for information)

INSTRUCTIONS

1. ATF 4710 (buyer) be prepared in duplicate for each transaction involving the distribution of explosive materials to persons who have not been issued a Federal explosives license or permit.

2. If the distributee (buyer) is a corporation or other business entity, the agent authorized by such corporation or business entity to arrange for the distribution of explosive materials will complete items 1, 6 through 15, and 16c. and d.

3. All signatures required on this form must be in ink on the original and copy. All other entries on the form must be in ink or be typewritten.

4. The distributor (seller) of explosive materials will, in every instance, require the distributee (buyer) to complete and sign Section A of this form.

5. The distributor (seller) will complete Section B of this form. He will then serially number the original and copy, retain the original as his permanent record of disposition, and forward the copy to the nearest Bureau of Alcohol, Tobacco and Firearms office shown on the reverse on or before the close of business on the business day after the transaction occurs.

NOTICE TO DISTRIBUTEE (BUYER)

1. Explosive materials must be stored in conformance with regulations set forth in 27 CFR Part 181. It is unlawful for any person to store any explosive material in a manner not in conformity with these regulations. If the distributee (buyer) will store explosive materials, he should familiarize himself with the storage requirements before he stores such materials.

2. Section 842(k), 18 U.S.C. Chapter 40, provides "It shall be unlawful for any person who has knowledge of the theft or loss of any explosive materials from his stock, to fail to report such theft or loss within twenty-four hours of discovery thereof, to the Secretary and to appropriate local authorities." To meet this requirement, any theft or loss must be reported within 24 hours by telephone and in writing to the nearest Bureau of Alcohol, Tobacco and Firearms office shown on the attached sheet and to the appropriate local authority. Telephone ATF (Toll-Free) 800-424-9555 to report all losses of theft of explosives. For Alaska, Guam, Puerto Rico, or Virgin Islands, call collect 202-566-7143.

3. Each business entity acquiring explosive materials shall furnish a current certified list of the names of representatives or agents authorized to acquire materials on behalf of such business entity.

PRIVACY ACT INFORMATION

The following information is provided pursuant to Section 3 of the Privacy Act of 1974 (5 U.S.C. §552a(e)(3)):

1. AUTHORITY. Solicitation of this information is made pursuant to 18 U.S.C. §842. Disclosure of this information is mandatory.

2. PURPOSE. To enable ATF to identify the purchaser and his place of residence, and to determine his eligibility to purchase explosives.

3. ROUTINE USES. The information will be used by ATF to make determinations set forth in paragraph 2. In addition, the information may be disclosed to other Federal, State, foreign and local law enforcement and regulatory agency personnel to verify information on the form and to aid in the performance of their duties with respect to the regulation of explosives, unless such disclosure is prohibited by law. The information may further be disclosed to the Justice Department if it appears that the furnishing of false information may constitute a violation of Federal law. Finally, the information may be disclosed to members of the public in order to verify the information on the form where such disclosure is not prohibited by law.

4. EFFECTS OF NOT SUPPLYING INFORMATION REQUESTED. Failure to supply complete information will preclude effectuation of the transaction.

The following information is provided pursuant to Section 7(b) of the Privacy Act of 1974:

Disclosure of the individual's social security number is mandatory. Under 18 U.S.C. §842(i), ATF has authority to solicit an individual's social security number. The number may be used to verify the individual's identity.

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ADDRESS AND TELEPHONE LISTING OF ATF DISTRICT OFFICES

IMMEDIATELY REPORT ALL LOSSES OR THEFTS OF EXPLOSIVES BY TELEPHONING ATF (TOLL-FREE) AT 800-424-9555. FORWARD COMPLETED ATF FORM 4710 OR REPORTS OF THEFT OR LOSS OF EXPLOSIVES TO THE NEAREST BUREAU OF ALCOHOL, TOBACCO AND FIREARMS OFFICE LISTED BELOW:

CENTRAL REGION

INDIANA, KENTUCKY, MICHIGAN, OHIO AND WEST VIRGINIA

Special Agent in Charge (ATF)
U.S. Post Office Building
(Mailing Address: P.O. Box 17991)
Cincinnati, Ohio 45201
Phone: 513-684-3756

Special Agent in Charge (ATF)
05 Erie View Plaza
Cleveland, Ohio 44114
Phone: 216-522-3000

Special Agent in Charge (ATF)
211 Federal Building
Detroit, Michigan 48226
Phone: 313-226-7300

Special Agent in Charge (ATF)
600 Federal Place
Louisville, Kentucky 40202
Phone: 502-582-5211

MID-ATLANTIC REGION

DELAWARE, DISTRICT OF COLUMBIA, MARYLAND, NEW JERSEY, PENNSYLVANIA, AND VIRGINIA

Special Agent in Charge (ATF)
701 West Broad Street
Falls Church, Virginia 22046
Phone: 703-557-1650

Special Agent in Charge (ATF)
P.O. Box 327
Union, New Jersey 07083
Phone: 201-687-6100

Special Agent in Charge (ATF)
U.S. Customs House
2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106
Phone: 215-597-7266

Special Agent in Charge (ATF)
400 North 8th Street
(Mailing Address: P.O. Box 10068)
Richmond, Virginia 23240
Phone: 804-782-2871

NORTH-ATLANTIC REGION

CONNECTICUT, MAINE, MASSACHUSETTS, NEW HAMPSHIRE, NEW YORK, RHODE ISLAND, VERMONT, PUERTO RICO, & VIRGIN ISLANDS

Special Agent in Charge (ATF)
John F. Kennedy Bldg.
(Mailing Address: P.O. Box 8115)
Boston, Massachusetts 02114
Phone: 617-223-3817

Special Agent in Charge (ATF)
90 Church Street
(Mailing Address: P.O. Box 3462
Church Street Station)
New York, New York 10008
Phone: 212-264-4668

NORTH-ATLANTIC REGION (cont.)

Special Agent (ATF)
U.S. Courthouse & Federal Bldg.
Carlos E. Chardon Ave.
Hato Rey, Puerto Rico 00919
Phone: 809-753-4084

Special Agent in Charge (ATF)
135 High Street
Hartford, Connecticut 06101
Phone: 203-244-3642

MIDWEST REGION

ILLINOIS, IOWA, KANSAS, MINNESOTA, MISSOURI, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WISCONSIN

Special Agent in Charge (ATF)
2115 Butterfield Road
Oak Brook, Illinois 60521
Phone: 312-325-8620

Special Agent in Charge (ATF)
1150 Grand Avenue
Kansas City, Missouri 64106
Phone: 816-374-3886

Special Agent in Charge (ATF)
1114 Market Street
St. Louis, Missouri 63101
Phone: 314-425-5560

Special Agent in Charge (ATF)
U.S. Court House & Fed. Bldg.
316 North Robert Street
St. Paul, Minnesota 55101
Phone: 612-725-7093

SOUTHEAST REGION

ALABAMA, FLORIDA, GEORGIA, MISSISSIPPI, NORTH CAROLINA, SOUTH CAROLINA & TENNESSEE

Special Agent in Charge (ATF)
C&S Bank Building
1 West Court Square
Decatur, Georgia 30030
Phone: 404-221-6626/27

Special Agent in Charge (ATF)
2121 8th Avenue, North
Birmingham, Alabama 35203
Phone: 205-254-1205

Special Agents in Charge (ATF)
222 S. Church Street
Charlotte, North Carolina 28202
Phone: 704-644-7071

Special Agent in Charge (ATF)
Federal Building
901 Sumter Street
Columbia, South Carolina 29201
Phone: 803-765-5641

Special Agent in Charge (ATF)
100 West Capitol Street
Jackson, Mississippi 39201
Phone: 601-969-4200

SOUTHEAST REGION (cont.)

Special Agent in Charge (ATF)
9205 N.W. 84th Ave.
Miami, Florida 33166
Phone: 305-592-9568

Special Agent in Charge (ATF)
4004 Hilsboro Road
Nashville, Tennessee 37215
Phone: 615-251-5412

SOUTHWEST REGION

ARKANSAS, COLORADO, LOUISIANA, NEW MEXICO, OKLAHOMA, TEXAS, AND WYOMING

Special Agent in Charge (ATF)
P.O. Box 80927
Houston, Texas 77205
Phone: 713-226-5405

Special Agent in Charge (ATF)
1200 Main Street
Dallas, Texas 75202
Phone: 214-767-2250

Special Agent in Charge (ATF)
Hale Boggs Federal Office Bldg.
500 Camp Street
New Orleans, Louisiana 70130
Phone: 504-589-2048

Special Agent in Charge (ATF)
200 N.W. Fifth Street
Oklahoma City, Oklahoma 73102
Phone: 405-231-4877

WESTERN REGION

ALASKA, ARIZONA, CALIFORNIA, GUAM, HAWAII, IDAHO, MONTANA, NEVADA, OREGON, UTAH, AND WASHINGTON

Resident Agent in Charge (ATF)
300 Ala Moana Blvd.
(Mailing Address: P.O. Box 50103)
Honolulu, Hawaii 96850
Phone: 808-546-3196

Special Agent in Charge (ATF)
300 N. Los Angeles Street
(Mailing Address: P.O. Box 1991)
Los Angeles, California 90053
Phone: 213-688-4812

Special Agent in Charge (ATF)
915 2nd Ave.
Seattle, Washington 98174
Phone: 206-442-4485

Special Agent in Charge (ATF)
2721 N. Central Ave.
Phoenix, Arizona 85004
Phone: 602-261-3220

Special Agent in Charge (ATF)
525 Market Street
San Francisco, California 94105
Phone: 415-556-6769

Resident Agent in Charge (ATF)
Federal Bldg.
Anchorage, Alaska 99501
Phone: 907-278-7914

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Chapter 3

Storage and General Safety

Several basic categories of folly contribute to perhaps 95 percent of the problems one can encounter with explosives.

The first and foremost are people problems. Anyone who has been around high explosives any length of time has incredible stories to tell—about the powder monkey who crimps the caps with his teeth, carries a stick of dynamite in his truck jockey-box to impress his girlfriend, hammers the caps into the primer stick with a convenient rock, or runs off and leaves a misfire located in a well-traveled place.

I even knew one fellow who tied his cases of powder shut with four-foot lengths of primer cord. A popular writer, commenting about high explosives, said he saw another fellow using a piece of primer cord for a belt. Primer cord is plastic rope-like material that is very explosive and very powerful. It was used more extensively in the past to fire multiple charges when electric caps were not available or were difficult to obtain. Primer cord can be very destructive.

Obviously, these are not the kind of borderline dumb events that usually allow the powder monkey to get by. They are plain, old-fashioned, death-dealing stupidity. Borderline procedures include such things as carrying caps in a shirt pocket or even in the same load with the powder, using metal pliers rather than a capping tool to crimp caps, using an old, untested battery to fire electric charges, neglecting to cut a fresh end on a fuze, or not standing clear

of the work zone when the shot goes. The powder monkey who finds he occasionally has to do these things will usually get by. The guy who crimps caps with his teeth or runs right up to a misfire when it didn't detonate will have his day of reckoning rather quickly.

Even OSHA, which issues scores of citations each year for improper storage and transport of explosives, has come to the conclusion that most explosives problems are people problems. It is people who cause them by not paying strict heed to rather simple, direct cautions. It's a variation of the plaintive cry of the gun owners—explosives don't cause accidents, people cause accidents!

When I was a younger powder monkey I had an employer who loved to hear the charges thump. I told him that a nice *whoomp* indicated a properly sized charge, but he insisted that as long as he was paying for the powder, I should use enough to make the results spectacular.

It was a typical Midwestern morning. Our shirts were shamefully sweated through, although we had done very little work. The long-handled bore-hole auger shaved out the sticky black soil in coarse ribbons, if one could just stay motivated enough to power the thing. I fired the stemming charge to produce a nice powder chamber under the large box elder stump on which we labored.

Normally, I would have slid five sticks of dynamite into the little cavern under the still-fibrous, woody green stump. My client, however, liked the fireworks. I put in the five. He urged me to slip in five more so that we wouldn't "tear up" his tractor "pulling the pieces out of the ground."

I followed his instructions, stemmed the hole with the solid, damp earth, lit the fuze, and at a fast walk retreated to his pickup truck parked broadside to the charge about one hundred yards away.

As usual, the fuze took longer than one would suppose to burn down to the cap. At the blast, the stump disappeared in a cloud of smoke and rubble. A large chunk of root shot out like a bullet on a virtual level line toward the truck. We were behind the truck and needed to do nothing more than duck down. The chunk passed not a foot over the bed of the truck, landing perhaps sixty feet behind us.

Our biggest problem was a pair of severely bumped heads incurred when ducking simultaneously.

Statistically, the most frequent cause of real, act-of-God accidents while handling explosives is inappropriate and insufficient precautions against what people in the industry call "throw rock."

Throw rock is a broad term for the pieces the explosion throws out of the set. Simply put, if you are too close to the blast site when it goes, chunks will fall on your head. The overcharged box elder and my client, the fireworks lover, are the best example in my personal experience.

Knowing how far back to stand from a blast site is, to a great extent, a matter of experience. I started my children out with explosives by allowing them to shoot single sticks on the bare ground. After they mastered that, we blasted large ant nests and snowbanks, again with nothing more than single sticks. I let them come along and sit in the open jeep when I was really blasting something significant so that they could see firsthand how destructive dynamite could be. If they so much as set one foot outside the jeep, I took them home immediately. Like everyone else, they enjoyed the show. They were extremely careful not to break the rules.

There are, of course, the great long lists of do's and don'ts involved with using powder. Before getting to those, however, there is one other broad category of folly of which neophyte blasters must be aware.

By their very nature, blasting caps are much more sensitive and dangerous than the powder itself. I always carry only enough caps for the immediate job. I carry them securely fastened in a small Styrofoam box inside a cheap Styrofoam cooler. Don't allow the caps to rattle around and, for God's sake, if there are more than one or two caps that cannot be widely separated from the powder in the back of the truck, carry the two in separate vehicles.

Don't ever carry caps in your pocket. Treat the caps as you would an easily detonated M-80 firecracker. They may not be quite that powerful, but respect them at least to that extent.

As part of the demonstrations I do for people, I have

dropped dynamite caps (both electric and fuzed) on the concrete floor from shoulder height. As a precaution, I wear high boots, heavy pants, and stout goggles, and always attempt the demonstrations out on the patio, where a low wall also offers protection. So far I have never had a cap detonate. Even so, I always treat them as though the slightest shock or warming will touch them off.

After using common sense, planning smart to avoid throw rock, and treating caps with respect, the following cautions apply. I have kept dynamite 'til it was ten years old without undue problems. I watched it closely, however, always ready to take action if necessary. As a general rule, explosives store poorly. Unlike people, they do not get weak and feeble with age. Use them up regularly. Don't keep explosives around for long periods of time unless you are skilled enough to know the signs of deterioration. If explosives are to be stored, follow state, federal, and industry standards for storage.

As a younger man, I kept our powder in the pump house located about ten feet from the bedroom window. This could have been an unsmart procedure, but as a general rule, fresh commercial powder is not particularly cantankerous.

Ideally, storage areas should be stout, secure buildings located away from inhabited buildings, bridges, heavily used roads, or areas where lightning might strike. These buildings should have good roofs and sound floors, and be dry and well ventilated. No metal tools should be stored with the powder. Gasoline and other petroleum products must be kept away from powder. If stray bullets might be a problem, take that into consideration. Doors should be tight and lockable and the structure generally rodent-proof.

I keep my caps in a small, detached barn and the powder up the mountain about three hundred yards in a small, cement-floored cellar dug into the hillside. Federal and state laws require that I put out warning signs, but that is simply asking for trouble in my opinion.

Always use nonsparking or nonmetal tools around explosives when placing charges. I have always used old, wooden shovel handles, being careful never to bring the

metal auger near the powder.

Keep boxes and cartons in good repair, and don't allow the cartridges to get scattered around.

Don't use any explosives or caps that have been soaked with water, no matter how well they seem to have dried.

Be cautious regarding the preparation of primers. More about this in a later chapter.

Stand apart from the powder and any watchers when preparing the primer cartridge.

Be certain of all bore holes. Know where the cartridges are being loaded. Don't load in or near sites that could contain old, unexploded cartridges.

Keep explosives away from the working area until the moment they are loaded.

Don't tamp, pressure, or pound any dynamite—especially material cut from the cartridge that is placed loose in the blast hole.

Primer cord, fuze, and cap wires should not be kinked or injured.

When firing electrical caps, use the correct amount of electrical current, test the circuits, and quit if an electrical storm comes up. Even miners setting explosives deep underground do something else until an electrical storm blows past.

Be sure all electrical connections are clean, bright, and electrically and mechanically secure.

Keep the power source well away from the blasting circuit until the moment of firing. Keep all wires shunted (tied together).

Attach caps to detonating cord in an approved manner and do so last, just before the detonation sequence is commenced.

When lighting multiple cap and fuze sets, cut a length of fuze half the length of the shortest fuze in the group, cap it, and light it first. When that cap explodes, all lighters must immediately leave the blasting area.

Never light a fuze while holding the charge in your hand.

Never place any capped charge or fuze under pressure.

Make sure soil covers the dynamite so that no sparks

from the burning fuze fall on an exposed cartridge.

When a misfire would be an absolute disaster, use the more certain and often less troublesome electric caps.

Keep clear of a blast area until the smoke and fumes are well dissipated.

Post guards to be sure no one inadvertently moves onto the blast site.

Old dynamite can be burned as a means of disposal. Simply lay the stocks on the ground, douse them with kerosene, and light them. I have never had a detonation following this procedure, but you should always assume one could occur. When burning dynamite, it is best to plan for the worst and burn in a remote area.

Most of all, use caution and common sense. If the blaster does not allow himself to be complacent, the entire procedure is certainly safer than many other things we commonly do every day.

Chapter 4

Basic Procedures

Detonating dynamite is relatively simple. Getting it to go off at the time and place one desires is a matter of straightforward training combined with a modest amount of self-discipline.

Capping a dynamite cartridge is the first, most basic skill that the would-be blaster must acquire.

Before proceeding, users who have never examined dynamite before should open the end of a cartridge for a firsthand look. They will find that the tan to tan-grey mixture looks like old chewing gum. The white prills (spherical pellets), if included in the mixture, should be round and firm. Mushy, distorted prills are a sign of old, going-out-of-condition powder. Don't buy this kind if you can help it. If you have it already, use it up. If the cartridges are weeping or leaking, carefully dispose of them by burning.

Cartridges come in a great variety of sizes and shapes. Nine hundred and ninety-nine times out of a thousand they will be half-pound sticks that are about one-and-a-quarter inches in diameter by eight inches long. I have occasionally used some twelve-inch long sticks and some three-pound canisters, but only a handful of times in forty years of blasting. The three-pound canisters were special orders that I lined up for dealing with an especially dreary stump-removal project.

Approximately thirty-five fresh oak stumps dotted the middle of a fifty-acre field. We had cut out the logs the previous winter. Some of the logs were forty inches on the

butt end, which gives the reader some idea of the size of the stumps. All the logs were cut into one-inch boards. Any limbs bigger than three inches were stacked up by the stove. Other than the stumps, we were ready to farm the ground.

Usually a blaster would use a hand auger to dig down under the stumps, fire a springing charge, and then blast the stumps out with a heavy main charge. Because the stumps were so large and green, it was a tough project. The sandy, dry soil and the incredibly hot, muggy weather added immeasurably to our grief. It took immense willpower just to go out to the humidity-sodden work site, where the last fresh breeze had blown months ago.

Lightening the work load became a priority item. The plan we worked out did the job very nicely. By connecting a rotating six-foot length of cold, rolled-round steel stock to the drawbar of our D-8 Cat, we fashioned a punch that took the place of the auger. One drum of the machine's winch raised and lowered the bar, producing a very workable, power-punching dynamite tool.

By lowering the pitch of the punch to a 45° angle, we were able to back up the Cat onto the bar and drive it down under the stump. The hole it produced was just right for the three-pound canisters. We routinely pushed four or five of the cylinders of 40-percent powder down the hole with our rake handle and let 'em rip.

When we had eight or ten sets batched up, we lit them all en masse. The little dozer operator who just returned from a government-sponsored hunting trip in Korea jumped two feet every time a charge thumped. A couple of times the blasts were so close together that he didn't get to touch the ground between thumps.

