

:About the Book

Please send me any submissions/comments/insane ideas/suggestions. This book is still undergoing work (and seeking a hardcopy publisher) and currently needs:

1. Illustrations (I have a few in B&W, but need assistance)
2. An 'introduction to basic chemistry concepts' section
3. A couple case studies- please make suggestions!
World Trade Center Bombing
The Unabomb case(s)
Major professional pyrotechnical mishaps.

I will pay a share of any profits for professional-quality illustrations!

:Read me first

AUTHOR: David Richards (dr@ripco.com)

TITLE: The Big Book Of Mischief

EDITION: Interim release (1.5) from DTP file

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:Credits and Disclaimers

This book is dedicated to Ben, who made it possible, to Arthur, who helped keep it going, and to all the amateur pyrotechnicians who have lost their lives, senses, and limbs in the search for knowledge.

The processes and techniques herein should
not be carried out under any circumstances!!

On the advice of my lawyer, I hereby state that I assume no responsibilities for any use of the information presented in this book. The intention of this book is to demonstrate the many techniques and methods used by persons in this and other countries to produce a number of conceivably hazardous devices. None of the statements herein should be taken to indicate the opinions or actions of the author. The techniques described here may be found in public libraries and all the information given is available from public sources. Any loss of life, property, or other perceived loss, injury or harm is the sole responsibility of the purchaser.

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:SAFETY

Safety is an important concern in many activities, but it is even more important when working with explosives and related compounds. If you have an accident with a power tool you can permanently maim or kill yourself. An automobile accident can not only kill yourself, but a dozen or more others who have the bad luck to be on the same road as you. When an airplane crashes, it often kills not only the passengers on board, but anybody who happens to have lived near the crash site. An accidental explosion can be much destructive than any of these. Any accident involving explosives is likely to be fatal, and a serious accident can, under some circumstances circumstances, kill hundreds of people.

There are no such things as truly "safe" explosive devices. While some explosives are less dangerous than others, all such compositions are, by their very nature, extremely hazardous.

Basic Safety Rules

1) Don't smoke! (don't laugh- an errant cigarette wiped out the Weathermen). Avoid open flames, especially when working with flammable liquids or powdered metals.

2) Grind all ingredients separately. It is alarming how friction sensitive some supposedly safe compositions really are. Grinding causes heat and possibly sparks, both of which can initiate an explosion.

3) Start with very small quantities. Even small quantities of high explosives can be very dangerous. Once you have some idea of the power of the explosive, you can progress to larger amounts. Store high explosives separately from low explosives, and sensitive devices, such as blasting caps, should be stored well away from all flammable or explosive material.

4) Allow for a 20% margin of error. Never let your safety depend on the expected results. Just because the average burning rate of a fuse is 30 secs/foot, don't depend on the 6 inches sticking out of your pipe bomb to take exactly 15 seconds.

5) Never underestimate the range of your shrapnel. The cap from a pipe bomb can often travel a block or more at high velocities before coming to rest- If you have to stay nearby, remember that if you can see it, it can kill you.

6) At the least, take the author's precautions. When mixing sensitive compounds (such as flash powder) avoid all sources of static electricity. Work in an area with moderate humidity, good ventilation, and watch out for sources of sparks and flame, which can ignite particles suspended in the air. Always follow the directions given and never take shortcuts.

7) Buy quality safety equipment, and use it at all times. Always wear a face shield, or at the minimum, shatterproof lab glasses. It's usually a good idea to wear gloves when handling corrosive chemicals, and a lab apron can help prevent life-threatening burns.