Unlike regular cartridges, the three-pound canisters were packed in what appeared to be common cardboard tubes. Dynamite cartridges are wrapped in tough, deep-brown paper. The slick paperlike material of regular half-pound charges is specially treated so that it will enter into the detonation. The paper ends and the seam along the cartridge are sealed with wax. Dynamite cartridges are compact and tough. As many miners can attest, they will

withstand a fair amount of rough handling bordering on abuse.

Powder users will commonly encounter two types of detonating caps. Electrical caps are easily distinguished by their two red-and-white or green-and-yellow wire leads. The cap itself will be a natural aluminum color. It will have a watertight rubber plug securing the wire leads to the cap body.

The 2 1/4-inch x 3/8-inch caps are marked "Dangerous Blasting Cap Explosive" on the body. Several different styles of electrical caps are available, providing for a time lapse between firing and actual detonation. These are used in mining and quarrying to allow multi-charge sets to be set off in proper sequence. Standard industry codes for these caps are as follows:

Delay Period (code)	Time in Seconds to Actual Detonation
0	0.008
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
8	4.0
9	4.5
10	5.0

Delay-action electrical caps are manufactured by putting a delay element with a closely controlled burn time between the ignition element and the primer charge. The primer ultimately deteriorates the cap. Standard delay caps are designed to fire at intervals of from one-half to five seconds after they are electrically "set off."

Codes used to designate the type of cap one is dealing with are fastened to the lead wires. These range from 0 (virtually instantaneous detonation) to 10 (five seconds). The delay caps are used in a way that the outside charge

blows first, relieving the outside wall so that the inner charges will then in sequence crack the material being blasted free in the correct direction.

As a general rule, the hobby blaster will use only the instantaneous varieties of electric blasting caps. The only exception might occur if one buys supplies from a quarry operator or other secondary source.

Caps used with fuze were, in times past, most common because they were generally less expensive and less cumbersome to use than their electrical counterparts. Lately I have had trouble buying fuze and caps in anything but very limited quantities, due—in part, vendors tell me—to a government drive to make these easier-to-use explosives more difficult to obtain.

Fuze caps are thin, hollow aluminum cylinders one-and-one-half inches long and about one-quarter inch in diameter. Fuze caps are much smaller than electrical caps, even excluding the wire leads.

Unlike regular dynamite (which burns without incident for a minute or two when torched), the mixture that fills the cap up to about two-fifths of its capacity is fire-sensitive. When the fuze burns to it, an explosion about the intensity of a healthy firecracker results.

Fuze comes in white, red, and black colors depending on the whim of the maker. The feel is stiff and slick. Coils can be from four to nine inches in diameter, with lengths from fifty to one hundred feet. The fuze core burns with a hissing, spitting, smoking flame. Surrounding the core is a sticky, tar-like layer that is, in turn, covered with a wrapping of light thread that is lightly painted.

It doesn't happen easily, but the fuze should be protected from kinking. Old timers sometimes knot the fuze around the dynamite to hold the cap in place. This procedure is a definite no-no if one wants to avoid adrenalin-inducing rushes while cleaning up messy misfires.

The correct procedure when attaching a cap to the fuze is to always trim about one-half inch from the end of the coil of fuze. Do this to expose a clean, fresh, right-angle cut to the cap.

The cut can be done with a knife but is best accom-

plished with a nonsparking combination cutting tool made specifically for this purpose. Dynamite combination tools are made by Diamond Tool and others, and are available for about $8 from dynamite distributors—usually without filling out forms.

One handle of the tool is a punch and the other is a screwdriver, which is useful when connecting drop wires to a power box. The tool is principally useful when crimping the cap to the fuze and for cutting fuze.

Crimping can be done with common gas-pipe pliers but—like many, many things in life—is best done with the correct instrument.

Knife cutting distorts the fuze a bit, especially on a hot day when the tar-like fuze is more pliable.

Insert the fresh-cut fuze end firmly into the cap. I perform this part of the sequence well away from the box of cartridges, although I have never had a cap go off prematurely.

Crimp the thin aluminum skirt of the cap securely onto the fuze. Considering that the fuze will burn at the rate of one foot per minute, that no fuze should ever be less than a foot in length, and that the extra time the extra fuze provides is always worth the price, cut a proper length off the roll of fuze.

Always be very cautious about the springy fuze snapping the cap around into a rock or other hard object and detonating it.

Using a one-quarter-inch wooden stick as the pick, or the dynamite tool, push a diagonal hole down through a dynamite cartridge, starting about one-third of the way down the stick.

Be cautious not to run the hole through both sides of the cartridge. Some blasters run the hole in from the end but I have always run the hole in the side. There is no reason for preferring the side-pick system other than this is how I was originally taught.

Insert the cap on the fuze snugly into the hole in the punched cartridge. I use a precut eight-inch length of baler twine to tie the capped fuze securely in place. Place the knot over the pick hole to protect it a bit.

This package constitutes the cap charge.

It is much easier to light fuze if it is sliced back about an inch, exposing the inner powder train. Otherwise, the tar coating may burn with a weak, yellow flame for a minute or two before the fuze itself sputters to life, giving the neophyte apoplexy in the process.

Electrical caps are inserted into cartridges much the same way fuzed caps are installed. In the case of electrical caps, the leads can be knotted around the cartridge to hold the cap in place without compromising safety.

Electrical caps are most practical when multiple charges are shot. It is possible to shoot a number of charges simultaneously using match cap and fuze with detonating cord, but if the charges are very far apart, the cost becomes prohibitive.

The first time I used det-cord was to take out a number of six- to ten-inch hawthorne trees. A covering of long, very sharp thorns virtually precluded cutting them with a saw.

I tightly wrapped three winds of det-cord around the trunks two feet above ground level, slipped a fuze cap between the trunk of the tree and the det cord, and shot them individually. In spite of a seemingly minimal amount of exposure, I pinched up my hands and arms doing even this much work around those damn trees.

Detonating cord looks like heavy, poly-plastic clothesline. It is fairly flexible, coming in ten-inch, one-thousand-foot reels. The explosive component of det-cord is extremely fast and powerful. It will take an eight-inch green tree and splinter the trunk through to the core.

I had all the trees lying over in an hour.

The principal use of det-cord, other than placing it in ditches and holes the enemy might use during an ambush, is to connect multiple match and fuze charges together. The material runs forty cents per foot, precluding one from getting too carried away with this use.

To obtain more or less simultaneous detonations, you can wrap a turn of det-cord around each cartridge in a set running from the main charge that was capped conventionally to the side charges.

Match- and fuze-capped charges are fairly reliable in about ten feet of water. When going deeper or using electrical caps, I place the capped charge in a thin plastic bag. The water pressure will collapse the bag, which helps seal out harmful moisture.

Besides the combination tool and a pocket knife, the blaster will need a long-handled shovel. The wooden handle is good for poking the cartridges down the bore hole, especially the first charge (called the *spring* or *springing charge*), which is used to create the main powder chamber under the stump or rock.

I have marked my shovel handle with pieces of tape spaced every eight inches to quickly indicate how many charges can be placed in the hole. Some blasters use a separate tamping stick. I don't find this necessary.

When I was a young man, we often saw dynamite augers being sold at farm auctions. After a few years, they all disappeared—I suspect into the hands of antique collectors. To make do, we purchased some of the many one-and-one-half-inch-diameter wood augers that barn carpenters used. By welding a five-foot-long, three-eighths-inch steel rod to them, we had a reasonably good dynamite drill. Now even the large-diameter bore carpenter bits are tough to find. An auger with flights rather than a flat-spoon cutting edge is needed to pull the dirt out of the hole. New or used, these tools are virtually unfindable.

By whatever means, a good bore-hole auger is invaluable when doing serious work with commercial explosives. The flights must be wide enough to pull out small stones, the cutting edge sharp enough to cut small roots, the handle long enough to reach under the designated object and the turning handle long enough to torque the rig through common obstructions.

Powder monkeys shooting mostly electrical caps will also need an ohmmeter to read the resistance in the electrical sets, a minimum of 250 feet of drop wire and up to 500 feet for heavier charges, such as that used for blasting duck ponds or drainage ditches.

After learning to make blasts with cap and fuze that allow the user to retreat as far as his legs and discretion take

him, the user will also learn how to make sets that merely *whoomp* and do not throw rock and debris all over the state. Having learned to contain the blast by using the correct type and amount of powder, the blaster can feel more confident regarding the use of the shorter 250-foot drop wires.

Drop lines should be heavily insulated, 14-gauge wire. The ohmmeter can be a simple instrument purchased from Radio Shack.

I have never used a blasting machine. Instead, I relied on a lantern battery for single charges and truck batteries for multiples under five caps. I try to limit my electrical sets to five charges. Casual dynamite users will seldom be called on to make sets larger than could be handled by five caps.

Larger sets, in my opinion, defeat the safety argument in favor of electrical caps—i.e., when they are touched off, they either go or don't go. With match and fuze there is always a question until the moment of detonation. Sometimes detonation takes what seems like forever between lighting the fuze, the retreat, and the *whoomp*.

Electrical blasting is not a mysterious process. It does, however, require a knowledge of the most basic laws of electricity.

Electric current flowing through a conductor such as a wire is comparable to water moving through a pipe. Voltage is the pressure of the water (electricity). Rate of flow through the wire is measured in amperes. In a pipe, it is gallons-per-minute.

The diameter of a wire influences the rate of flow of electricity much the same as the diameter of a pipe influences the rate of water flow. The cross section of either (or lack thereof) opposes the flow or creates resistance.

The three factors—voltage, current, and resistance—are related in a formula known as Ohm's Law. Ohm's Law is probably the most basic piece of electrical physics.

Every schoolboy learns the formula at one time or another:

Pressure/Resistance = Rate of Flow

or

Volts/Ohms = Amperes

These terms relate to the three elements of an electrical blasting circuit, including the electrical cap itself, the source of energy, and the drop wires that carry the electrical current.

The electrical blasting cap transforms electrical energy into heat, which starts an explosive force strong enough to detonate the main charge.

Like a filament in a light bulb, the electrical charge heats a bridge wire embedded in a flash compound. The flash compound detonates an intermediate charge in the cap that is actually the primer. This small but powerful charge has enough strength to detonate the dynamite cartridge.

It takes an extremely short time for the electricity to heat enough to flash the compound. This time can vary, depending on the amount of electrical energy going to the cap. To a point, increasing the current lessens the irregularities among caps.

A minimum current of 0.3 to 0.4 amps will fire a commercial electrical cap, but safety and consistency dictate that a charge of 0.6 to 0.8 amps be used. Cautious blasters usually figure on a minimum of 1.5 amps of direct current (batteries) and at least 3.0 amps of 60-cycle alternating current from a wall socket or a portable generator.

Power sources for a shot can be delivered by blasting machines, commercial power lines, motor-driven generators, and storage and dry-cell batteries.

Most blasting machines, including the old rack-bar-type push boxes used in the movies, are portable electric generators designed to have high voltages. Newer blasting machines are sometimes the condenser-discharge type. Some machines that are more than adequate for ten simultaneous shots can be carried in one hand. They are discharged by a quick twist of the wrist.

Because of the high cost, I have never purchased a blasting machine. When hooked up in series or used while

the engine is running, standard 12-volt truck batteries will usually fire more charges than I have the energy to install in one set.

For safety's sake, every charge set in a day should be fired that day. Do not allow a charge to stand overnight or even leave the site for lunch or a break.

No blasting should be attempted with vehicle batteries that are not fully charged or that show signs of any deterioration or weakness. The engine should be on fast idle when the shot is made to ensure that enough amperage is available.

Three types of wire are used in the blasting circuits:

Leg wires are the thin, insulated wires that run from the cap itself. They range in length from six to fifty feet. It is important to know the resistance of these caps, including the leg wires, so that accurate calculations can be made regarding the adequacy of one's power supply.

Resistance of Copper Wire Electrical Blasting Caps

Length of Leg Wires (feet)	Average Resistance (ohms)
6	1.53
8	1.66
10	1.72
16	1.91
20	2.04
24	2.17
30	2.00
40	2.20
50	2.40

Resistance can be extrapolated from six to twenty feet and from twenty-four to fifty feet. At twenty feet, the wire size in caps jumps from 22 gauge to 20 gauge. The heavier wires are needed for lower resistances over longer distances.

Connecting wires are those insulated wires run through the shot region that may be torn up at detonation. They are usually 20 gauge, ultimately connecting to the drop wires from the caps.

Drop wires are those that connect the basic set to the power source. If at all possible, these wires should be 14-gauge copper.

One must know the resistance of connecting and drop wires to calculate how many caps can be fired from a given power source. Use the following chart, along with an ohmmeter.

Gauge	Ohms per 1,000 ft. of drop wire
4	0.248
6	0.395
8	0.628
10	0.999
12	1.59
14	2.52
16	4.02
18	6.38
20	10.15
22	16.14

There are three types of circuits commonly used: single series, series in parallel, and parallel. Many times, the nature of the shot will dictate the type of circuit that must be used.

A single series is illustrated on page 41.

If there were fifty electrical caps rather than the six shown, the blaster would compute the circuit as follows:

50 electric caps with 20-ft. leg wires =
50 x 2.04 = 102.0 ohms

Resistance of 100-ft. No. 20 connecting wire = 1.0 ohm

Resistance of 250-ft. No. 14 drop wire = .5 ohm

Total Resistance of Circuit = 103.5 Ohms

If the current were supplied by a 220-volt AC generator, the current supplied would be:

220 volts/103.5 ohms = 2.12 amps.

This is not enough power supply to power the necessary 3.0 amps of alternating current per cap that is considered a safe standard. To be entirely safe, the blaster would have to cut the set down to fifty charges. These readings can be verified by using the ohmmeter.

For example, fifty caps have a resistance of 51.75 ohms.

220 volts/51.75 ohms = 4.25 ohms

A partial solution—if a larger set must be used, or if one is working with a smaller power source such as a vehicle battery—is to connect the caps in a parallel circuit. An example of a parallel circuit is shown on page 42.

The resistance in this case is only the resistance of each cap. Using a parallel circuit or a parallel-series circuit, a huge number of caps can be fired. Some sets containing more than one thousand caps are made using a variation of a parallel series.

Parallel Series Circuit Example

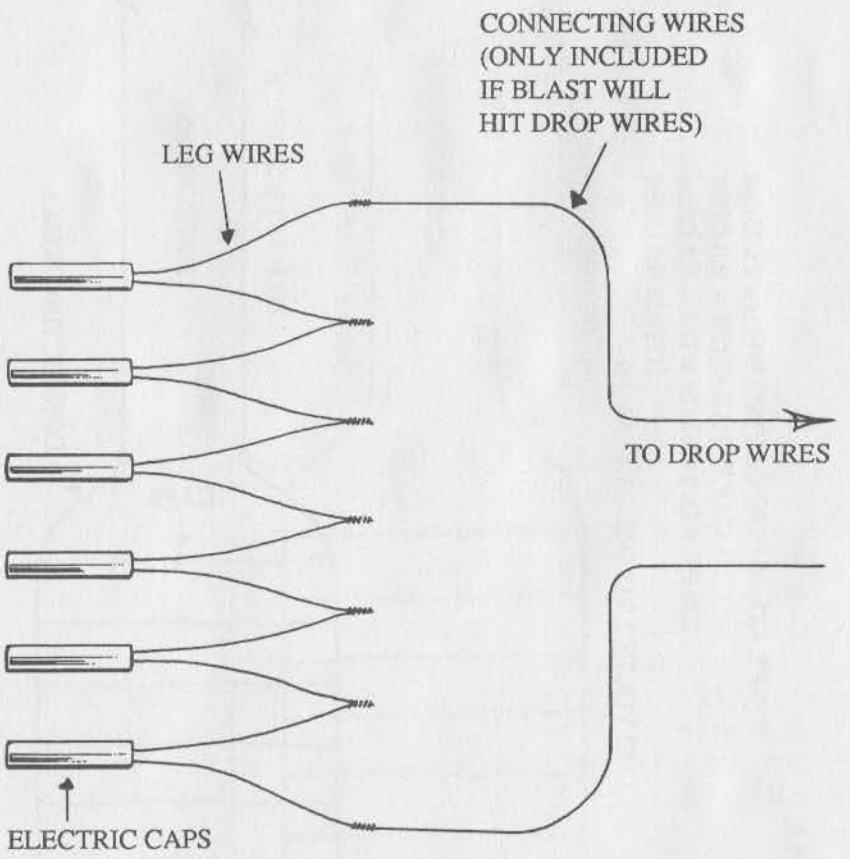
200-ft. No. 20 connecting wire = 1.0 ohm

4 caps in parallel series = 8.12 ohms

250-ft. No. 14 drop wire = .5 ohms

Total = 9.62 ohms

12 volts/9.62 ohms = 1.24 amps

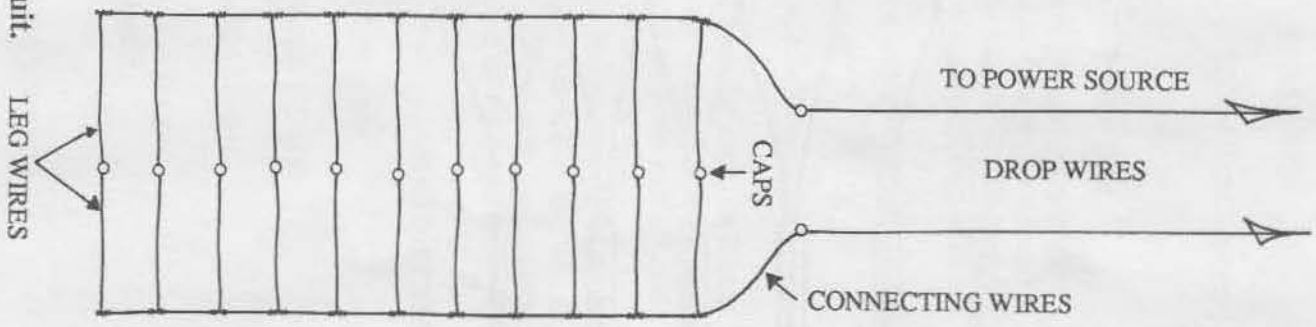


Single-series circuit.

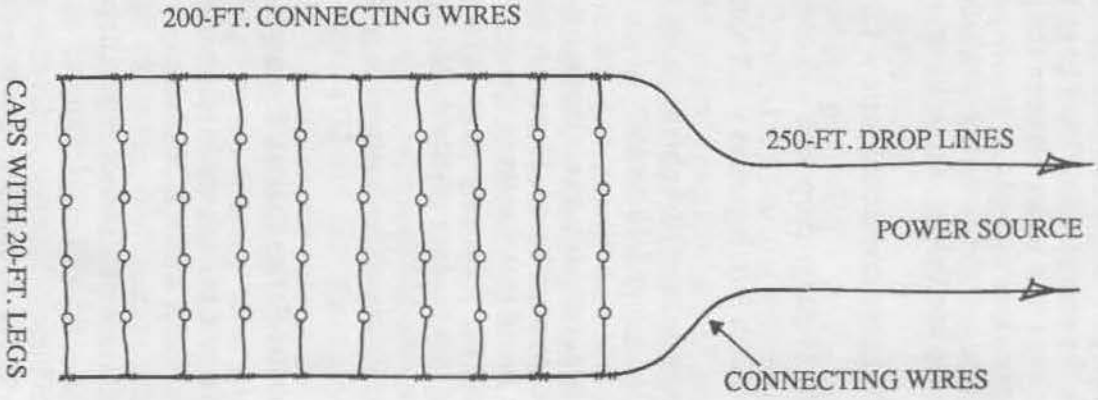
EXAMPLE:

200-FT. NO. 20 CONNECTING WIRE = 1.0 OHM
1 CAP IN PARALLEL = 2.0 OHM
250-FT. NO. 14 DROP WIRE = 0.5 OHM
TOTAL: 3.5 OHM
12 VOLTS/3.5 OHMS = 3.42 AMPS

Parallel circuit.



Parallel-series circuit.



Note that, with direct current from a battery only, 1.5 amps is required to safely set off a single cap. In parallel, only the resistance of a single cap between the connecting wires are used in the computation. Very large sets are made by placing more caps in a series between the parallel lines, but the computation does change.

Going back again to the five-shot series (which for me is the most common multiple shot), we have:

100-ft. 20-gauge connecting wire = 1.0 ohm

250-ft. 14-gauge drop wire = .5 ohms

5 caps with 8-ft. leg wires = 8.3 ohms

12-volt truck battery/10.4 ohms total resistance
= 1.15 amps

Again, this is not enough direct current to meet the 1.5 amps of direct current criterion. However, with the engine running, I have found that the setup always fires properly. The example on the following page, while not perfect, illustrates a relatively easy method of using common equipment to do some blasting.

A parallel-series circuit is shown on page 43.

Parallel-Series Circuit Example:

Resistance of each series of 4 caps =
4.0 x 2.04 = 8.16 ohms

Resistance of 10 series in parallel =
8.12/10 = .81 ohm

Resistance of 200-ft. connecting wire = 1.00 ohm

Resistance of 250-ft. No. 14 drop wire = .50 ohm

Total = 2.31 ohms

Assuming one used a 12-volt battery, the computation would be as follows:

12/2.31 = 5.19 amps

Each series would receive 5.19/10 = .52 amps, which is not enough to take us up to the 1.5-amp safe level required. The 5.19 amps must be divided by 10 because there are ten series of four in the string.

Using a portable generator:

220/2.31 = 95.6/10 = 9.56 amps

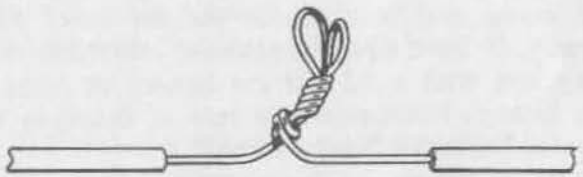
A portable power generator would probably be adequate in most situations, but vehicle batteries, even wired in series, would not be. The only exception might be to power the charge from a large bulldozer battery while the machine is running and the battery charging. Test all multiple shots with an ohmmeter, and use short leg wires and heavy drop wires to minimize wire-resistance problems.

In the cases above, the examples are very conservative. They probably do not reflect the average day-to-day needs of the home and recreational blaster. As I mentioned previously, I have always powered my little four- and five-cap sets with a 12-volt car battery or even a 6-volt lantern battery. Remember, the rule of thumb is 1.5 amps per cap for DC and 3.0 amps for AC.

Electrical splices on blasting lines are critical. Most experienced blasters prefer the twisted-loop splice. This and an equally acceptable telegrapher's splice are illustrated on page 46. Your ohmmeter will quickly tell you if all the splices are sound, making good electrical contact.

Be sure to keep all splices tight and practice good housekeeping with the connecting wires. Neat, taut runs are likely to cause fewer problems. All open-wire splices should be raised up off the ground, away from puddles or wet grass, using dry rocks or pieces of cardboard as props.

Telegrapher's splice.



Twisted-loop splice.

Again, be sure to test each circuit with an ohmmeter to be certain the power source you intend to use is adequate. All drop and connecting lines should be securely wound (shunted) together until they are connected. Connecting should be the last step as the user retreats from the blast site. Keep the drop wires shunted and the power source well out of any possible reach until the moment you are ready for the shot.

For God's sake, *cease all operations* if an electrical storm comes up. Even miners working a mile underground do something else 'til an electrical storm has passed over.

One thing to keep in mind is that not all charges go off according to the user's prearranged plan, as evidenced by the following tale.

I was waiting in front of the low, white, wooden houselike structure that serves as the consulate in Chiang Mai, Thailand. Suddenly a wind-shock thump, strong enough to take out exposed windows, hit me. A long, low rumble followed, echoing up the Ping River, which runs near the consulate. I ran out the gate and onto the street, where I could see to the north a kilometer or two. It was possible to make out a black, swirling cloud of dust over the trees and houses.

The detonation was deep and gutsy enough to get our serious attention but distant enough not to cause real alarm. My first reaction was to look for aircraft.

It took what seemed like an inordinate amount of time before some sirens began to wail in the distance. We jumped into a friend's LandCruiser and headed out for a look. Obviously, something was going on that we should know about.

A line of police and military vehicles, many with flashing lights, was converging on one of the rather non-descript yet more exclusive neighborhoods of north Chiang Mai.

We followed discreetly until we started to get walled in by hundreds of people walking down the street. Without an escort or a flashing light, we could not proceed. I asked a police officer what was going on. He just shrugged. Either he didn't know or he wasn't going to tell a *farong* (foreign

devil).

By now an hour had passed since the blast, but still no one on the street knew what had happened except that there had been an explosion. Just before dark, we finally threaded our way through the little narrow streets to the remains of a palatial home.

Leaves on the palms in the garden hung in tatters, shredded into threads. Several buildings nearby lacked roofs. A school half a block away was windowless on the blast side. A harried police officer told us no children were at the school when the blast hit.

Dozens of uniformed men poked around in the piles of debris. The front of the massive house hung in tatters. One wall of a former garage leaned sloppily amidst the mess. There might have been other damage, but a twelve-foot cement block wall around the property limited our ability to see everything in the compound.

"Looks to me like a commercial dynamite blast," I told the consular official. "The trees and bushes aren't blown away enough for it to have been a faster, much more powerful military-type explosive." No one seemed to know whose house had been hit, or if anyone had been injured. Gossip spread through the crowd to the effect that no one had been home at the time of the blast.

After a day or two, some information filtered out about the incident. The house, we learned, was the secret retreat of General Li, a notorious Kuomintang Chinese drug lord. General Li, who originally came from northern China to Thailand at the time of Mao, was so reclusive that no one was aware he lived—at least part-time—in Chiang Mai.

It was not entirely true that nobody was home when the blast occurred. A bathtub salvaged from the carnage became the repository used by the police. It was filled with body pieces they collected. A cook and driver were never seen again, but were never identified among the pieces, either.

The theory on the streets was that some of General Li's drug-dealing enemies had tried to assassinate him, but that their timing was bad. A truck that allegedly had contained the explosives had been vaporized in the blast. The police

didn't even try to find a bathtub full of parts from it.

My theory is somewhat different. It seemed obvious that we were dealing with a relatively large quantity of commercial dynamite rather than military explosives. I knew that people in the Chiang Mai region often illegally traded commercial explosives for raw opium with the jade miners who used the explosives to get rocks out of the ground. I reasoned that perhaps we were dealing with an accidental detonation. Assassins almost certainly would have used military explosives.

The theory is reinforced by the fact that one of General Li's drivers appears to have been wiped out in the incident, that Thais are awfully cavalier about explosives, and that an assassination attempt was not logical. No one in the region had an overt motive for doing the general in. If they had, it seems logical that they would have planned the whole thing a bit better.

My accidental discharge theory apparently has gained some credibility, because many Burmese jade smugglers have come forward in the last year since the incident to complain that their source of explosives has dried up. More significantly, no one among the drug lords has come forward admitting to perpetrating the incident. If it had been intentional, General Li would have retaliated. Open warfare did not break out among the drug lords.

Knowing the Thais, they probably stored the caps with the powder. Later, when they snuck off in the truck to have a smoke, disaster struck.

Chapter 5

Doing the Work

Novices who work with dynamite for the first time are often surprised to discover that commercial explosives are very precise in nature. They expect to encounter an uncontrollable, unpredictable force that promiscuously rends the earth. Instead, they find they are working with a tool that can be likened to a hugely powerful precision instrument.

One of my earlier jobs as a powder handler involved placing charges for a neighbor who wanted to excavate the ground under his standing home. The guy was determined to have a basement under his house—despite the fact that the original builders one hundred years ago had not seen it that way at all! We had a small four-foot by four-foot root cellar to start with. As a plus, the stairs going down were already in place. Lack of moisture for one hundred years, however, had set up the soil under the house like concrete—digging could not be accomplished via traditional pick and shovel methods because of limited space and the hardness of the earth.

Using mud and wet burlap bags to cap the charges, we shot half sticks of 60-percent to break up the existing pavement and walls in the root cellar. The cement was not particularly thick but had been placed back when it was de rigueur to do a very good job. The breakup would have been impossible if it weren't for the larger rock they mixed with the concrete in an attempt to save on material costs.

After the concrete was cleared out, I used a one-and-a-half-inch hammer driven mason's hand drill to bore a hole back into the century-old hardened clay. The material was

so consolidated and brittle that a half stick of 60-percent shattered a cone-shaped hole to dust.

I carefully worked the charges back to the area below the house's rear support beam. We shoveled the now loose material into a conveyor belt that moved it upstairs and deposited it in a dump truck parked at the rear of the house. By nightfall, we had excavated an area large enough to build a frame for a foundation wall.

I let the owners spend the next day completing that work, as well as shoveling out the remaining loose material I had shaken loose.

While the new cement was hardening, I worked back in the other direction with my explosives. By week's end, the back wall was in place as well. Although I fired possibly twenty-five shots, nothing in the house above was damaged. The lady of the house said she was surprised that the blasting produced very little dust and no damage. We usually warned her before the shots, but otherwise the work failed to disturb her routine.

Precision blasters have shot holes in solid rock within inches of high-pressure gas lines. They have opened trenches so that telephone lines could be laid right through the heart of large cities and have spectacularly demolished great buildings that stood within inches of other great buildings that were not even scratched.

Although it is the wrong end of the spectrum on which a novice should start, propagation sets used to cut ditches nicely illustrate the precise nature of dynamite.

Because a field drainage ditch is seldom if ever blasted through regions where one must be concerned about coming too close to buildings, gas mains, power lines, or other works of man, blasting one is a good project for someone who wants to test the precision of explosives. The technique is not, however, one the novice should start with if he has any choice in the matter. It is so difficult to master ditching with powder that the neophyte can easily become discouraged.

Ditch building by propagation is done using regular ditching powder. Your local explosives dealer can assist you in choosing the correct explosive material. This will be

either a 60- or 80-percent material that is more sensitive to shock than regular powder and is of itself powerful enough to throw out a large quantity of material. Other powder may push rather than shock and throw, and will certainly not be sensitive enough to propagate. The concept is to use one cap charge to set off up to hundreds of shock-sensitive cartridges, all placed in a predetermined grid.

Unlike 40-percent dynamite, which is so sleepy it often cannot be detonated even by a direct hit from a high-power rifle, ditching powder is very shock-sensitive.

When I first used it, I carried the cartridges around in a sawdust-filled box. This seemed to be more paranoia than I am accustomed to accommodating, so I decided to experiment.

A half-pound stick thrown as high as possible from the top of a twenty-four-foot barn did not detonate on hitting the frozen clay drive below. Eight additional attempts failed to produce a bang. I therefore concluded that the material was safe enough under normal circumstances.

It does, however, go off rather resolutely when hit with a bullet. Through the years, I have spent a considerable number of pleasurable hours on my range plunking off dynamite. There is never a question as to the placement of the shot. If it is good, everybody in the county will know.

Shooting dynamite is a bit tougher than it first seems. Targets little more than an inch wide are tough to hit, especially if one places them out far enough so that the blast does not constitute a danger to the shooter.

One time when such things were still permitted, I bought a 25mm French Peteau cannon home with me. It came right from the World War II Maginot line—eight hundred pounds, rubber tires, etc. By tinkering with the firing mechanism, I was able to bring the monster back to life. We spent many an enjoyable afternoon firing that cannon. Factory ammo cost but $32 per case of thirty-two rounds!

Eventually the thrill wore off. We went back to using ditching powder for targets, set off by more conventional firearms, but the neighbors never knew the difference. They thought we fired that antitank cannon one hell of a lot.

The best way to proceed with ditching powder is to run a couple of trial sets. In places where the ground is consistently wet, grassy, and marshy, the charges can be placed up to two feet apart. Should one be working with ground that is only very damp and not wet, the spacing may only be four to eight inches. Old logs, rocks, and roots mixed in the material to be ditched may require that one cut the distance between charges down even further.

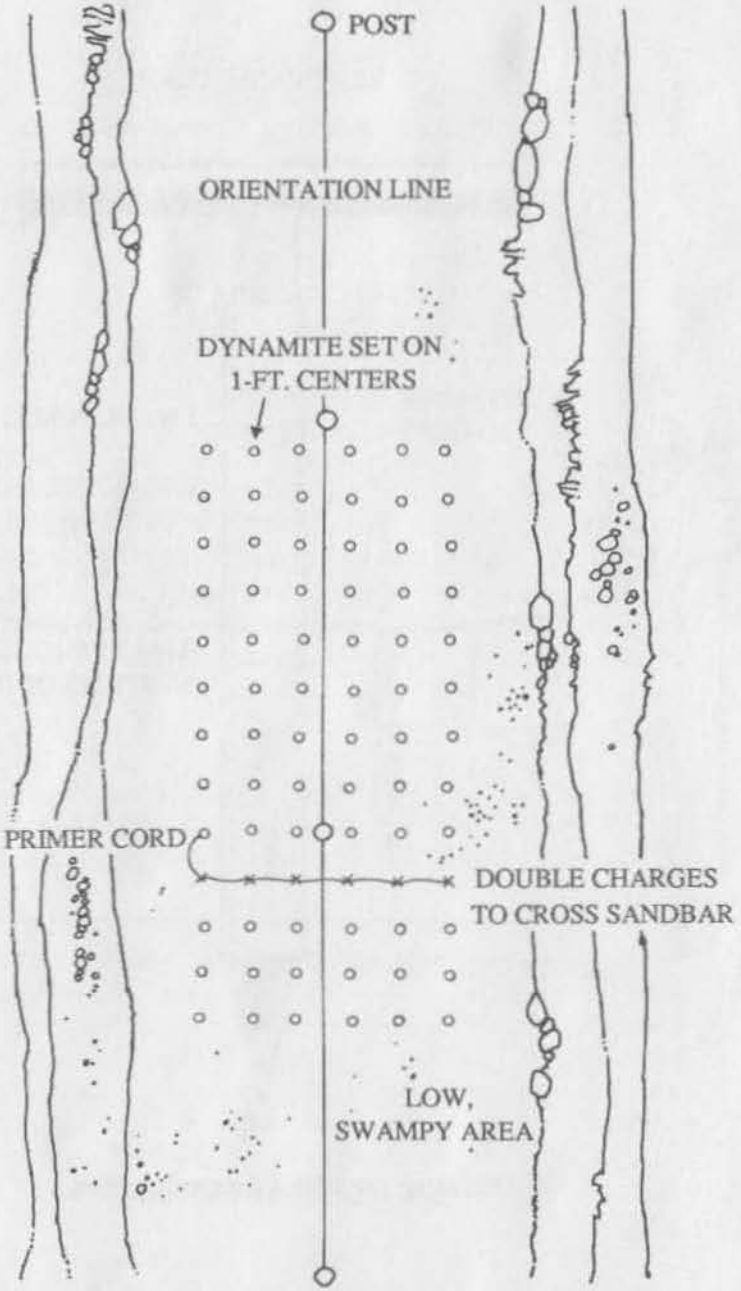
It is impossible to tell what spacing to use, even by looking, much less make a valid recommendation in a book. The only way to find out what will work is to try an experimental shot.

Only one cap charge is used to set off all the charges. Be careful to note whether the shot detonates all the charges placed in the string. Some borderline cartridges may be thrown out undetonated. No matter how ideal the conditions, the maximum spacing will never be more than two feet. Generally you will end up setting up the shot grid on about one-foot centers unless the ground is virtually saturated with standing water.

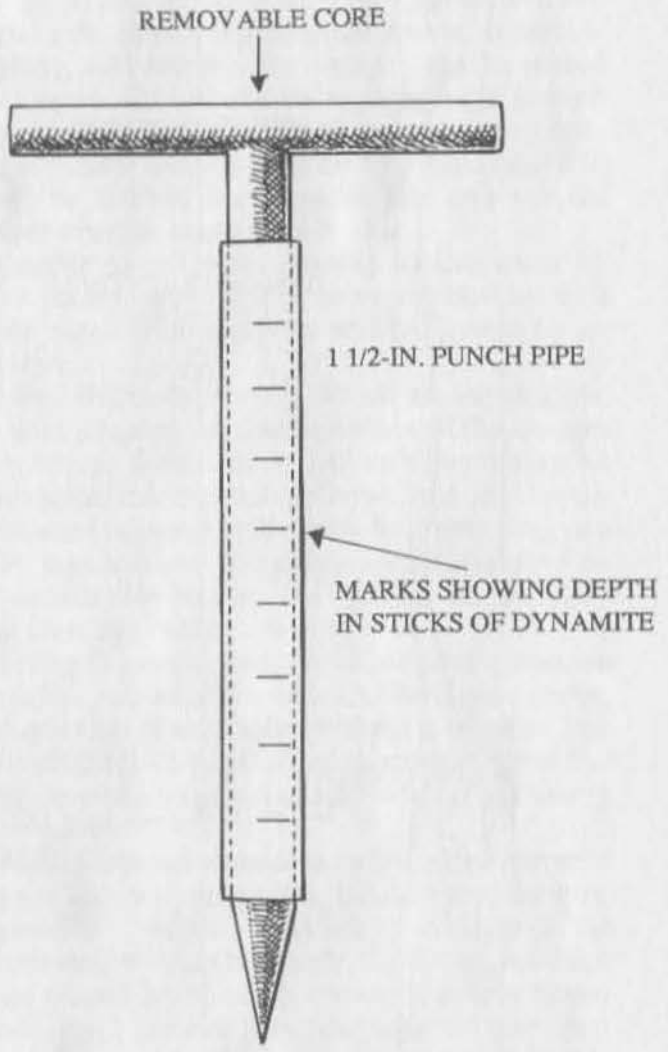
Before starting in earnest, run a cord and post line down through the region you want ditched. Unlikely as it seems, running a straight line of cartridges without a physical line staked out is incredibly difficult. A nice, straight ditch that the powder monkey can be proud of will result if such early precautions are taken.

Experimental shots are done not only to determine at what spacing the shot will propagate, but also to determine how much powder is needed to produce a ditch of the necessary depth and width. Obviously the depth at which the charges are placed is extremely critical if proper drainage is to result. As a general rule, a charge set three feet deep will cut down to about four feet if enough powder is placed above to move away the overburden material. This may require stacking two or even three sticks in the same hole.

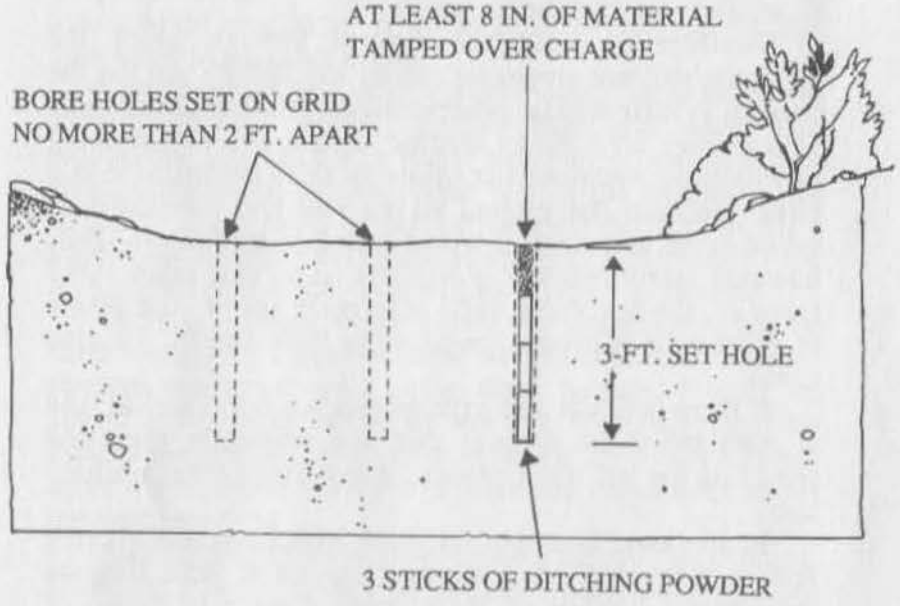
Ditching powder is usually placed using a hollow-core punch bar. The punch bar is made out of common water pipe with an outside diameter of one and a half inches. If the swamp through which one is blasting is so soft that the



Top view of a ditching grid.



Ditching powder placement ram.



Side view of ditching set.

punch hole caves in immediately, the pipe must be fitted with a removable core. This pointed core can be withdrawn and the dynamite slid into the hollow outer shell and held in place with a wooden tamping stick as the punch is withdrawn.

It is helpful to fit the punch with a handle to facilitate pulling, and it is essential that deep, easily seen notches be ground in the probe outer shell showing the depth of the tool in dynamite cartridge lengths.

Every cartridge must be identically placed through material that is identical in makeup.