How To Mix Dry Ingredients

The best way to mix two dry chemicals to form an explosive is to use

a technique perfected by small-scale fireworks manufacturers:

- 1) Take a large sheet of smooth paper (for example a page from a newspaper that does not use staples)
- 2) Measure out the appropriate amounts of the two chemicals, and pour them in two small heaps near opposite corners of the sheet.
- 3) Pick up the sheet by the two corners near the piles, allowing the powders to roll towards the center of the sheet.
- 4) By raising one corner and then the other, rock the powders back and forth in the middle of the open sheet, taking care not to let the mixture spill from either of the loose ends.
- 5) Pour the powder off from the middle of the sheet, and use it immediately. Use airtight containers for storage, It's best to use 35mm film canisters or other jars which do not have screw-on tops. If you must keep the mixture for long periods, place a small packet of desiccant in the container, and never store near heat or valuable items.

:BUYING EXPLOSIVES AND PROPELLANTS

Almost any city or town of reasonable size has a gun store and one or more drugstores. These are two of the places that serious pyrotechnicians can visit to purchase potentially explosive material. All that one has to do is know something about the mundane uses of the substances.

Black powder, for example, is normally used in blackpowder firearms. It comes in varying grades, with each different grade being a slightly different size. The grade of black powder depends on what the calibre of the gun that it is intended for; a fine grade of powder could burn too fast in the wrong caliber weapon. The rule is: the smaller the grade, the faster the burn rate of the powder.

Propellants

There are many varieties of powder used as propellants, and many of these can be adapted for use in explosive devices. Propellants are usually selected for stability and high gas production, and can be very effective if used in a strong container. Some propellants, such as nitrocellulose, burn at a much higher rate when under pressure, while others burn at basically the same rate in the open and when confined.

Black Powder

Black powder is commonly available in four grades. The smaller, faster burning sizes are more difficult to find than the large, slow grades. The powder's burn rate is extremely important when it is to be used in explosives. Since an explosion is a rapid increase of gas volume in a confined environment, quick-burning powder is desired. The four common grades of black powder are listed below, along with the usual bore width (calibre) of the gun they would be used in. Generally, the fastest burning powder, the FFFF grade is desirable for explosives, and the larger grades are used as propellants.

The FFFF grade is the fastest burning, because the smaller grade has more surface area exposed to the flame front, allowing the flame to propagate through the material much faster than it could if a larger sized powder was used. The price range of black powder is about \$8.50 - \$9.00 per pound. The price per pound is the same regardless of the grade, so you can save time and work by buying finer grade of powder.

There are several problems with using black powder. It can be accidentally ignited by static electricity or friction, and that it has a tendency to absorb moisture from the air. To safely crush it, you should use a plastic or wooden spoon and a wooden salad bowl. Taking a small pile at a time, slowly apply pressure to the powder through the spoon and rub it in a series of light strokes or circles. It is fine enough to use when it reaches the consistency of flour.

The particle size needed is dependent on the type of device it is going to be used in. The size of the grains is less important in large devices, and in large strong casings coarse grained powder will work. Any adult can purchase black powder, since anyone can own black powder firearms in the United States.

PYRODEX*

Pyrodex is a synthetic powder that is used like black powder, and which can be substituted by volume for standard blackpowder. It comes in the many of the standard grades, but it is more expensive per pound.

However, a one pound container of pyrodex contains more material by volume than one pound of black powder. Pyrodex is much easier to crush to a very fine powder than black powder, and it is considerably safer and more reliable. This is because Pyrodex is less sensitive to friction and static electricity, and it absorbs moisture more slowly than black powder. Pyrodex can be crushed in the same manner as black powder, or it can be dissolved in boiling water and dried in the sun.

Rifle/Shotgun Powder

Rifle and shotgun propellants are usually nitrocellulose based with additives to modify the burning rate. They will be referred to as smokeless powder in all future references. Smokeless powder is made by the action of concentrated nitric and sulfuric acid upon cotton or some other cellulose material, a process that is described on page 19. This material is then dissolved by solvents and then reformed in the desired grain size.

When dealing with smokeless powder, the grain size is not nearly as important as that of black powder. Both large and small grained powders burn fairly slowly compared to black powder when unconfined, but when it is confined, smokeless burns both hotter and produces a greater volume of gas, producing more pressure. Therefore, the grinding process that is often necessary for other propellants is not necessary for smokeless.

Smokeless powder costs slightly more than black powder. In most states any citizen with a valid driver's license can buy it, since there are currently few restrictions on rifles or shotguns in the U.S. There are now ID checks in many states when purchasing powder at a retail outlet, however mail order purchases from another state are not subject to such checks. When purchased by mail order propellants must be shipped by a private carrier, since the Postal Service will not carry hazardous materials. Shipping charges will be high, due to Department Of Transportation regulations on packaging flammable and explosive materials.

Rocket Engine Powder

Model rocketry is a popular hobby in the United States and many other countries. Estes*, the largest producer of model rocket kits and engines, takes great pains to ensure that their engines are both safe and reliable. The simple design of these engines makes it very easy to extract the propellant powder.

Model rocket engines contain a single large grain of propellant. This grain is encased in heavy cardboard tubing with a clay cap at the top and a clay or ceramic nozzle in the bottom. The propellant can be removed by slitting the tube lengthwise, and unwrapping it like you would a roll of paper towels. When this is done, the grey fire clay at either end of the propellant grain should be removed. This can be done by either cracking it off with a sharp bow, or by gently prying with a plastic or brass knife. The engine material consists of three stages. First the large fuel stage, which is at the end nearest the nozzle. Above this is the delay stage, which may not be found in some engines. This stage burns slowly and produces a large amount of smoke. Last is the ejection charge, which normally would produce gases to push the parachute out through the top of the rocket.

The propellant material contains an epoxy which makes it exceptionally hard, so it must be crushed to a fine powder before it can be used. By double bagging the propellant in small plastic bags and gripping it in a pliers or small vise, the powder can be carefully crushed without shattering all over. This process should be repeated until there are no remaining chunks, after which it may be crushed in the same manner as black powder.

Model rocket engines come in various sizes, ranging from -A -2T to the incredibly powerful D engines. The larger engines are much more expensive, and each letter size contains about twice as much propellant as the previous

one. The D engines come in packages of three, and contain more powder than lesser engines. These engines are also very useful without modification. Large engines can be used to create very impressive skyrockets and other devices.

Explosives

There are many commercially available materials which are either used as explosives, or which are used to produce explosives. Materials which are used to produce explosives are known as "precursors", and some of them are very difficult to obtain. Chemical suppliers are not stupid, and they will notice if a single person orders a combination of materials which can be used to produce a common explosive. Most chemicals are available in several grades, which vary by the purity of the chemical, and the types of impurities present. In most cases lab grade chemicals are more than sufficient. There are a few primitive mixtures which will work even with very impure chemicals, and a few which require technical grade materials.

Ammonium Nitrate

Ammonium nitrate is a high explosive material that is used as a commercial "safety explosive". It is very stable, and is difficult to ignite with a match, and even then will not explode under normal circumstances. It is also difficult to detonate; (the phenomenon of detonation will be explained later) as it requires a powerful shockwave to cause it act as a high explosive.

Commercially, ammonium nitrate is sometimes mixed with a small amount of nitroglycerine to increase its sensitivity. A versatile chemical, ammonium nitrate is used in the "Cold-Paks" or "Instant Cold", available in most drug stores. The "Cold Paks" consist of a bag of water, surrounded by a second plastic bag containing the ammonium nitrate. To get the ammonium nitrate, simply cut off the top of the outside bag, remove the plastic bag of water, and save the ammonium nitrate in a well sealed, airtight container. It is hygroscopic, (it tends to absorb water from the air) and will eventually be neutralized if it is allowed to react with water, or used in compounds containing water. Ammonium nitrate may also be found in many fertilizers.

Flash Powder

Flash powder is a mixture of powdered aluminum or magnesium metal and one of any number of oxidizers. It is extremely sensitive to heat or sparks, and should be treated with more care than black powder, and under no circumstances should it be mixed with black powder or any other explosives.