Sandbars or subsurface logjams through which the dynamite will not propagate can be handled by placing the charges in their regular predetermined grid and firing them with primer cord or by electric detonation. Determining exactly how much powder to use in this circumstance is a bitch. Because the ground is not wet and lubricated, it would seem as though it would take less explosives. This, however, is not necessarily true. As no set rule exists that I know of, the best thing to do is to make sure to use plenty of powder. It is always tough to go back and hit the area again.

If there is doubt and experiments are not practical, use at least twice the amount that you originally estimated would do the job when crossing a dry bar or other obstruction.

In all cases, mark out the ditch with posts and a string with a great deal of precision. Use small wire flags to indicate the location of the charges if there is danger of them being lost or misplaced in the marsh as you work around your grid line. The grid of charges must be very accurately placed according to a pretested, predetermined plan.

When a ditch set is detonated, there is a very nice ground-shuddering thump. When enough powder is used and the grid is correct, the work accomplished is very gratifying as well as being most spectacular. The material from the ditch is thrown out and away without forming a costly-to-handle spoil bank. Spoil banks would be there if the ditch were dug mechanically. Often the dirt and water

are thrown two hundred feet into the air, negating any need to bring in a dozer with a blade to smooth things over.

Other advantages to cutting ditches with explosives include the fact that man and horses can pack explosives into places otherwise inaccessible to backhoes and power shovels. Much smaller jobs can be profitably undertaken due to economies of scale. Mechanical equipment requires a much larger job to be profitable. Using explosives is also often much faster than hauling in power shovels.

At the time the charges are placed, it may seem as though costs are going through the ceiling. But in most cases, when everything is added in, expenses are far less than when using other means.

Clearing grass and other material out of an existing but silted-in ditch is virtually always faster and easier with explosives. In this case, a single string of cartridges is run down through the existing ditch line. If the cartridges are buried at least three inches beneath the surface, as they should be with any propagation set, clay and plastic field tiles emptying into the ditch will usually not be harmed.

There is no limit to the number of charges that can be fired using one capped charge as the explosive impulse through the moist soil. Using three helpers, I have set almost a ton of dynamite in one day. The only practical limit is the amount of territory available on which to work and the amount of energy and drive one can muster to put out the explosives.

All charges placed in a day should be fired that evening. Ditching powder is not particularly water-sensitive, but many other factors could lead to a potential misfire or an unsafe adventure if the charges are left unfired overnight.

Field conditions, vis-à-vis the season of the year, are important whenever one uses explosives. When blasting ditches, wet ground condition is one of the primary considerations. It may be necessary to either wait for a hot spell to dry up the ground or, conversely, for spring rains to bring enough moisture to allow the system to work. Only shooting a trial charge will provide the necessary information.

Clearing out stumps comprises the other end of the

spectrum of work with which a powder handler will probably involve himself. Stump removal is not only common, it is reasonably easy to master. Most blasters will do as I did and learn the ropes of the business in the field actually doing the work.

Stumping is both easy and yet quite a challenge for those given to thinking about such things. Like cutting a diamond, every situation is a little different. Some varieties of trees (such as Norway pine, hickory, white oak, elm, and gum) have massive, deep penetrating roots referred to as tap roots. Others (such as white pine, fir, maple, box elder, and cedar) have heavy lateral root structures. There is no tap root in this second case, but rather large branch roots extruding out to the side in all directions. Removing these stumps can be a real problem. If they are not charged correctly, the dirt will be blown away from the base of the stump, leaving a wooden, spider-like critter standing in the field that is very difficult to cut away.

Unless one is a trained forester, it is impossible to tell for sure what kind of a stump one is dealing with a couple of years after the tree has been cut. The most certain plan is to use the dynamite auger to bore a hole under the stump and do a bit of exploring.

If the auger hits a tap root on a 30° angle down under the stump, it's safe to assume it's the kind with big vertical roots. Sometimes, however, that pronouncement is premature. Hit it once with a springing charge, which will throw away the dirt and soil around the root. If the stump has a tap root, it will then be obvious.

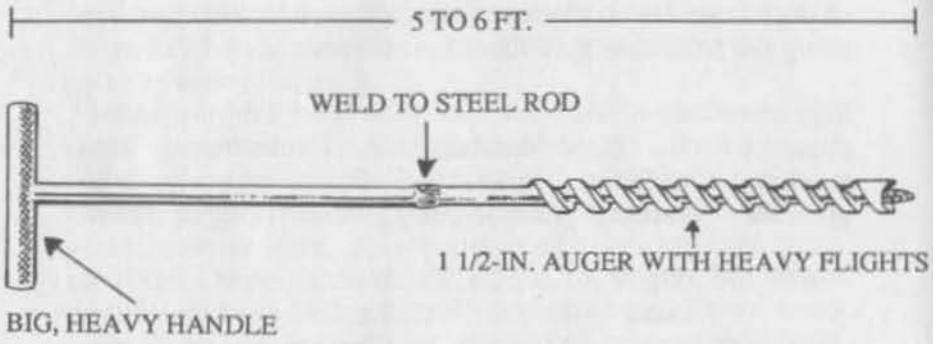
I do not like to try to bore a shot hole into the tap roots to save powder. What I save in powder breaking the root off underground, I lose in Wheaties trying to force the auger into the punky, tough-as-wang-leather wood.

Instead, clean out a space next to the tap root about the size of a small pumpkin. Pack in eight to ten—or more if the stump is still large and green—40-percent cartridges against the tap root and let 'em rip.

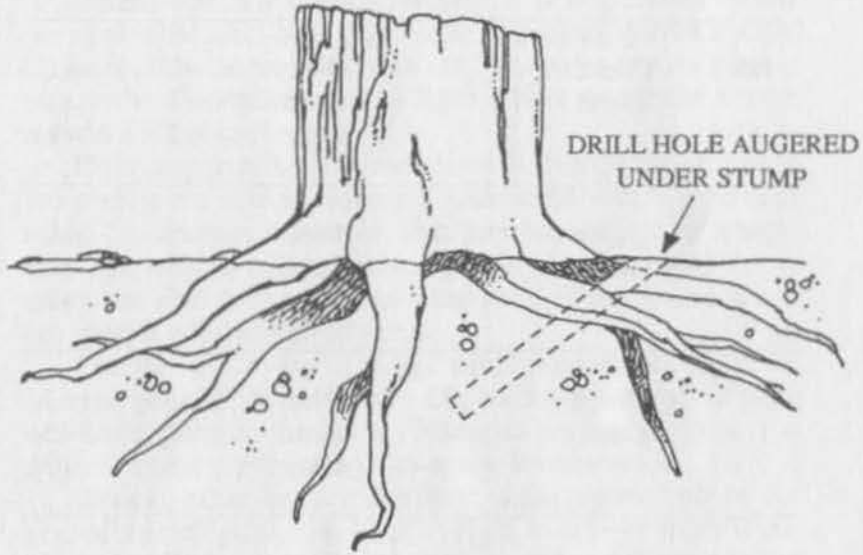
Stumps with massive lateral roots require about the same procedure. Dig the auger in under the main stump mass, fire a single holing charge, and then hit it with the

main charge. The essential element is knowing how many cartridges should comprise the main charge. Conditions change from day to day and from soil type to soil type. Try using the following guidelines for starters:

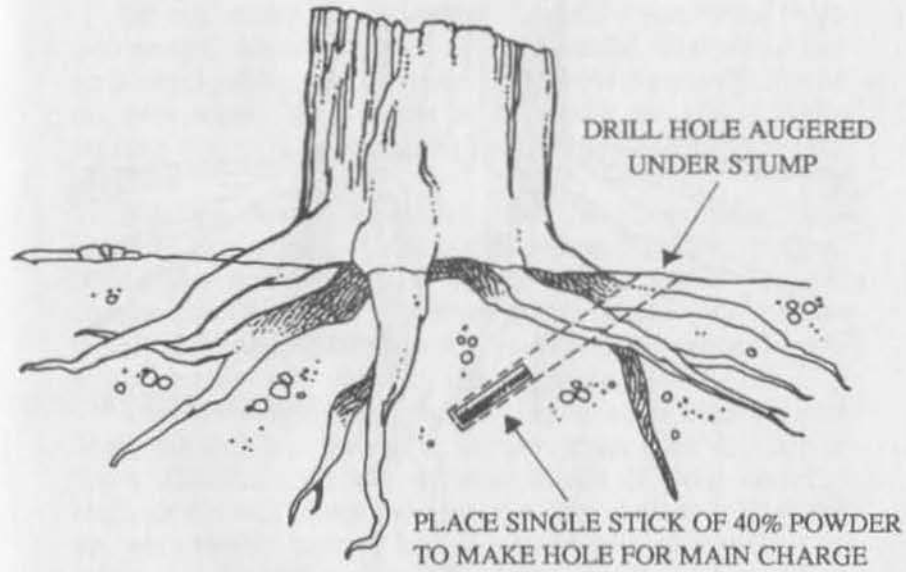
Size of stump 1 ft. above ground	Condition of stump	Number of cartridges	Soil type	Add number of cartridges	Add for tap roots
6"	Green	2	Wet	0	0
	Dead	1	Sand	+2	0
			Clay	+1	0
12"	Green	4	Wet	+1	0
	Dead	2	Sand	+3	0
			Clay	+1	0
18"	Green	7	Wet	+2	+1
	Dead	3	Sand	+4	+1
			Clay	+2	+1
24"	Green	9	Wet	+2	+2
	Dead	5	Sand	+3	+2
			Clay	+3	+2
30"	Green	12	Wet	+3	+3
	Dead	6	Sand	+4	+3
			Clay	+5	+3
36"	Green	15	Wet	+4	+4
	Dead	8	Sand	+4	+4
			Clay	+4	+4



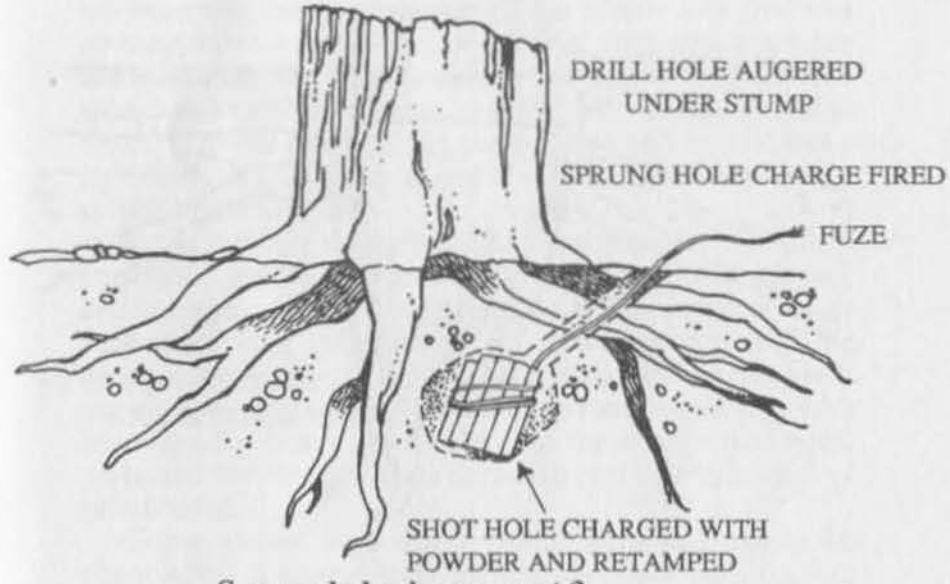
Dynamite auger.



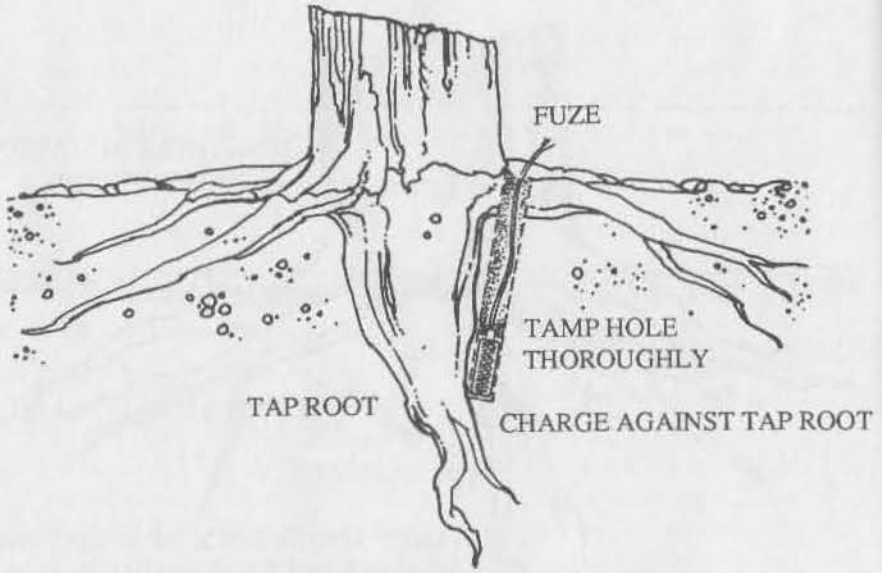
Sprung hole charge, part 1.



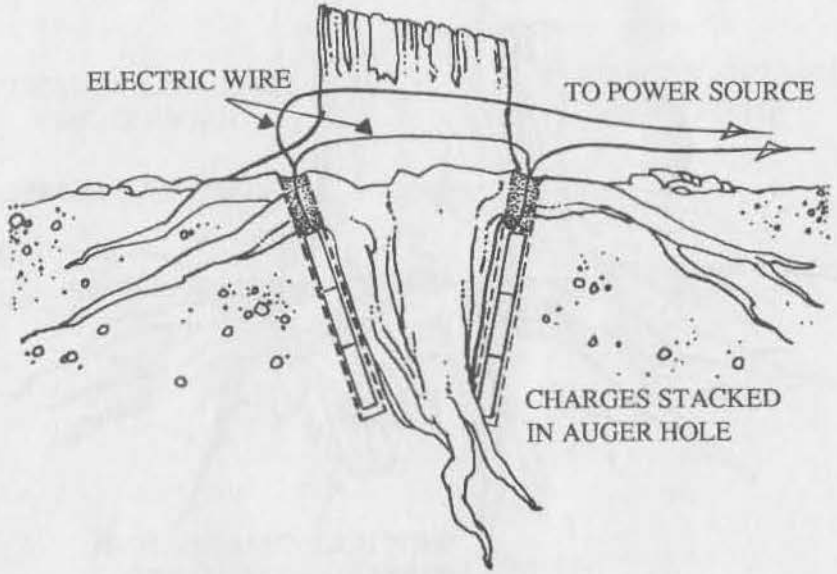
Sprung hole charge, part 2.



Sprung hole charge, part 3.



Stump with tap roots.



Stump with tap root shot electrically on sides of root.

Do not, under any circumstances, allow your mind to go into neutral while stumping with dynamite. The result can be a bunch of thundering roars that throw pieces all around or, even worse, a blast that simply splits the stump while leaving it firmly anchored in bent, broken sections in the ground.

Blasting stumps quickly teaches novice powder monkeys the importance of adequately stemming their charges. Shot holes that are solidly packed with mud or wet soil contain the explosion in a much more satisfactory manner than if this chore is neglected. The difference can add up to a case or more of powder by the end of the day.

Start tamping the charge by dumping some crumbly soil down the shot hole on top of the cartridges after they are in place. Do this with the wooden handle of your tamping stock or shovel. Keep working the hole until it is plugged up with tightly tamped soil. It also helps immeasurably to pile a few shovels of dirt on the hole after it has been filled to ground level.

At times when the ground does not adequately contain the first springing shot charge or when the powder monkey inadvertently overcharges the set, the blaster will find that he must move in quite a bit of material with which to tamp the hole under the stump. Best to fire up the long-handled shovel and move in whatever it takes to do the job properly. Usually, if this happens, the surrounding soil will be loose and easily shoveled as a result of being torn up by the sprung hole charge.

As previously mentioned, some people who work with explosives make a practice of boring a hole into the tap root under large stumps. The procedure saves powder but is such hard work that I never became enamored with the concept. In the case of a very large stump with corresponding tap root, I will either pack the tap root on one side with an unusually heavy charge or split the charge into equal parts and fire the two simultaneously with electric caps or primer cord.

Some stumps with many lateral roots can simply be chopped off at ground level using faster powder. Pick a fold in the stump into which several sticks can be packed. Cap

them over with a heavy layer of mud and fire them off. If done properly, the stump will be rent into little pieces, leaving the bigger subsurface roots at ground level to rot.

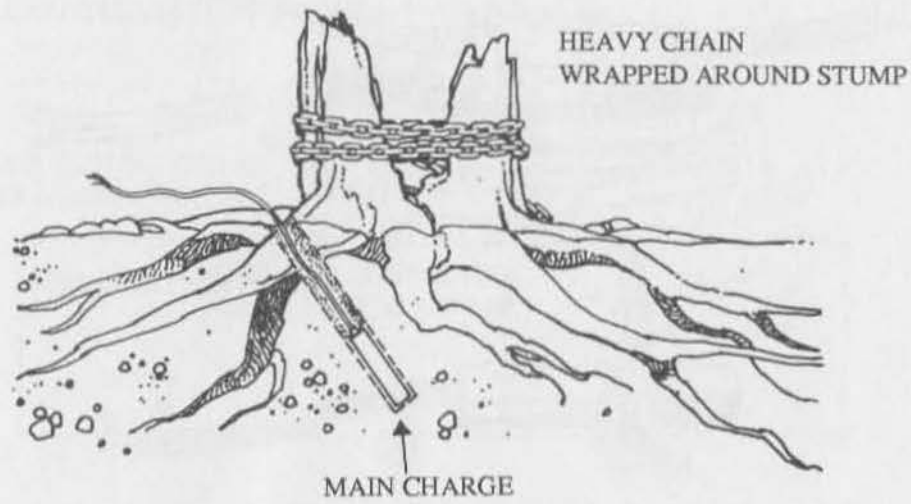
The most difficult stump to take out is one that is burnt or has been already shot, with only the heart taken out. The various sections must either be shot electrically with two or more charges or, in some cases, the shell can be wrapped with a chain and successfully shot out in one piece (see illustration). It still may be necessary to use multiple charges but the chain will tend to hold the stump together and pull it all out in one piece. Use plenty of chain along with slower 40-percent powder or less when employing this method.

Removing stumps with explosives works especially well if one can combine the work with the efforts of a bulldozer as mentioned earlier. The dozer can be rigged to punch the charge holes. It can grub out those stumps that are not sufficiently loosened by the dynamite and it can fill in excessive holes made by using too much powder. It's an ideal combination if the novice powder handler can put it together.

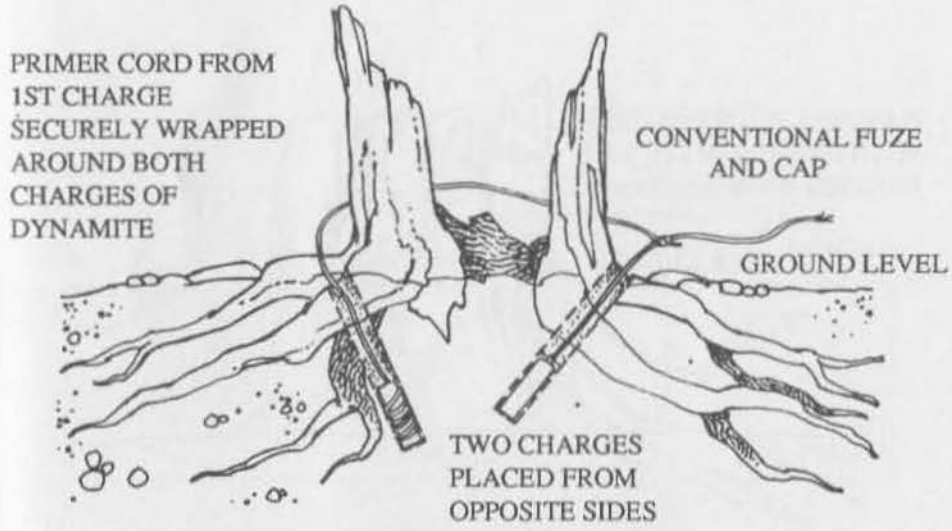
Stumping with dynamite was, in the past, the most common nonprofessional use for explosives. Stump removal is no longer a big item with farmers, most of whom are currently working fields that have been cleared for more years than the farmers are old. I don't know which use is currently in second place, but for us it was removing and breaking stones, old foundation footings, and cement pads.

Huge stones, many as large as cars or pickups, can be thrown free of the ground, mud-capped, split, and hauled away using a few sticks of easily portable powder by one skilled powder monkey.