Small quantities of flash powder can be purchased from magic shops and theatrical suppliers in the form of two small containers, which must be mixed before use. Commercial flash powder is not cheap but it is usually very reliable. There are three speeds of flash powder commonly used in magic, however only the fast flash powder can be used to create reliable explosives.

Flash powder should always be mixed according to the method given at the beginning of the book, and under no circumstances should it be shaken or stored in any packaging which might carry static electricity.

:PREPARATION OF CHEMICALS

While many chemicals are not easily available in their pure form, it is sometimes possible for the home chemist to partially purify more easily available sources of impure forms of desired chemicals.

Most liquids are diluted with water, which can be removed by distillation. It is more difficult to purify solids, but there are a few methods available. If the impurity is insoluble in water but the pure chemical is, then the solid is mixed into a large quantity of warm water, and the water (with the chemical dissolved in it) is saved. The undissolved impurities (dregs) are discarded. When the water is boiled off it leaves a precipitate of the desired material. If the desired chemical is not water soluble and the impurity is, then the same basic procedure is followed, but in this case the dregs are saved and the liquid discarded.

Nitric acid (HNO₃)

There are several ways to make this most essential of all acids for explosives. It is often produced by the oxidation of ammonia per the following formula:



If the chemist has sodium and potassium nitrate available, they can be used to convert the much less useful sulfuric acid. While this method can be used to produce nitric acid, the process is extremely hazardous, and it should not be carried out unless there is no other way to obtain nitric acid. Do not attempt this on a larger scale without the use of remote manipulation equipment.

Materials

potassium nitrate	ice bath	stirring rod
conc sulfuric acid	distilled water	retort
collecting flask with stopper	retort (300ml)	heat source
sodium nitrate	mortar and pestle	

1) Carefully pour 100 milliliters of concentrated sulfuric acid into the retort.

2) Weigh out exactly 185 grams of sodium nitrate, or 210 grams of potassium nitrate. Crush to a fine powder in a clean, dry mortar and pestle, then slowly add this powder to the retort of sulfuric acid. If all of the powder does not dissolve, carefully stir the solution with a glass rod until the powder is completely dissolved.

3) Place the open end of the retort into the collecting flask, and place the collecting flask in the ice bath.

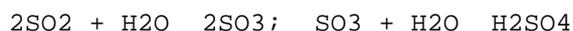
4) Begin heating the retort, using low heat. Continue heating until liquid begins to come out of the end of the retort. The liquid that forms is nitric acid. Heat until the precipitate in the bottom of the retort is almost dry, or until no more nitric acid forms.

CAUTION

If the acid is heated too strongly, the nitric acid will decompose as soon as it is formed. This can result in the production of highly flammable and toxic gasses that may explode. It is a good idea to set the above apparatus up, and then get away from it.

Sulfuric Acid (H₂SO₄)

There are two common processes used to make sulfuric acid, unfortunately neither of them is suitable for small scale production outside of a laboratory or industrial plant. The Contact Process utilizes Sulfur Dioxide (SO₂), an intensely irritating gas.



The Chamber Process uses nitric oxide and nitrogen dioxide. On contact with air, nitric oxide forms nitrogen dioxide, a deadly reddish brown gas. The reaction used for production is as follows:



Sulfuric acid is far too difficult to make outside of a laboratory or industrial plant. However, it is readily available as it is a major component of lead-acid batteries. The sulfuric acid could be poured off from a new battery, or purchased from a battery shop or motorcycle store. If the acid is removed from a battery there will be pieces of lead from the battery which must be removed, either by boiling and filtration. The concentration of the sulfuric acid can also be increased by boiling it or otherwise removing some of the water from the solution. Very pure sulfuric acid pours slightly faster than clean motor oil.

Ammonium Nitrate

Ammonium nitrate is a very powerful but insensitive high explosive. It could be made very easily by pouring nitric acid into a large flask in an ice bath. Then, by simply pour household ammonia into the flask and keep a safe distance away until the reaction has completed. After the materials have stopped reacting, one simply has to leave the solution in a warm dry place until all of the water and any neutralized ammonia or acid have evaporated. Finely powdered crystals of ammonium nitrate would remain. These must be kept in an airtight container, because of their tendency to pick up water from the air. The crystals formed in the above process would have to be heated very gently to drive off the remaining water before they can be used.

Potassium Nitrate

Potassium nitrate can be obtained from black powder. Simply stir a quantity of black powder into boiling water. The sulfur and charcoal will be suspended in the water, but the potassium nitrate will dissolve. To obtain 68g of potassium nitrate, it would be necessary to dissolve about 90g of black powder in about one liter of boiling water.

Filter the dissolved solution through filter paper until the liquid that pours through is clear. The charcoal and sulfur in black powder are insoluble in water, and so when the solution is allowed to evaporate, small crystals of potassium nitrate will be left in the container.

:EXPLOSIVE FORMULAS

Once again, persons reading this material should never attempt to produce any of the explosives described here. It is illegal and extremely dangerous to do so. Loss of life and limbs could easily result from a failed (or successful) attempt to produce any explosives or hazardous chemicals.

These procedures are correct, however many of the methods given here are usually scaled down industrial procedures, and therefore may be better suited to large scale production.

Explosive Theory

An explosive is any material that, when ignited by heat, shock, or chemical reaction, undergoes rapid decomposition or oxidation. This process releases energy that is stored in the material. The energy, in the form of heat and light, is released when the material breaks down into gaseous compounds that occupy a much larger volume than the explosive did originally. Because this expansion is very rapid, the expanding gasses displace large volumes of air. This expansion often occurs at a speed greater than the speed of sound, creating a shockwave similar to the sonic boom produced by high-speed jet planes.

Explosives occur in several forms: high order explosives (detonating explosives), low order explosives (deflagrating explosives), primers, and some explosives which can progress from deflagrating to detonation. All high order explosives are capable of detonation. Some high order explosives may start out burning (deflagration) and progress to detonation. A detonation can only occur in a high order explosive.

Detonation is caused by a shockwave that passes through a block of the high explosive material. High explosives consist of molecules with many high-energy bonds. The shockwave breaks apart the molecular bonds between the atoms of the material, at a rate approximately equal to the speed of sound traveling through that substance. Because high explosives are generally solids or liquids, this speed can be much greater than the speed of sound in air.

Unlike low-explosives, the fuel and oxidizer in a high-explosive are chemically bonded, and this bond is usually too strong to be easily broken. Usually a primer made from a sensitive high explosive is used to initiate the detonation. When the primer detonates it sends a shockwave through the high-explosive. This shockwave breaks apart the bonds, and the chemicals released recombine to produce mostly gasses. Some examples of high explosives are dynamite, ammonium nitrate, and RDX.

Low order explosives do not detonate. Instead they burn (undergo oxidation) at a very high rate. When heated, the fuel and oxidizer combine to produce heat, light, and gaseous products.

Some low order materials burn at about the same speed under pressure as they do in the open, such as blackpowder. Others, such as smokeless gunpowder (which is primarily nitrocellulose) burn much faster and hotter when they are in a confined space, such as the barrel of a firearm; they usually burn much slower than blackpowder when they are ignited in the open. Blackpowder, nitrocellulose, and flash powder are common examples of low order explosives.

Primers are the most dangerous explosive compounds in common use. Some of them, such as mercury fulminate, will function as a low or high order explosive. They are chosen because they are more sensitive to friction, heat, and shock, than commonly used high or low explosives. Most primers perform like a dangerously sensitive high explosive. Others merely burn, but when they are confined, they burn at a very high rate and with a large expansion of gasses that produces a shockwave. A small amount of a priming material is used to initiate, or cause to decompose, a large quantity of

relatively insensitive high explosives. They are also frequently used as a reliable means of igniting low order explosives. The gunpowder in a bullet is ignited by the detonation of the primer.