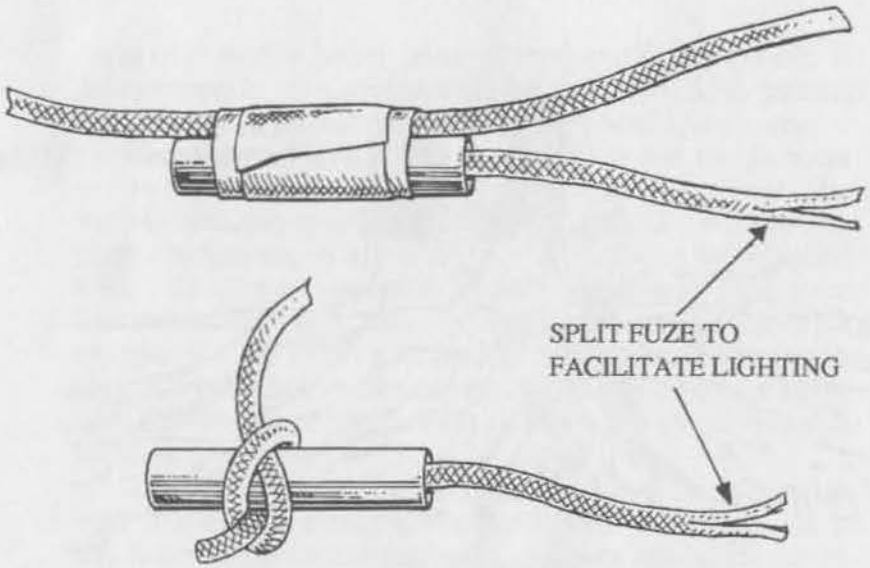
One monster stone on our farm had maliciously and mercilessly torn shares from our plow for years. It lay about one foot below ground level, was flat as a dining room table, and just as big if one added all the extra leaves. One day it ate two of my shares simultaneously. That was absolutely it. I went straight back to the shop for the dynamite. My brothers depreciated my determination.



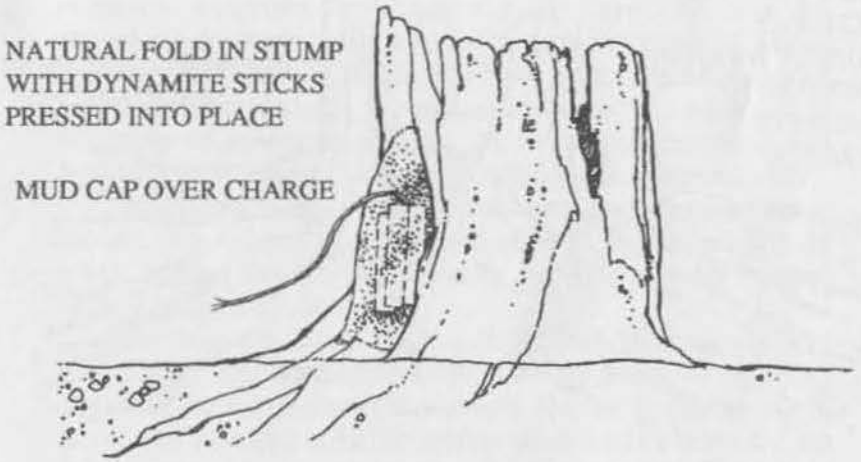
Chaining split stump for removal in one piece.



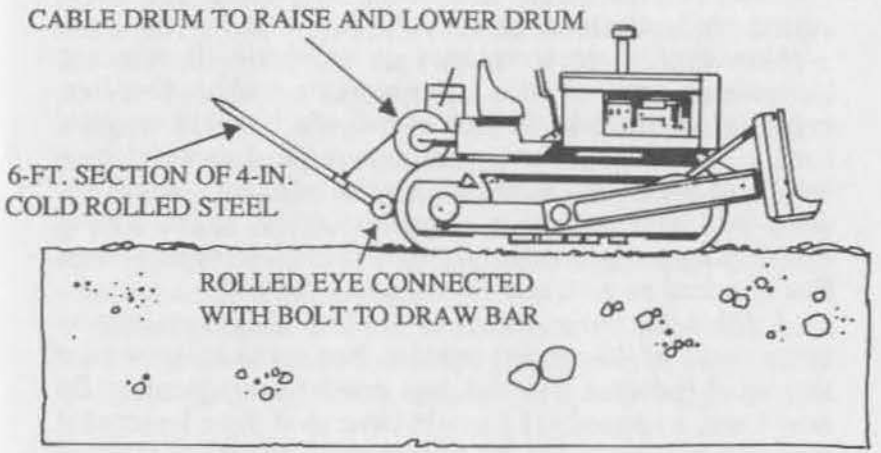
Split charge fired with det cord to take out stump left in two pieces.



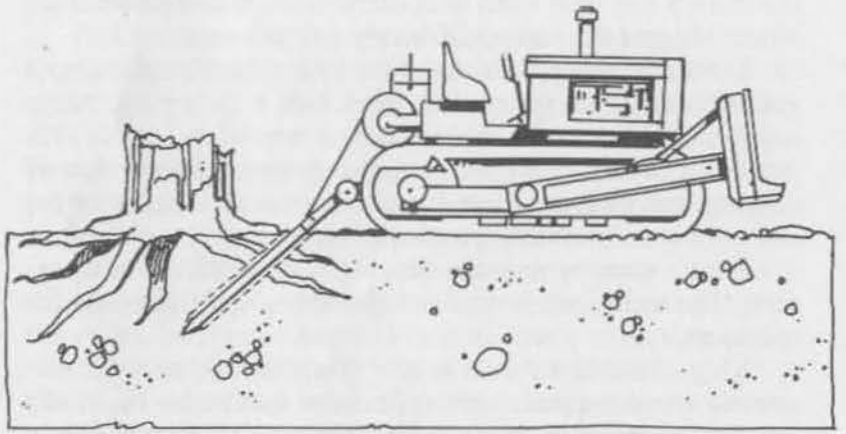
Det cord attached to conventional fuze and cap used to detonate the det cord.



Old, rotten stumps can often be blown off at ground level with a mud-cap charge.



Dozer with dynamite punch.



Crawler with punch lowered and pushed under stump.

"That stone is so big and mean," they said, "you don't have enough powder to get it out."

How words are sometimes so prophetic. It was not immediately obvious what I was working with. A five-foot auger did not reach to the bottom side of the rock. One stick fired as a springing charge did very little. I dropped in a bundle of seven and threw out a nice hole that I could get down into with my shovel. Again using the auger, I went down under the monstrous piece of granite. Another charge finally poked an adequate cavern under the rock.

I filled the hole under the rock with approximately thirty sticks of 40-percent powder. Not many rocks require that much powder, but this was not an average rock. By now I was so pissed off I would have used three hundred if that's what it took. My brothers wanted to split it in place but, in my eyes, that would have been a cop-out.

The thirty sticks thumped about hard enough to be felt in the county seat fifteen miles away. El Rocko pitched out on the ground, leaving a gaping hole that eventually filled with water and mired our tractors every year we worked the field 'til we sold out. It had to be the biggest rock anyone in the county had ever tried to contend with in one piece. Two of our biggest tractors could barely pull it away.

Even normal, garden-sized rocks are best handled by a variation of the technique we used. Get a springing charge hole under them and throw them clear with lots of 40-percent powder. The technique requires quite a lot of digging and augering, but it's the only way I know of for one man to economically remove boulders.

Rock outcroppings can be removed nicely with dynamite. The technique is similar to breaking up large rocks for transport.

Large boulders such as the plow-eating monster are usually mud-capped and split into hundreds of easily handled pieces. It's better to haul them away whole, if you have big enough machinery, rather than pick up all the pieces. But in cases of very large boulders, that is often not possible.

Mud-capping consists of placing a number of sticks of fast 60- or 80-percent powder on top of the victim rock.

Cover the cartridge with four to six inches of very wet mud and touch it off. Apparently, shock waves from the sharp, fast detonation fracture the rock. It is the one case when a powder handler can experience a nice, audible explosion as a result of his labors. The mud vaporizes. There is no throw-rock danger from mud-cap charges.

At times, powder handlers will use a large masonry drill to bore a hole into an offending rock. After filling the hole with powder, they shoot it much the same way a miner would shoot a working face.

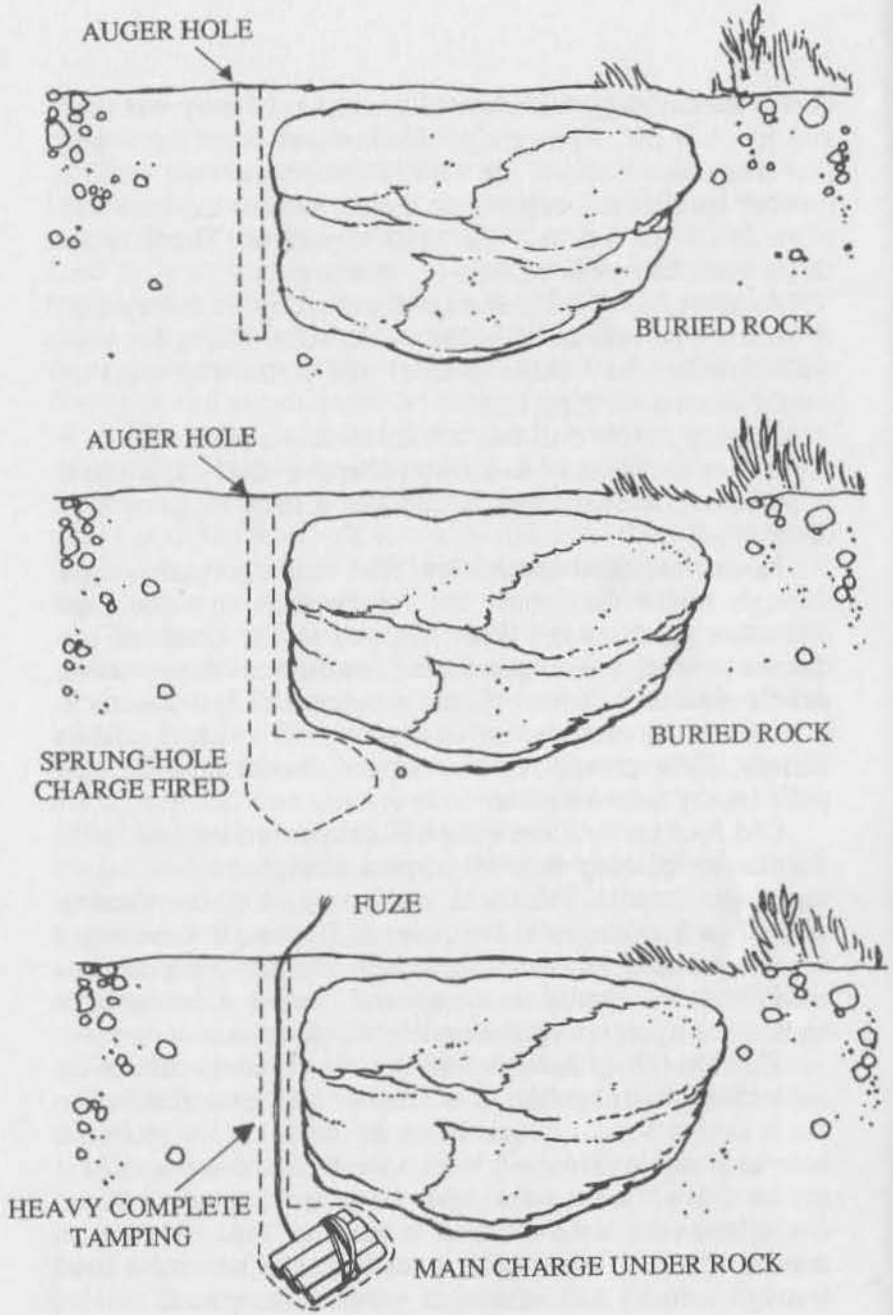
Driving a steel drill into a solid rock is a poor substitute for conventional, easy-to-set-up, effective mud caps, but it is necessary if one wants to take out a rock ledge or outcrop.

Home builders sometimes find underground ledges through which they must cut for footings or which are otherwise in the way. When the job is too small or too remote to bring in a ripper, there is no alternative to trotting out the rock drill, hammers, and powder. Use fast powder if it is easier to clean up with a scoop shovel and wheelbarrow. Slow powder creates bigger chunks that are best pulled away with a tractor.

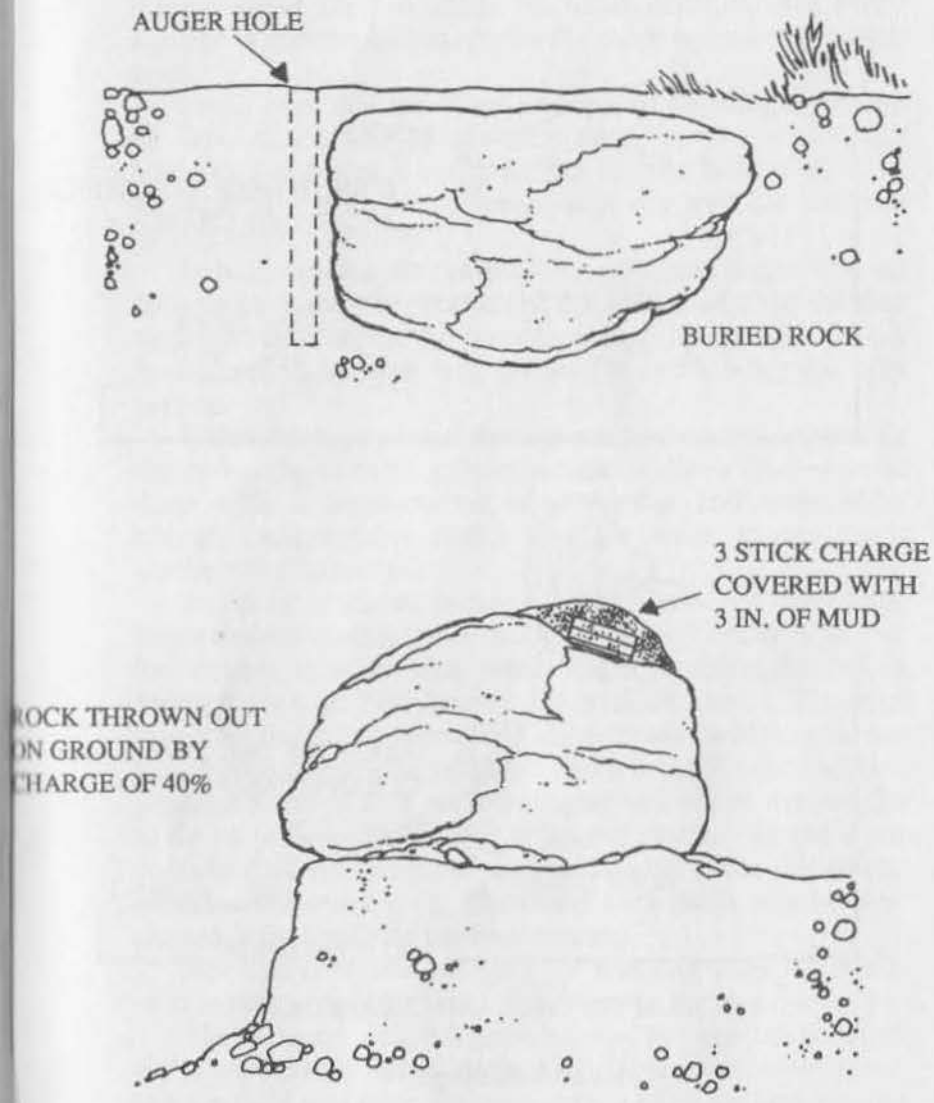
Old footings and cement pads can be broken into large chunks by placing fast 60-percent charges a foot or so under the material. The shock will tip up the slab or footing as well as breaking it at the point of impact. If the cement contains reinforcing metal, it must be further cut mechanically. Metal is usually too tough and flexible to be cut with explosives except in special military situations.

Road building through hilly terrain is nicely done with explosives. Start by boring down into the ground between the rocks with your auger. Place as much explosive in the hole as possible. This will loosen the rock and soil so that it can be moved. Keep working down in and around whatever obstacles exist 'til the roadbed is about as wide and deep as needed. Even a farmer with a small tractor can cut a road through a rocky hill using this method along with a relatively small amount of explosives.

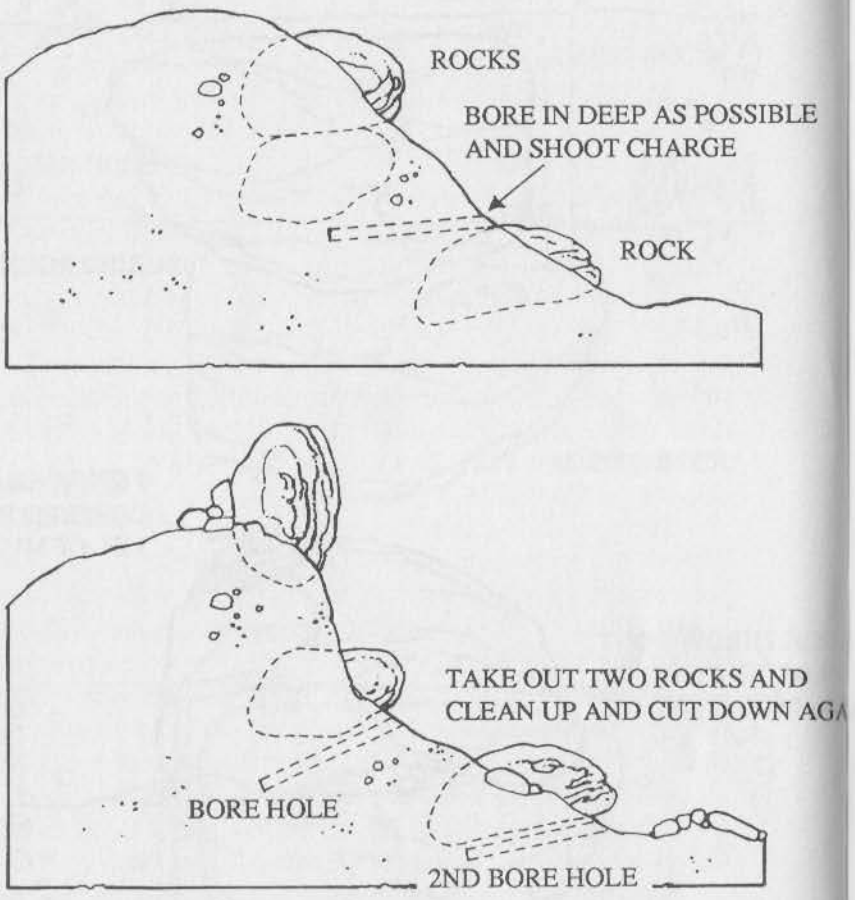
Several other chores that are a bit obscure are possible with dynamite.



Removing a deeply buried boulder.



Using a mud-cap charge.



ROCKS AFTER SHOT AND CLEANED OUT

Road building.

Springs that are leaking water onto one's property and creating bog holes can sometimes be shut off permanently by shooting a large charge of fast powder deep in the ground above the hill where the water surfaces. Not every attempt is successful but, given the modest cost, it is worth a try.

Small potholes are often drained by shooting a charge of fast, shocking-type powder deep in the underlying hardpan that forms a water barrier for the hole. This must be done at a time when the hole is dry and the hardpan barrier becomes brittle.

In both cases, bore down with a post-hole digger and set the charge at the very bottom of the hole. Tamp the set shut nicely. In the case of the pothole, it may be spring before it is obvious if the shot was successful in breaking the clay barrier.

Other work—such as blasting out duck ponds, tunneling through rock, or cutting down a rock hill for a road—can be done with a combination of dynamite and ammonium nitrate. (Ammonium nitrate and the work it can do is covered in Chapter 6.)

Building a tunnel is not usually work that the casual home and recreational user will do. This generally is left for the miners who do that work. Like stumping, tunneling through rock is best learned by trial and error. The trial involves finding a seam soft enough into which you can sink a hammer-driven star drill. With a bit of practice, it is possible to determine what drill grid will allow the powder to do its best work. Usually it is advisable to fire the outer charges first, releasing the wall so that the inner charge can dislodge the most rock. Hardened rock drills can be purchased from specialty hardware stores.

Another common category of working uses for dynamite is taking out ice.