Blasting caps are similar to primers, but they usually include both a primer and some intermediate explosive. Compounds used as primers can include lead azide, lead styphnate, diazodinitrophenol or mixtures of two or more of them. A small charge of PETN, RDX, or pentolite may be included in the more powerful blasting caps, such as those used in grenades. The small charge of moderately-sensitive high explosive initiates a much larger charge of insensitive high explosive.

Impact Explosives

Impact explosives are often used as primers. Of the ones discussed here, only mercury fulminate and nitroglycerine are real explosives; Ammonium triiodide crystals decompose upon impact, but they release little heat and no light. Impact explosives are always treated with the greatest care, and nobody without an extreme death wish would store them near any high or low explosives.

Ammonium triiodide crystals (nitrogen triiodide)

Ammonium triiodide crystals are foul smelling purple colored crystals that decompose under the slightest amount of heat, friction, or shock, if they are made with the purest ammonia (ammonium hydroxide) and iodine. Such crystals are so sensitive that they will decompose when a fly lands on them, or when an ant walks across them. Household ammonia, however, has enough impurities, such as soaps and abrasive agents, so that the crystals will detonate only when thrown, crushed, or heated.

The ammonia available in stores comes in a variety of forms. The pine and cloudy ammonia should not be used; only the strong clear ammonia can be used to make ammonium triiodide crystals. Upon detonation, a loud report is heard, and a cloud of purple iodine gas will appear. Whatever the unfortunate surface that the crystal was detonated upon, it will probably be ruined, as some of the iodine in the crystal is thrown about in a solid form, and iodine is corrosive. It leaves nasty, ugly, brownish-purple stains on whatever it contacts. These stains can be removed with photographer's hypo solution, or with the dechlorinating compound sold for use in fish tanks.

Iodine fumes are also bad news, since they can damage your lungs, and they will settle to the ground, leaving stains there as well. Contact with iodine leaves brown stains on the skin that last for about a week, unless they are immediately and vigorously washed off.

Ammonium triiodide crystals could be produced in the following manner:

Materials

iodine crystals funnel filter paperglass stirring rod
paper towels clear ammoniatwo glass jarspotassium iodide

1) Place 5 grams of iodine into one of the glass jars. Because the iodine is very difficult to remove, use jars that you don't want to save.

2) Add enough ammonia to completely cover the iodine. Stir several times, then add 5 grams of potassium iodide. Stir for 30 seconds.

3) Place the funnel into the other jar, and put the filter paper in the funnel. The technique for putting filter paper in a funnel is taught in

every basic chemistry lab class: fold the circular paper in half, so that a semicircle is formed. Then, fold it in half again to form a triangle with one curved side. Pull one thickness of paper out to form a cone, and place the cone into the funnel.

4) After allowing the iodine to soak in the ammonia for a while, pour the solution into the paper in the funnel through the filter paper.

5) While the solution is being filtered, put more ammonia into the first jar to wash any remaining crystals into the funnel as soon as it drains.

6) Collect all the crystals without touching the brown filter paper, and place them on the paper towels to dry. Make sure that they are not too close to any lights or other sources of heat, as they could well detonate. While they are still wet, divide the wet material into small pieces as large as your thumbnail.

To use them, simply throw them against any surface or place them where they will be stepped on or crushed. When the crystals are disturbed they decompose into iodine vapor, nitrogen, and ammonia.



iodine + ammonium hydroxide ammonium iodide + ammonium nitrogen triiodide
+ water

The optimal yield from pure iodine is 54% of the original mass in the form of the explosive sediment. The remainder of the iodine remains in the solution of ammonium iodide, and can be extracted by extracting the water (vacuum distillation is an efficient method) and treating the remaining product with chlorine.

Mercury Fulminate

Mercury fulminate is perhaps one of the oldest known initiating compounds. It can be detonated by either heat or shock. Even the action of dropping a crystal of the fulminate can cause it to explode. This material can be produced through the following procedure:

MATERIALS

5 g mercury	glass stirring rod	blue litmus paper
35 ml conc nitric acid	filter paper	small funnel
100 ml beaker (2)	acid resistant gloves	heat source
30 ml ethyl alcohol	distilled water	

Solvent alcohol must be at least 95% ethyl alcohol if it is used to make mercury fulminate. Methyl alcohol may prevent mercury fulminate from forming.

Mercury thermometers are becoming a rarity, unfortunately. They may be hard to find in most stores as they have been superseded by alcohol and other less toxic fillings. Mercury is also used in mercury switches, which are available at electronics stores. Mercury is a hazardous substance, and should be kept in the thermometer, mercury switch, or other container until used. At room temperature mercury vapor is evolved, and it can be absorbed through the skin. Once in your body mercury will cause damage to the brain and other organs. For this reason, it is a good idea not to spill mercury, and to always use it outdoors. Also, do not get it in an open cut; rubber gloves will help prevent this.

1) In one beaker, mix 5 g of mercury with 35 ml of concentrated nitric acid, using the glass rod.

2) Slowly heat the mixture until the mercury is dissolved, which is when the solution turns green and boils.

3) Place 30 ml of ethyl alcohol into the second beaker, and slowly and carefully add all of the contents of the first beaker to it. Red and/or brown fumes should appear. These fumes are toxic and flammable.

4) between thirty and forty minutes after the fumes first appear, they should turn white, indicating that the reaction is near completion. After ten more minutes, add 30 ml distilled water to the solution.

5) Carefully filter out the crystals of mercury fulminate from the liquid solution. Dispose of the solution in a safe place, as it is corrosive and toxic.

6) Wash the crystals several times in distilled water to remove as much excess acid as possible. Test the crystals with the litmus paper until they are neutral. This will be when the litmus paper stays blue when it touches the wet crystals.

7) Allow the crystals to dry, and store them in a safe place, far away from any explosive or flammable material.

This procedure can also be done by volume, if the available mercury cannot be weighed. Simply use 10 volumes of nitric acid and 10 volumes of ethanol to every one volume of mercury.

Nitroglycerin (C₃H₅N₃O₉)

Nitroglycerin is one of the most sensitive explosives ever to be commercially produced. It is a very dense liquid, and is sensitive to heat, impact, and many organic materials. Although it is not water soluble, it will dissolve in 4 parts of pure ethyl alcohol.

Heat of Combustion: 1580 cal/g

Products of Explosion: Carbon Dioxide, Water, Nitrogen, Oxygen

Human Toxicity: Highly toxic vasodilator, avoid skin contact!

Although it is possible to make it safely, it is difficult to do so in small quantities. Many a young pyrotechnician has been killed or seriously injured while trying to make the stuff. When Nobel's factories make it, many people were killed by the all-to-frequent factory explosions. Usually, as soon as nitroglycerin is made, it is converted into a safer substance, such as dynamite. A person foolish enough to make nitroglycerine could use the following procedure:

EQUIPMENT

distilled water	eyedropper	thermometer
1 100 ml beaker	20 g sodium bicarbonate	glycerine
3 300 ml beakers	13 ml concentrated nitric acid	
blue litmus paper	39 ml concentrated sulfuric acid	

2 ice baths:

2 small non-metallic containers each filled halfway with:
crushed ice
6 tablespoons table salt

The salt will lower the freezing point of the water, increasing the cooling efficiency of the ice bath.

1) Prepare the two ice baths. While the ice baths are cooling, pour 150 ml of distilled water into each of the beakers.

2) Slowly add sodium bicarbonate to the second beaker, stirring constantly. Do not add too much sodium bicarbonate to the water. If some remains undissolved, pour the solution into a fresh beaker.