The farm on which I grew up was surrounded on three sides by a fairly large river. Our most productive river-bottom field was once threatened by a huge ice jam causing floodwater to cut across the field. Our neighbor on the other side of the water watched jubilantly as Mother Nature prepared to hand him an additional forty acres of prime

farm ground. (Land titles at that time specified that ownership ran up to the high water mark of the river, wherever that might be.)

Dad asked me if I could help him do something before the new channel got deep and permanent. I said I could, but that it would cost as much as twenty dollars or more for dynamite. In retrospect, the amount was so trivial it is embarrassing, but at the time, having money for two or three cases of dynamite seemed horribly extravagant.

Dad immediately took the truck down to the hardware store. He bought two fifty-pound cases of 60-percent, plus a coil of fuze and a half box of caps.

I didn't know how much powder to use or how long to make the fuzes. The rule of thumb when hitting ice is to use three times as much powder as seems necessary. Length of time on the fuze could only be learned by experimenting.

I cut two identical lengths of fuze six feet long, capped them to two different sticks of dynamite, and put them back in the box. We tied the box shut securely with baler twine.

At the river I lit both fuzes at as close to the same time as possible and pushed the case into the freezing, ice-swollen current with a long stick.

A full case of dynamite in water doesn't really sink or float. It kind of bumps along half under the surface. We kept track of its progress by watching for the smoke from the fuze. Unless it is put in the water too quickly or goes too deep, dynamite fuze will burn pretty well under water.

Driven by the current, the case bumped along under the great ice pack. Huge chunks of floating ice, backed up perhaps two hundred yards, soon obscured the progress of the drifting bomb.

After about five minutes, the case went off about one-third of the way down the ice pack. It sent huge chunks flying nicely into the trees standing ankle deep along the swollen river bank. A shock wave rippled downstream, almost taking out the jam, but mostly the log and ice pileup stood firm.

We rigged the second case. I cut the fuze off at ten minutes (ten feet) and double-capped it again.

This time the charge took so long it was at first

monotonous and then scary as we began to think we had a misfire. It finally went with a nice roar, right at the head of the jam.

After about ten minutes, the river started to move again in its traditional banks. The stream across our river-bottom field diminished in intensity. Thanks to the explosives, our property remained intact.

Dynamite is, of course, useful when one is after large numbers of fish. The fact that fuze will burn up to ten feet under water is very helpful when one is pursuing that activity.

If there is a question, at times I will place the entire cap charge and coiled fuze in a thin plastic bag. Water pressure collapses the bag, protecting the burning fuze and cap charge a bit. I am not absolutely certain that this allows me to go deeper with my charges, but I think it does.

No particular care need be taken with cap charges set for regular propagation sets when ditching with powder. The water is never deep enough to be of concern.

We used dynamite to clean out drainage tiles, blast holes for end posts or fence lines, clear log jams, and knock the limbs from old, dead, "widow maker" trees we were clearing before we cut them with a chain saw.

Using dynamite greatly expands one person's ability to accomplish uncommonly difficult tasks. This list may be a bit archaic, and is certainly not all-inclusive, but it does illustrate to some extent the range of activities that can be undertaken using common explosives.

Chapter 6

Ammonium Nitrate

Three of us stood looking at a huge boulder lying in the middle of a black loam field snuggled in a draw in central Ecuador.

Dr. Richard, the self-proclaimed university expert on our team, pontificated about the fact that they (the lazy Ecuadorians) should get some dynamite and remove that obstacle to modern farming. Dr. Prick (as he came to be known) knew nothing about explosives, much less removing rocks with explosives. In retrospect, he actually knew damn little about farming.

"We aren't allowed to buy explosives," our Ecuadorian host quietly and patiently explained. "Doing this job would require a petition to the army."

"Then you can use ammonium nitrate," Dr. Prick persisted. Like so many college professors away from home a few miles, this guy was an instant expert on anything.

Ammonium nitrate is commonly available for sale in the United States, but is very uncommon in most if not all Third World countries. Jorge, our host, explained that Ecuador is among the countries where it is uncommon.

As for the "expert," there were several things he had forgotten about explosives, putting him in the category of just barely knowing enough to even be dangerous.

Ammonium nitrate is not really an explosive. It is, more correctly, a blasting agent. When combined with fuel oil or diesel fuel at the rate of two gallons per one hundred pounds, it can have the explosive force of about sixty pounds of 40-percent dynamite.

Emphasis in the above statement is on the word *can*.

Even properly treated, ammonium nitrate is quite difficult to detonate. It is only partially true in the instance of the Ecuadorian rock to say it can be an explosive.

Another difficulty lies in the fact that, although many road builders and quarry operators use the material to blast rock, it is not in a general sense a fast-enough material to do much more than throw out rock—similar to what 40-percent dynamite does.

Ammonium nitrate has been around as a blasting agent for a long time. People interested in explosives tend to think of ammonium nitrate in terms of the coastal freighter *Grandcamp*, which caught fire off the shore of Texas City, Texas, on April 16, 1947. The fire burned for about an hour before reaching the critical stage. The detonation of a reported thirteen million pounds of fertilizer shook the earth two hundred miles away, killed at least 550 people, injured 3,000, knocked two light planes out of the air and caused a reported fifty million dollars in damage.

In January 1973, a 340,000-pound truckload of ammonium nitrate being unloaded at a quarry six miles east of Moscow, Idaho, went up. Workers who had found the frozen material difficult to break loose burned tires under the truck to "warm it up a bit." The blast wiped out a gun club house and several homes within a mile of the truck, as well as taking out a number of windows as far away as downtown Moscow.

Ammonium nitrate as an explosive was discovered by two Swedes in 1867. Ironically, 1867 was the same year Alfred Nobel patented dynamite. The patented ammonium nitrate mixture was composed of four parts ammonium nitrate and one part charcoal powder. It was called ammoniakrut. Charcoal provided the carbon base we currently get when we add kerosene.

Commercial interest in the material never materialized due to the absence of a suitable detonating system. Apparently, early users lacked old tires to burn.

Today the problem with ammonium nitrate continues to be difficult detonation. A blaster friend tells me he simply sticks an electric cap in the slurry and gets it to go every time. My experience has not been that good.

During the early fifties, I worked one summer for the Iowa state fish and game department shooting duck potholes. Two of us dug all day trying to get as deep a hole as possible in the marshy, grassy land on which we worked. At about four to five feet, we usually hit water. Ammonium nitrate tolerates water very poorly—any water at all in the shot hole stopped our work.

Eighty-pound sacks of the fertilizer were then saturated with two gallons of diesel fuel and allowed to cure for thirty minutes to an hour. The still-watertight bags were sealed again and carefully placed in the hole.

Some days we managed to dig six or eight holes about sixty to ninety yards apart. Each hole was stuffed with as many sacks of fertilizer as possible, amounting in most cases to about eight hundred pounds. Containing the shot was a problem, so we put two feet of damp earth back on top of the bags.

Each set was shot electrically. The only down side to the whole effort was that at least one out of every four shots failed to detonate. Often we threw fertilizer all over the prairie. Even with two and three sticks of dynamite acting as a booster, the stuff often failed to go. When it did, however, the effect was very nice.

Later, I ran an experiment using an empty thirty-gallon oil drum. An eighty-pound sack of ammonium nitrate fertilizer sank the drum about two feet into the pond, but the drum kept the fertilizer bone dry. I soaked the material with kerosene, capped a stick of 80-percent, tied it into a five-stick bundle, and put it in the ammonium nitrate/kerosene mixture in the barrel. To contain the charge, I put a sack of mud on top of the pile of fertilizer.

The ammonium nitrate still failed to detonate. Certainly the water contained the charge, giving the mixture a chance to detonate. The drum itself remained watertight 'til hit by the dynamite. Five sticks should have detonated anything explosive.

In spite of the fact that tons and tons of the stuff is used by quarry operators, road builders, and others, I have concluded that ammonium nitrate can only be made to detonate when it damn well pleases, and not before.

Under some conditions, it can be a good material, such as where the bore holes are dry, huge amounts of explosives are required, and the user is on a tight budget. It is not practical, however, unless the user can easily accommodate a misfire, has good dynamite and caps to use as a booster detonator, and can accommodate mixing the material with diesel fuel.

Although it isn't as powerful as 40-percent dynamite on a pound-for-pound basis, ammonium nitrate sometimes makes up for its relative feebleness by taking advantage of its pourability. The material will flow in and conform to the exact dimensions of a sprung or shot hole. This can add power to the shot in a most gratifying manner because the explosive flows in and exactly fills the shot hole if one can only get it to detonate.

Another relative advantage to ammonium nitrate is that it is relatively cheap and very commonly available. Cost is about ten cents per pound or eight dollars per eighty-pound bag when purchased a bag at a time. Farmers and blasters buy it for about $120 per ton, or $4.80 per eighty-pound bag.

Virtually all farm supply stores sell ammonium nitrate. No special handling requirements are necessary, provided it is kept away from fuels and oils and no one attempts to burn tires under their material storage area.

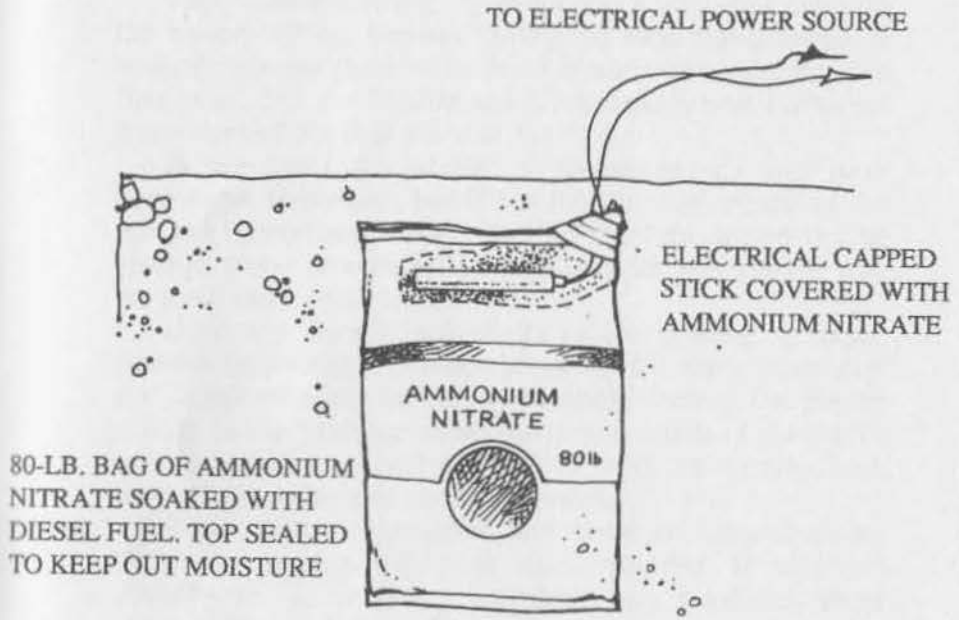
Ammonium nitrate is 34-0-0 (indicating percentages of nitrogen, phosphate, and potash, respectively). Be sure the bag says ammonium nitrate and not ammonium sulfate, which will not detonate under any conditions. Often unknowing and uncaring store clerks will try to foist the second material off on the unsuspecting buyer. I have experienced clerks who tried this many times over the years.

Also, be careful to note that no calcium is contained in the mixture. Some manufacturers coat their ammonium nitrate prills with limestone. The material flows more easily and as fertilizer it works more effectively, but this coated material is so difficult to detonate that it isn't worth considering under any circumstances.

Ask the dealer and look on the bag. Under state laws,

calcium should be listed on the tag even if it is only used as a coating at rates around one percent.

Obviously ammonium nitrate has a place in the explosives user's repertoire of tricks. It isn't terribly versatile, nor is it as easily available as an explosive as some people seem to think.



Ammonium nitrate charge.

Chapter 7

Sugar Chlorate Powder

The discovery of sugar powder was a landmark event in the history of the Benson family. In total significance, it ranked right up there with Pearl Harbor and catching our first mink. For my brother and I, it certainly was the moral equivalent of our first piece of ass.

In retrospect, the advent of nuclear energy may have been more important, but if we took a vote regarding the relative immediate importance, the outcome would not be certain. Sugar-powder technology may actually get the vote for total, immediate impact.

Even my parents acknowledge the coming of sugar powder technology. I remember it as if it were yesterday: my father standing on the workbench, feeling the plaster ceiling in the basement after the largest batch of the stuff I ever attempted to make went up with an unruly hiss, producing an obscene amount of smoke.

Sugar powder provides one with an easy-to-manufacture rough equivalent of black powder. It may not actually be as powerful as black but, confined under pressure, it seemed to us, at least, to be far more powerful than Four F Black.

Far and away, however, the greatest advantage to sugar powder (other than the fact that we obtained it without undue strain) was that it was incredibly cheap to manufacture. At the time of discovery, we paid sixty-five cents per bottle of potassium chlorate, yielding a total net weight of sixteen ounces. The equal volume of granulated, white sugar we borrowed from the kitchen didn't cost us a cent. From this we got two pounds of pretty good explosive.

When making sugar powder, be sure to get the chemical with three molecules of oxygen ($KClO_3$) and not potassium chloride (KCl), which is basically inert. Potassium chlorate is still used by some farmers to treat livestock and by a great number of manufacturers to make various products. It is available from most drugstores, drug supply houses, vet supply houses, and most industrial chemical suppliers. Nowadays the cost is far more than eight cents per ounce, but unlike other explosives that are practically unavailable, this is a pretty good one that just about anyone can have.

The only down side is that making an acceptable explosive out of equal parts of sugar and potassium chlorate requires that one carefully follow some basic procedures. The procedures are about as complex as making a cake from a package mix, but unless you follow the directions, your father may also be feeling the scorched plaster basement ceiling to see if a fire has started.

We originally got our first hint about sugar powder while reading an ancient Harding book called *1001 Questions and Answers,* purchased for a dollar (one muskrat hide) through *Fur, Fish and Game* magazine. Then there was the article in *Sports Afield* about the fellow out west who concocted the powder to load in his .22 long rifle cases. "Potent medicine on out-of-range jackrabbits," he wrote.

The problem we encountered was that, although several sources said it could be done, no one gave step-by-step instructions for successfully accomplishing the chemical union of the potassium chlorate and common table sugar.

Our first experiment came out surprisingly like inedible cake frosting. We did not heat the sugar sufficiently to melt it. Instead, we had used a couple of teaspoons of water to dissolve the sugar—a complete no-no, we later discovered. I don't know if we actually had explosive fudge, but I still suspect that it was basically worthless, either to eat or to blow things up with. The material was soft and sticky. After three days, we pitched it.

By some quirk of fate, my brother and I figured out that the sugar must be melted and not dissolved. Our second batch contained no water and a lot more heat. It was

infinitely better.

By some similar quirk of fate, we also allowed the melted sugar to cool down sufficiently before mixing in the $KClO_3$. As a result, our second batch came off without incident. Part of this luck occurred as the result of the $KClO_3$ cooling the melted sugar very rapidly when stirred in. The batch was so small, the $KClO_3$ never got hot enough to ignite. Keep in mind that we were a bunch of destitute farm kids without many funds for expensive chemicals. A successful batch of powder was a momentous occasion. Pulling the needed elements together was as great a financial challenge as buying a new truck is today.

The second time around, we produced a material much like rock candy. It was tough to grind fine enough to do anything with. In this instance, the melted sugar got a bit too hot. The correct temperature of the melted sugar should be no more than 255° Fahrenheit. Science and technology have since overtaken the Benson household. I now use a candy thermometer to make my sugar powder.

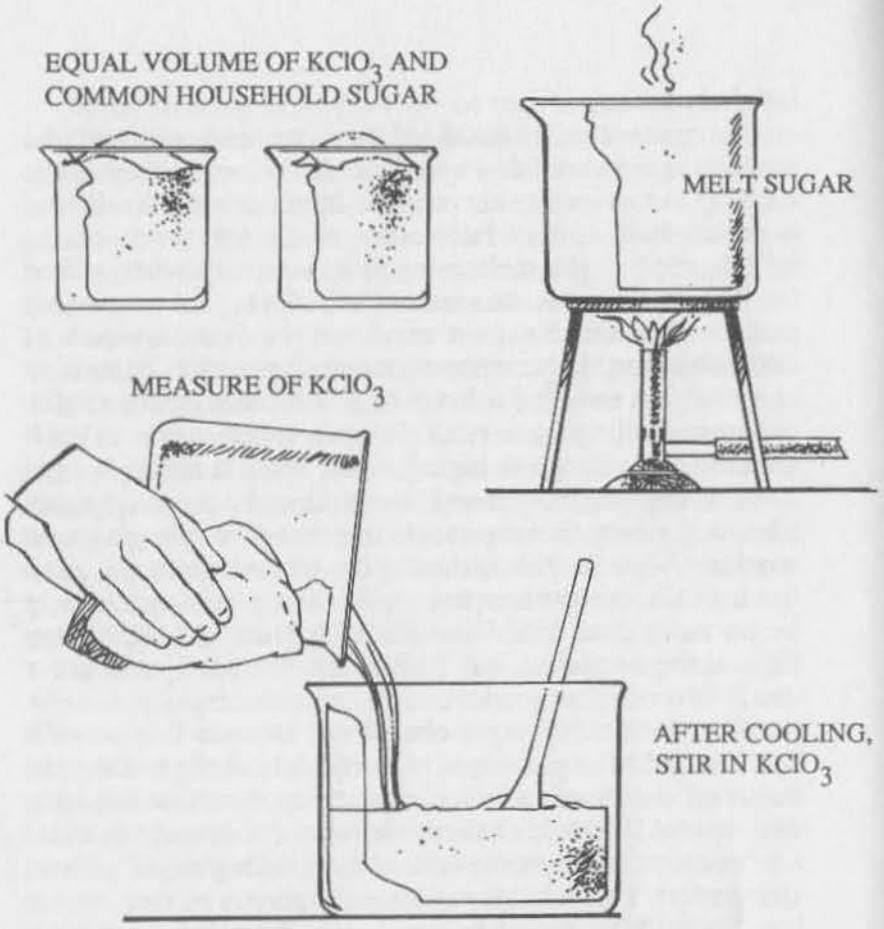
Stir the melting sugar constantly. Be sure that when it reaches 255° Fahrenheit, it is completely melted. Take the sugar off the stove and stir constantly to eliminate hot spots and to cool. My rule of thumb is to cool it enough so that I can put my thumb in the melted but cooling sugar without discomfort. This will take constant, vigorous mixing.

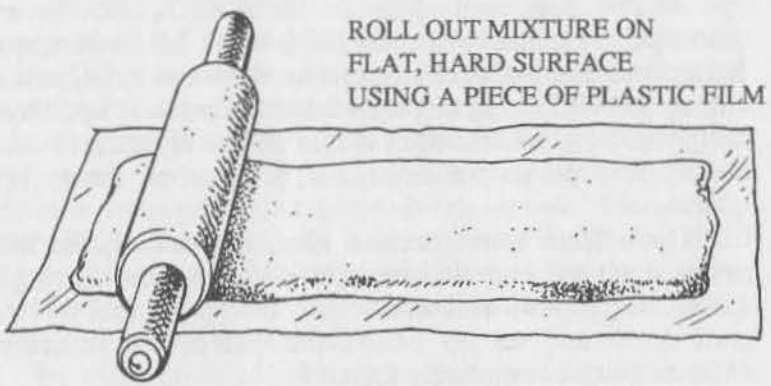
The $KClO_3$ should be premeasured so that equal parts by volume are used. Stir in the $KClO_3$ slowly and thoroughly. Lumps in the chemical must be broken apart before mixing. At times we have used the expedient of sifting the $KClO_3$ through a screen to break it up. Store-bought $KClO_3$ comes out of the jar as fine crystals.

At this point the compound will cool down very quickly.

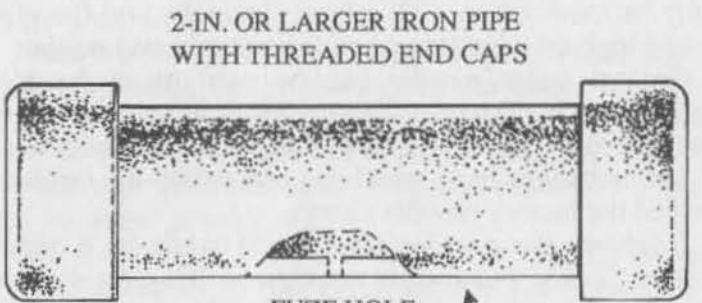
If you have been cautious about not letting the temperature get too high and are very diligent about stirring in the $KClO_3$ rapidly and with vigor, the compound will not cool down and set up before the last of the potassium chlorate can be completely mixed in.

Spoon the compound—which is now a kind of off-white material with the consistency of year-old wedding-cake

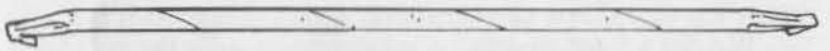




Sugar chlorate powder.



Pipe bomb.



COMMON SODA STRAW
FILLED WITH MIX OF
50% SUGAR CHLORATE,
50% FINE HARDWOOD SAWDUST

Fuze.

frosting—onto a piece of Saran wrap. Let it set overnight in a cool, dry place. A refrigerator is too cool and damp. An open garage in Iowa most August nights is ideal.

After curing for twelve hours, the powder must be ground. For years we used my mother's rolling pin, 'til one of my brothers got to high school chemistry and found out about a high-tech implement called a mortar and pestle.

Ground sugar powder can be used as is for many applications, but for reloading ammo, it is best to sieve the fines out. We took the resulting fine dust and loaded it into .22 LR cartridges from which we had pulled the heads and dumped the factory powder charge.

I believe the powder also would work on a volume basis in 30-30s, but I've never tried it. If I ever did use a sugar-powder reload, I would cautiously use light bullets and tie the gun down first.

Although the powder works in some cartridges, it is best used for pipe bombs and the like. The sugar powder is so hard on gun barrels you might as well hire a mouse to piss down the barrel regularly. The net result would be almost the same.

Sugar powder is match-sensitive. I do not know if it is impact-sensitive but suspect it is. I never tried the powder with standard dynamite caps (which I regret), so I do not know for sure if it is cap-sensitive. Again, I suspect it is.

We did a huge number of experiments with the powder in pipe bombs. In three-quarter-inch pipes, the sugar powder does not reach critical mass and simply fizzles. When ignited with a fuze in half-pound quantities in one-half-inch or larger pipe bombs, it barks nicely, doing the requisite amount of damage. The best charges are packed in the pipe in as dense a manner as possible.

Cotton string dipped in a solution of sugar powder makes acceptable fuze for some applications. It can be subject to flash burns, so it should only be used in very long lengths. Thankfully, it is cheap and easy to make.

Another trick we developed was to mix 50-percent fine-cut hardwood sawdust with fine ground sugar powder and pour this concoction into a fat plastic straw. If needed, the straws could be slipped together to make really long

fuzes. Unlike string dipped in a sugar-powder solution, straws packed with sawdust and sugar powder are very reliable and predictable. The speed at which the fuze burns can be altered by the amount of sawdust put in the mixture. We have worked out extremely predictable, one-foot-per-minute fuzes many times.

Probably the most unique use of sugar powder was the light bulb bombs my brothers often made up. They took regular 60- or 100-watt lightbulbs, knocked out a small chunk of the side using a towel or rag and small ball peen hammer, and filled the bulbs with one-quarter to one-half pound of sugar powder.

On throwing the light switch, the oxygen-exposed elements in the bulbs flashed, setting off the sugar powder that, in turn, thumped the room nicely. The device won't do much damage. It won't even blow out the windows. So much smoke and confusion are created, however, that the effect is well worth the trouble trying to get light bulbs to break properly.

Recapping briefly: I make potassium chlorate powder as follows:

1. Buy the correct chemical—use potassium chlorate $KClO_3$.

2. Use common, granulated white sugar as the second ingredient.

3. Dry measure the two into equal amounts by volume (i.e., use one cup of $KClO_3$ for each cup of sugar).

4. Sift the $KClO_3$ so that all the lumps are removed or crushed.

5. Place the sugar in an old pot. Heat it to 255° Fahrenheit, stirring constantly.

6. Take the melted sugar away from the stove burner and continue to stir vigorously.

7. Continue to stir until the melted sugar cools sufficiently to comfortably put your finger in the mixture.

8. Quickly and vigorously stir in the $KClO_3$ before the compound cools down and sets up, completely mixing in the $KClO_3$.

9. Dump the solidifying compound on a piece of Saran wrap and flatten out to not more than one-half-inch thick.

10. Allow the batch to cure overnight in a cool, dry place.

11. Using a wooden rolling pin, crush the frangible powder as fine as required for the intended use. Fine is better for reloading; coarse is okay for bombs.

12. Sift the powder through a fine screen to grade for particle size.

13. Use however you wish.

Chapter 8

Improvised Detonating Caps

Alfred Nobel's discovery of the principle of initial ignition (blasting caps) in 1863 may be more significant than the work he did pioneering the development of dynamite itself. Without the means of safely detonating one's explosives, the explosives are of little value. As I demonstrated in the chapter on ammonium nitrate, it is not particularly difficult to come up with some kind of blasting agent. Making it go boom somewhat on schedule is the real piece of work in this business.

Finding something to use for a cap is a different kettle of fish. Usually under the facade of safety, blasting caps are the first item to be taken off the market by despotic governments.

There are at least two reasonably easy expedient methods of making blasting caps. The formulas are not terribly dangerous, but do require that one exercises a high degree of caution. Caps, after all, are the most sensitive, dangerous part of the blasting process.

Improvised caps have an additional element of risk due to the fact that they are sensitive to relatively small amounts of heat, shock, static electricity, and chemical deterioration. The solution is to think your way carefully through each operation and to make only a few caps at a time. By doing so, you will limit the potential damage to what you hope are acceptable levels.

Fuze and electric-sensitive chemical mixtures are best put in extremely thin-walled .25 ID (inside diameter) aluminum tubing. If the tubing is not readily available, use

clean, bright, unsquashed, undamaged .22 magnum rimfire cases. Do not use copper tubing unless the caps will be put in service within forty-eight hours of their manufacture. Copper can combine with either of the primer mixtures described below, creating an even more dangerous compound.

For fuze-type caps, empty .22 mag brass should be filled to within one-quarter inch of the top of the empty case. This unfilled one-quarter inch provides the needed "skirt" used to crimp the fuze to the cap.

Fuze can often be purchased. If not, make it yourself out of straws and sugar chloride powder as described in Chapter 9.

Two mixtures are fairly easy when making the priming compound for blasting caps.

Crush to fine powder two and a half teaspoons of hexamine (military fuel) tablets. Make sure you use *hexamine*. Sometimes hexamine is confused with trioxaine, a chemical that is used for basically the same purpose. Often, but not always, hexamine is white, while trioxaine is bluish.

Hexamine is available at many sporting goods stores and virtually all army surplus shops. Many of the survival catalogs also carry it, often in larger quantities at reduced prices. I personally favor ordering my hexamine from survival catalogs to be more certain of what I am getting.

Many clerks in sporting goods stores seem to have undergone a lobotomy as a qualification for the job. In my experience, they will either try to talk you out of hexamine if they don't have it, or try substituting something else (suppositories, for instance) if they can't determine for sure what it is they have or exactly what you want.

As of this writing, a sufficient amount of hexamine to make two batches of caps costs from $.75 to $1.50.

Place the finely powdered hexamine in a clear glass mixing jar. A pint-sized jar with an old-fashioned glass top is perfect for the job.

Add four and a half tablespoons of citric acid to the two and a half teaspoons of crushed hexamine. Stir with a glass rod until the mixture is a slurry. The citric acid can be

the common variety found in the canning department of the grocery store. It is usually used to preserve the color of home-frozen and canned fruit and sells for about $1.59 per bottle.

The final mix involves pouring in a tablespoon of common peroxide. Use the stuff bottle blondes are famous for that is 20- to 30-percent pure by volume, available from drugstores. This material is the cheapest of the ingredients, costing roughly one dollar per bottle.

Shake the mixture vigorously for at least ten minutes, until everything appears to be in solution. Set the mixing jar in a dark, undisturbed spot for at least twelve hours. Be sure this place is somewhat cool as well as dark. Don't put it in the basement on top of a heat duct, for instance.

After a few hours of undisturbed, cool shelf sitting, a white, cloudy precipitate will begin to appear. At the end of twelve hours, there should be enough to load three blasting caps. Making enough chemical for three caps is just right, in my opinion. Anything more in one batch is too risky.

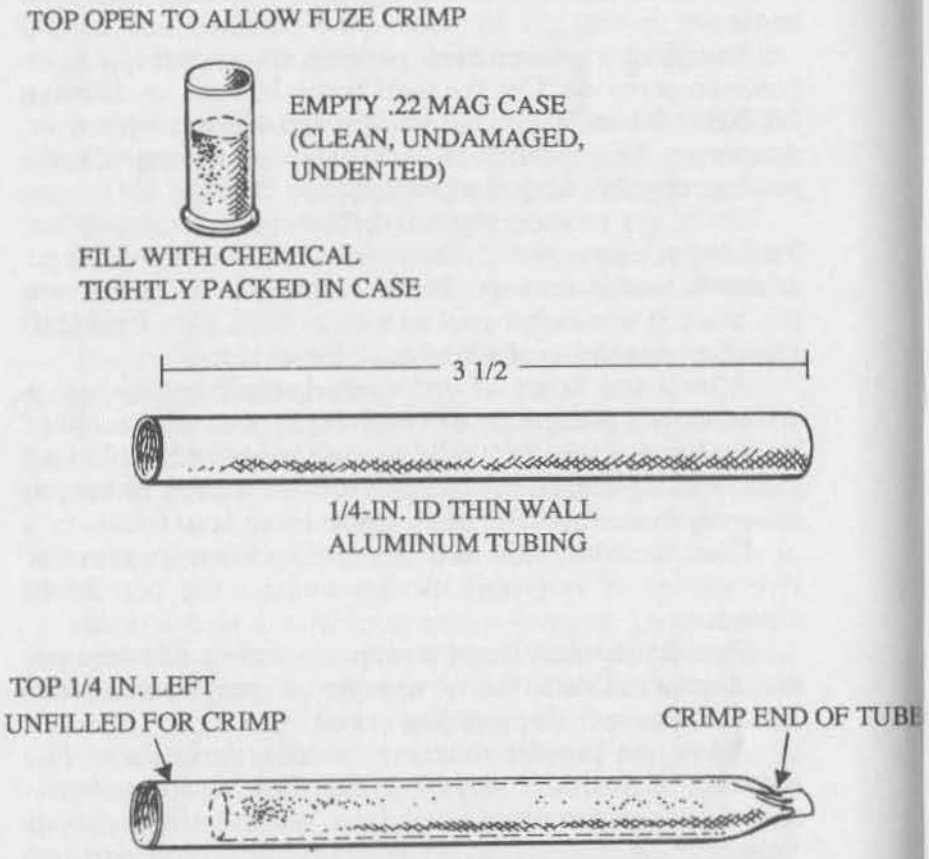
Filter the entire mix through a coffee filter. Run four or five spoons of isopropyl alcohol through the powder to clean it.

Spread the wet, filtered powder on a piece of uncoated, tough paper. Don't use newspaper or magazine covers. Notebook paper or a paper bag is ideal.

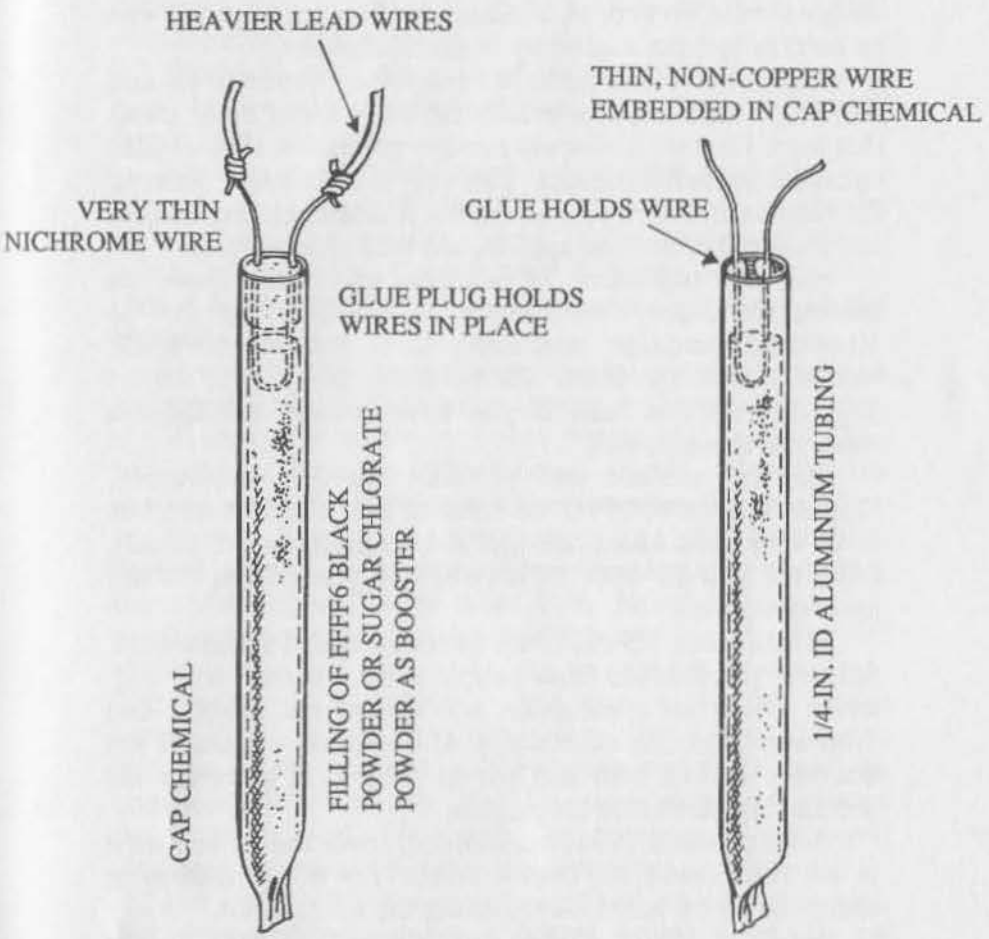
Allow the powder to dry in a cool, dark place. The resulting explosive is very powerful. It is also very sensitive, so use caution. In my opinion, the concoction is about three times as powerful as regular caps of the same size.

Using a plastic spoon, fill the presorted and precleaned .22 mag cases with the powder. Pack the powder down into the case with a tight-fitting brass rod. I have never had an incident, but for safety's sake I still use a heavy leather glove and a piece of one-quarter-inch steel clamped in a vise to shield me when I pack in the powder. The end result is a very nice cap, ready to clamp on the fuze in the customary fashion.

If a piece of tubing is used in place of a mag case, securely crimp or solder one end shut. It will not do to have the powder leak out of the cap. Powder contact with the



Homemade blasting caps.



Homemade blasting caps (cont.).

solder should be kept to a minimum. Fingernail polish can be used to seal the lead away from the chemical.

It is possible and perhaps desirable to continue on and turn these caps into electrically fired units, but more about that later. First we'll discuss another good formula that uses equally common materials. This one is a bit better because the mixture involves all liquids, but it is temperature critical and should therefore be approached with special care.

Mix 30 milliliters of acetone purchased from an automotive supply house with 50 milliliters of 20- to 30-percent peroxide purchased from the corner bottle blonde. There are about 28 milliliters per ounce. Adjust your mix on that basis if you have nothing but English measures to work with.

Stir the acetone and peroxide together thoroughly. Prepare a large bowl full of crushed ice. Mix in a quart or so of water and about one-half to two-thirds pound of salt. Place the pint jar with the acetone and peroxide in the salt ice cooling bath.

Measure out 2.5 milliliters of concentrated sulfuric acid. Sulfuric is available from people who sell lead acid batteries. Using an eyedropper, add this to the mixture one drop at a time. Stir continually. If the mixture starts to get hot, stop adding acid and stir as long as it takes for the temperature to start to drop again.

After all the acid has been added, cover the jar and set it in the refrigerator for twelve hours. Try not to disturb or shake the jar by needlessly opening the refrigerator.

Again, a white, cloudy precipitate will form in the bottom of the pint jar. As before, filter through a coffee filter, but wash it with a couple of spoons of distilled water.

Spread on paper and dry. Like the first material, this batch will produce enough powder for about three caps. These are pretty hefty caps, having about three times the power of regular dynamite caps.

They *should* set off ammonium nitrate, but don't be surprised if they don't. I have never tried it, but making two caps from a batch rather than three might create a cap with enough heft to reliably detonate ammonium nitrate. The problem then is that .22 mag brass does not have enough

capacity. You will have to go to a hardware store to find suitable aluminum tubing.

Electrical caps, because of the fact that bridge wires must be included in the package, must be considerably larger than fuze caps.

For making electrical caps, use any fine steel wire that is available. I use nichrome .002 diameter wire purchased from a hardware specialty shop. Hobby shops are also a source of this wire. Copper wire is easiest to obtain, but should not be used because of its possible reaction with the blasting material.

I strongly urge that an experimental piece of proposed bridge wire be placed in a circuit with a 12-volt car battery, a wall outlet, or whatever power source will be used. The wire should burn an instantaneous cherry red when the current is applied. If it doesn't, use a smaller diameter wire.

Having located a usable wire, cut the thread-thin material into six-inch pieces. Bend these into a U and place them in the bottom of the tubes. Pack the recently manufactured cap explosive in around the wire. Seal the cap off with silicon caulk. Allow the cap to cure for several days. The last step is to attach the lead wires to the thin bridge wires. The job can be tougher than one would suppose because of the thinness of the bridge wires. Be sure the connection is secure and solid. Use tiny mechanical clamps as necessary and, of course, do not even think about soldering the wires after they are embedded in the primer.

For some unknown reason, some of my mixtures have not detonated well using a heated bridge wire. To get around this, I have occasionally loaded two-thirds of the cap with hexamine or acetate booster and one-third with FFFF6 black powder or sugar chlorate powder, whichever is easier and more available.

The chlorate or black powder ignites much easier, taking in turn the more powerful cap mixture with it. Concocting this combination is, of course, dependent on having the necessary materials.

If black or sugar powder is not available, the caps can usually be made to work reliably using only the original cap powder.

Making these caps requires more than the usual amount of care and experimentation. The procedure is workable but dangerous. Blasters who can secure commercial caps are advised to go that route. But if not, these caps are workable and, in total, not all that tough to make.

Chapter 9

Improvised Explosives

This is the part of the explosives business that is really dangerous. I can't begin to remember my many friends who in their youth had misadventures with noncommercial explosives. To this day, many are maimed or impaired as a result of fooling around with this stuff.

On the other hand, I do not recall a single friend who ever got hurt with commercial explosives, in spite of some god-awful dumb things they did with them. Homemade explosives carry with them a huge intrinsic risk.

Those needing evidence of this fact need look no further than the early history of high explosives. Chemist after chemist who worked with explosives came to work to find his assistants splattered all over the lab wall. Those who survived charged gamely on 'til it seemed as though only the lucky remained.

On the other hand, high explosives are so much fun and so interesting I have always felt the risk was well worth the ultimate payoff. Perhaps because I am a reasonably good half-assed chemist (having taken chemistry in school), I have never had a serious incident. The closest I ever came was the time my batch of sugar powder went up. I have all my fingers and toes and even my hearing is not too bad considering all the mortars, heavy artillery, and demolition charges I have been around.

With this warning, I will charge ahead and offer some suggestions for the truly desperate who cannot get explosives by any other means. The formulas I list are not necessarily the easiest or most powerful. They are, how-

ever, among the safest one can put together in a jam.

The first formula I will recommend yields a product that is comparable to 40-percent commercial dynamite. It is not really powerful enough for military applications but does very nicely as a substitute for common dynamite.

First, finely grind potassium chlorate. If you find you cannot purchase commercial $KClO_3$, you will have to make it. This isn't terribly difficult, but in some places may be necessary if you cannot convince your corner druggist to order $KClO_3$ for you.

Potassium chlorate is a strong oxidizing agent. I claim that I use it as a wash for flowerpots, a cement cleaner, a super-soluble fertilizer for a hydroponics garden, or as a seed treatment. Readers undoubtedly can come up with equally creative reasons for owning $KClO_3$ that their corner druggist will accept.

When you are done grinding, the consistency of the $KClO_3$ must be similar to talcum powder. There must be no compromising here, or the product simply will not work.

There is little danger to the maker when grinding up this chemical into fine powder. Heat the powder slightly while paddling it to be sure not a trace of water remains on completion of the grinding operation.

Carefully measure five level teaspoons—or tablespoons if you want to make a larger initial batch—of common Vaseline and place this in an old ceramic or plastic bowl along with five carefully measured level teaspoons (tablespoons) of common beeswax. Use white—as in camp stove—gas to dissolve the mixture. Mix in as little white gas as possible. Usually about one-third cup or less will be enough to dissolve the wax/Vaseline mixture.

Take ninety premeasured level teaspoons of powdered potassium chlorate and hand knead it into the melted wax and Vaseline. You will want to work outside on a warm day so that the gasoline can evaporate out of the mixture and blow away.

As the mixture starts to harden, compress it very tightly into rolls from toilet paper, blocks, or whatever shape is desired. After packing and shaping the charge, place it in a cool, dry place for four or five days to cure.

Avoid rough friction and/or any sulfur or phosphorous compounds. Sulfur and phosphorous can needlessly sensitize and degrade the mixture. The finished block of explosives should be dipped in paraffin to seal it against moisture and foreign chemicals.

The addition of a trace of finely ground aluminum powder at the mixing stage will increase the detonation velocity a bit. Like 40-percent dynamite, this explosive must be shot with a cap.

Potassium chlorate, if it cannot be purchased off the shelf, can be made from common 5 1/4-percent sodium hypochlorite solution (bleach).

The maker will require an old hot plate, a reliable hydrometer (many people use a battery hydrometer), a large glass bowl, and an accurate metric scale.

Along with the gallon of bleach, you will need a total of 65 grams of potassium chloride. Potassium chloride is sold expensively in the grocery store as salt substitute and dirt cheap in farm supply stores for farmers to use as fertilizer. It is also sold as a cleaner at some drugstores.

Put the gallon of bleach on the hot plate and slowly heat it in a glass container. Add the 65 grams of potassium chloride and bring the mixture to a boil. Boil gently until the hydrometer reads 1.3. This is full charge on a battery hydrometer.

Take the 1.3 solution and place it in a snowbank or refrigerator until it drops to 32° Fahrenheit. Crystals will form. Filter the solution through a coffee filter and save the crystals in another container.

Boil again until the solution reads 1.3 on the hydrometer, cool, and filter, saving the crystals as in step one.

Combine the two batches of crystals and mix 56 grams of the material with 100 milliliters of distilled water. Gently heat this solution again, cool, and save the crystals, which should be pure $KClO_3$.

Obviously, this is a lot of dinking around for a small yield of potassium chlorate. There is at least one other method of securing $KClO_3$ in larger quantities.

Start with 1200 grams of calcium hypochlorite

(swimming pool chlorination compound). Add in 225 grams of potassium chloride (salt substitute) as above. Mix in enough jumping hot water to dissolve the potassium chloride. Boil the solution until a white, milky substance is formed. Boil as long as the white precipitate continues to form.

While the solution is still very hot, drain through a coffee filter to remove the milky precipitate. Set the remaining liquid on a shelf and allow the temperature to drop to about 65° to 70° Fahrenheit. Crystals of $KClO_3$ will form as the solution cools. This $KClO_3$ becomes the basis for manufacture of the explosives previously mentioned.

Another family of explosives can be made at home by those willing to take the risk. These are based on the R.D.X. compounds used often by the military.

R.D.X. is the basis of C-4, an explosive with which most GIs are very familiar. Making R.D.X. is a bit tough but certainly not an insurmountable task for the desperate, half-assed chemist.

If the maker can find a good source of nitric acid from school chem labs, jewelry shops, or other industrial users, the process is relatively easy. Even if the nitric acid must be home manufactured, the project is still doable.

Start by grinding hexamine fuel bars into fine powder. Hexamine is the old camp stove fuel used by GIs for years. It is getting a bit scarce, but is still commonly available in most surplus stores.

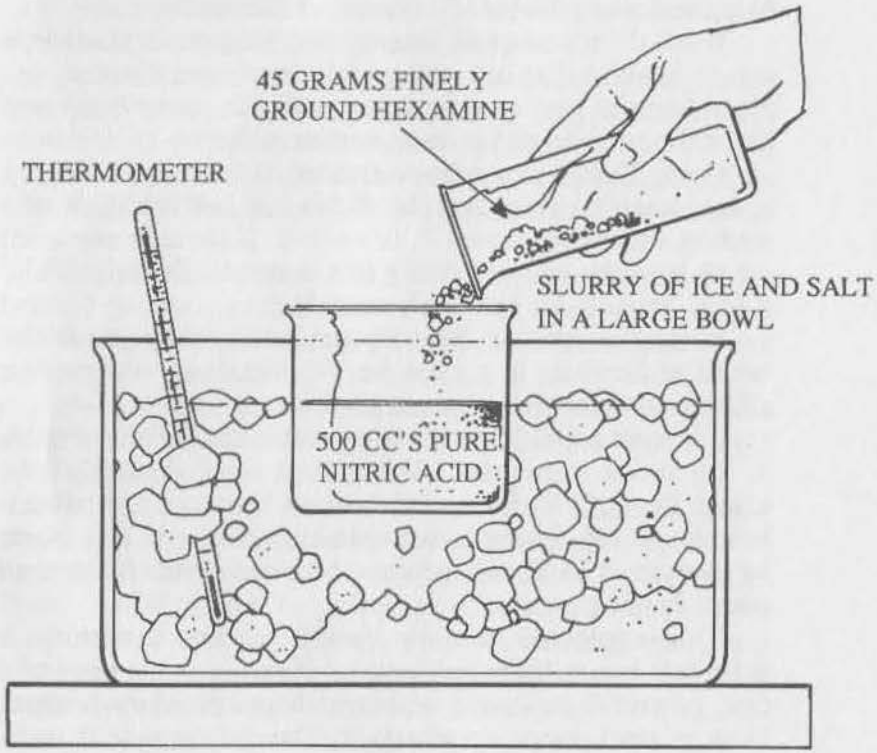
Carefully weigh out 45 grams of this finely ground hexamine and place it in a paper cup.

Prepare a salted, crushed-ice bath large enough to conveniently hold a large, glass beaker-type mixing bowl.

Measure out 500 grams of pure nitric acid. Since nitric acid is quite heavy, this will be considerably less than 500 cc's. Those who can not secure pure nitric can condense it down by carefully and slowly boiling the diluted nitric acid on a hot plate. Do this outside when a gentle wind is blowing. Continue to slowly boil until red fumes begin to come off the mixture. These red fumes are very poisonous. One whiff will generally cause a person to go T.U. (totally under).

Cool the now-pure nitric acid and place 500 grams by weight in the glass bowl, which is in turn nestled down in the chopped ice/salt cooling mixture.

Keep an accurate thermometer on hand to monitor the process of adding the powdered hexamine to the nitric acid. Stir continually with a glass rod. If the temperature of the mixture goes up to 85° Fahrenheit, stop adding hexamine and continue stirring. Keep plenty of ice and salt on hand to replenish the cooling bath as needed.



Manufacturing R.D.X.

Continue stirring for about fifteen minutes after the hexamine has all been added to the acid. The mixture should drop to about 32° Fahrenheit. Continue stirring until it does and then stir an additional ten minutes.

Take the now cooled and well mixed solution and dump it into a clean bowl of crushed ice and water. Be sure the water and ice are clean and relatively free of dissolved minerals. If there is a question, buy pure ice, grind it, and mix with distilled water.

Crystals of R.D.X. will form in the ice water. Filter these out. Make a second batch of crushed ice in which to dump and wash the R.D.X. crystals. Filter again.

Wash them one more time by dumping the crystals in a cup of boiling distilled water. Stir, cool, and filter again. Place them in just enough warm water to cover them and allow the batch to sit for three or four minutes.

Using litmus paper from a school lab or chem supply house, test the water for pH. To be on the safe side, the reading should be almost 7, or neutral. If there is any acid, reboil in water to wash away this material. Slightly acidic R.D.X. crystals are extremely unstable.

Since the crystals are very explosive, they should be stored underwater in a glass jar. No metals should ever be allowed to touch these chemicals.

To make a C-4-like explosive, allow the R.D.X. crystals to dry in an open bowl. When they are completely dry, knead the R.D.X. into a mixture of beeswax and wheel-bearing grease. I have found that a good mix is 80 percent by weight R.D.X., 10 percent beeswax, and 10 percent wheel-bearing grease.

This explosive is quite fast and very powerful. It definitely has military applications if one is in the need of a fast, powerful explosive with which to cut down bridges, blow in steel doors, or whatever. The only potential problem is that the explosive is sleepy below 45° Fahrenheit and becomes a bit unstable above 90° Fahrenheit, though this does not present a problem for many applications. In any case, it must be fired with a cap.

The real problem with R.D.X. occurs when a good source of nitric acid is not available. Nitric acid can be

made using commonly available apparatus and somewhat common chemicals, but it definitely is a pain in the ass.

You will need a retort still, which can be purchased from almost any chemical supply house. These are very expensive, running from $80 to $120. Buy 100 grams of potassium nitrate from a drugstore or vet supply house. Potassium nitrate is commonly available as a food preservative and feed additive. Almost any drugstore will order it if they don't have it. The price is around $5.

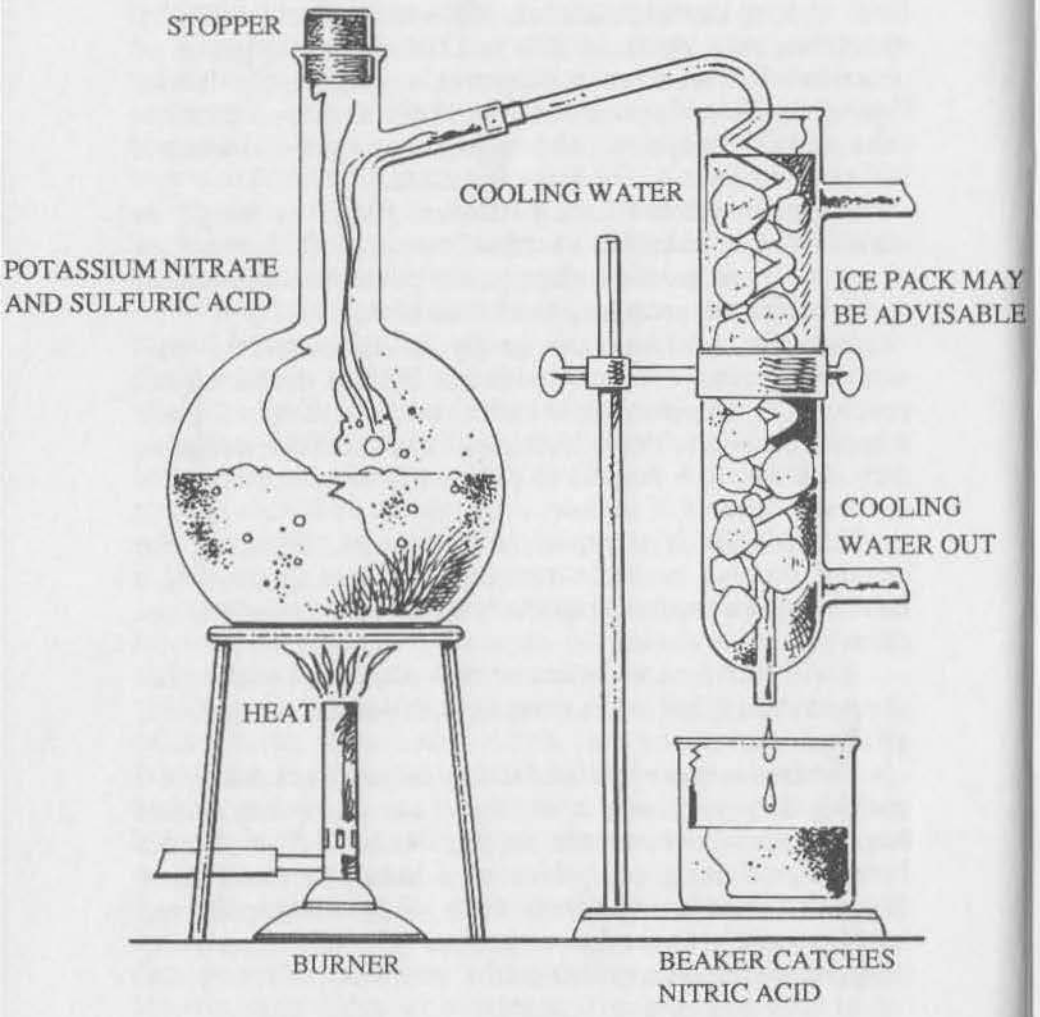
Place two-thirds of the potassium nitrate by weight in the retort. Add in half as much sulfuric acid. Battery acid is okay, but try to get the highest purity possible. Sulfuric acid of 98 to 100 percent purity works the best.

Heat the mixture very gently in an extremely well ventilated area. The gas produced by this reaction will condense as droplets on the inside neck of the retort. Place a bottle under the neck of the retort to catch the drops as they fall out. It is helpful to pack ice around the bottle to condense the acid.

The process is slow, but it does work. Speeding the heating process pushes water into the acid, producing a less-than-pure product, especially if the sulfuric acid is not pure.

It will take time to collect enough nitric acid with which to do anything, but it is a good field-expedient procedure if all else fails.

There are many additional explosives formulas that I could list. Anyone who is interested can easily buy one of the numerous books on the subject available from Paladin Press. Since using explosives as a hobby is much more dangerous than doing things such as bowling, golf, and hustling—and homemade explosives are especially dangerous—I will leave it at that.



Manufacturing nitric acid.

Chapter 10

Recreational Use of Explosives

It is difficult for me to comprehend the fact that some people actually do not consider all uses of explosives to be recreation. In my mind, at least, this is a perfectly logical progression, going from firecrackers when one is very young to heavy explosives when one is older and more mature.

I can remember the exact moment I fully appreciated the enjoyment that can come from using explosives.

Slowly and carefully, the mammoth, sixty-ton tank felt its way up to the top of the rise. I found it incredible that such a behemoth could give the impression of treading so lightly.

Toward the top of the basalt hill, the tank commander stood on tiptoe on his turret platform to look out over the vast expanse of desert. From the target eight hundred yards out, he was probably not visible; only his head showed over the basalt rock.

On seeing the target, he hit the traverse lever, swinging his 105mm main gun around. It fired almost instantaneously, tracking on the target. The old car body disintegrated into a shower of metal shards from the impact of the HE (high explosives) round.

The concussion from the shot threw up sand and bits of rock in a gritty, dusty shower. Trapped between the explosion and the little basalt canyon as I was, the blast about washed me off the tank. It was as if the steel monster had run into a wall of Jello.

All the sagebrush and wire grass in front of the tank

was uprooted and destroyed. Any living thing up to sixty feet under and in front of the main gun would have been killed by the muzzle blast. It was at that moment, sitting in the basket as I rode through the tank commander school on the desert south of Boise, Idaho, that I realized I was addicted to high explosives. The smell was exhilarating, the effect of the tank a charm, and the return rumble of the round as it detonated downrange a pure delight.

I don't know why everyone does not share my delight with explosives. If they don't, it has to be some abhorrent character defect.

My underprivileged wife was raised by college professors who thought firecrackers were dangerous. She grew up in an extremely deprived atmosphere. Now, given the chance, she just loves to set up a few surplus sticks of 60-percent and plink at them with her .257 Roberts. As she is quick to point out, they are terribly difficult to hit, but when you hit one, the whole neighborhood knows it. Nobody has to speculate if the round was accurately directed or not. Given the chance, she is quick to appreciate the funnier things in life.

A pleasant variation of that system involved placing a stick or two of powder under a milk jug filled with gasoline. It takes quite a sharpshooter to plunk off the dynamite before holing the gas container. Successful hits are very showy. The combination produces an angry black and red cloud of a most spectacular nature.

Blasting fish in eight or more feet of water is definitely recreational. The water flashes silver for an instant. The noise is a kind of sharp click. Water from the blast churns up in a kind of reverse maelstrom. In shallower water along creeks, it is fun to blast a waterspout up over the treetops.

When we were kids, we bought surplus parachute grenades by the case. We pulled the parachute and flare, packed in the most powerful dynamite we had around, and fired these out into the pasture field. One time, we stampeded the cattle toward the hired man, who was down along the creek with his girlfriend.

We got very good at dropping the grenades into logjams along the creek where trash had piled up during spring

floods. The homemade bombs blew sticks and twigs hundreds of feet into the air. This was indeed a thing of beauty. Each year, we looked forward to the new deposits of debris left during the flood season, so we could practice on them.

Case after case of our improvised rifle grenades went whizzing over the countryside, with but two "incidents." Both were practice runs that went amok.

In one case, I was demonstrating the proficiency we had acquired with our little bombs. Dad suggested I try lobbing one into the front yard of the homestead two hundred yards east.

"Aim for that little blue spruce in the far front yard," he said. "See how close you can come."

Perhaps I was lucky, but the grenade landed short about ten feet and bounced once, landing right under Dad's precious pine. It blew all the lower branches off and turned the top limbs in an awkward upward angle.

"I don't believe it," Dad said. "All the years I've been watering and caring for that tree and now it's blown up. I didn't think you could do it."

The other time, I was demonstrating a rifle grenade to some neighborhood kids. The thing malfunctioned and, instead of arcing out over the pasture field, anemically dribbled across the barnlot, coming to rest under our gas barrel. Luckily, the barrel—containing three hundred gallons of ethyl—was perched high enough to avoid any serious damage from the blast below.

Serious blasters eschew the use of common fireworks on the Fourth of July. The neighbor kids could take their M-80s, aerial and cherry bombs, and Zebras and stuff them. All this claptrap paled into insignificance compared to just one stick of 40-percent. On the Fourth, we treated our peers who had nothing more than firecrackers with a deference born of the natural superiority held by those who have real explosives.

Our best show occurred when we floated sticks with long fuzes high into the sky tied to helium-filled weather balloons.

A really wondrous recreational event using explosives occurs when an especially long, wide ditch is shot with

propagation powder. The black muck is instantaneously put in the air in a vaporized configuration. It is a real hype for those who enjoy the thump of explosives.

Another real high (no pun intended) occurs when shooting duck ponds with large charges of ammonium nitrate. This explosive isn't particularly powerful, but if you use a lot of it, the effect is very nice.

Blowing down buildings is very recreational. In my younger days, we absorbed several farms into our main operation. We wanted the land, not the buildings, which were by anyone's standards completely redundant.

Using a bug sprayer, we fogged the buildings with a quart of gasoline. A half stick of dynamite used as an igniter blew the buildings right resolutely to hell.

This spectacular recreational use of powder only works on buildings that are reasonably intact. The windows must be in place, the doors closed, and so on. A shop building we tried to shoot down several different times still stands. The doors were loose and the siding too open.

Using a mousetrap as a trip switch dates back almost to prehistoric times. My uncle was a great believer in rigging up a trip wire connected to a charge hung in a tree. Using a battery and two wires, he often scared people out of our woodlot at night. He also managed to deafen a significant number of our cows.

Those who are uncertain as to how to rig this set had best start by practicing with caps alone. Leave the dynamite off the set until you are experienced at wiring up a mousetrap that, when sprung, will close a circuit.

As I mentioned earlier, the thump, smell, and concussion rush becomes addictive to many users. On the other hand, many people will choose to use explosives only to do work. There is nothing wrong with that approach. It's just that, for many of us, there is much, much more.

ISBN 0-87364-478-6

Who else but Uncle Ragnar could write this down-home guide to home and recreational use of high explosives? Ice fishing with dynamite, blowing stumps, mixing up sugar chlorate powder—the Benson family was never the same after Ragnar discovered the fun to be had with high explosives.

It's not all fun and games, though. Benson details techniques, materials, hazards, and safeguards, drawing on his many years of experience on the farm and as a consultant all over the world. How to obtain commercial high explosives, safely storing and transporting explosives, detonation techniques, power sources, improvised explosives, and more are woven in with tales of Ragnar's outrageous adventures.

This book is dedicated to those hardy souls who enjoy harkening back to a time when the use of explosives, and dynamite in particular, was a domestic necessity—not to mention a source of pleasure and adventure. These techniques are still incredibly useful today. With them, says Ragnar, a single individual can dig a disposal pit or dry well in otherwise impenetrable ground, set posts, remove large boulders, redirect creeks, blow up bad guys, and perform a host of otherwise impossible chores of immense benefit to mankind.

This book is for information purposes only. The use of high explosives can be extremely dangerous. Whenever dealing with high explosives, failure to strictly follow industry standards may result in harm to life or limb.

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