3) Place the 100 ml beaker into the ice bath, and pour the 13 ml of concentrated nitric acid into the 100 ml beaker. Be sure that the beaker will not spill into the ice bath, and that the ice bath will not overflow into the beaker when more materials are added to it. Be sure to have a large enough container to add more ice if it gets too warm. Bring the temperature of the acid down to 20° centigrade or less.

4) Slowly and carefully add 39 ml of concentrated sulfuric acid to the nitric acid. Mix well, then cool the mixture to 10° centigrade. Do not be alarmed if the temperature rises slightly when the acids are mixed.

5) With the eyedropper, slowly drip the glycerine onto the acid mixture, one drop at a time. Hold the thermometer along the top of the mixture where the mixed acids and glycerine meet.

The glycerine will start to nitrate immediately, and the temperature will immediately begin to rise. Do not allow the temperature to rise above 30° celsius. If the temperature is allowed to get too high, the nitroglycerin may decompose spontaneously as it is formed. Add glycerine until there is a thin layer of glycerine on top of the mixed acids.

6) Stir the mixture for the first ten minutes of nitration, if necessary adding ice and salt to the ice bath to keep the temperature of the solution in the 100 ml beaker well below 30°. The nitroglycerine will form on the top of the mixed acid solution, and the concentrated sulfuric acid will absorb the water produced by the reaction.

7) When the reaction is over, the nitroglycerine should be chilled to below 25°. You can now slowly and carefully pour the solution of nitroglycerine and mixed acid into the beaker of distilled water in the beaker. The nitroglycerine should settle to the bottom of the beaker, and the water-acid solution on top can be poured off and disposed of. Drain as much of the acid-water solution as possible without disturbing the nitroglycerine.

8) Carefully remove a small quantity of nitroglycerine with a clean eye-dropper, and place it into the beaker filled in step 2. The sodium bicarbonate solution will eliminate much of the acid, which will make the nitroglycerine less likely to spontaneously explode. Test the nitroglycerine with the litmus paper until the litmus stays blue. Repeat this step if necessary, using new sodium bicarbonate solutions each time.

9) When the nitroglycerine is as acid-free as possible, store it in a clean container in a safe place. The best place to store nitroglycerine is far away as possible from anything of value. Nitroglycerine can explode for no apparent reason, even if it is stored in a secure cool place.

Picrates

Although the procedure for the production of picric acid, or trinitrophenol has not yet been given, its salts are described first, since they are extremely sensitive, and detonate on impact.

By mixing picric acid with a warm solution of a metal hydroxide, such as sodium or potassium hydroxide, metal picrates are formed. These picrates are easily soluble in warm water, (potassium picrate will dissolve in 4 parts water at 100° C), but relatively insoluble in cold water (potassium picrate will dissolve in 200 parts water at 10° C). While many of these picrates are dangerously impact sensitive, others are almost safe enough for a suicidal person to consider their manufacture.

To convert picric acid into potassium picrate, you first need to obtain picric acid, or produce it by following the instructions given on page 26. If the acid is in solid form it should be mixed with 10% water (by weight).

Prepare a moderately strong (6 mole) solution of potassium hydroxide, and heat it until it almost reaches a slow boil. Lower the temperature 10 degrees, and slowly add the picric acid solution. At first the mixture should bubble strongly, releasing carbon dioxide. when the bubbles cease stop adding picric acid. Cool the solution to 10° C. Potassium picrate will crystallize out. The solution should be properly disposed of.

These crystals are impact-sensitive, and can be used as an initiator for any type of high explosive. The crystals should be stored in a plastic or glass container under distilled water.

Low Order Explosives

Low order explosives can be defined as a single compound or mixture of compounds which burns at a high rate producing a large amount of gas, which is usually accompanied by heat and light. Most have the following components.

An oxidizer: This can be any chemical which contains a large amount of oxygen. When heated the oxidizer gives up this oxygen.

A fuel: The fuel is often carbon, or a finely powdered metal. It is the material that does the actual burning.

A catalyst: The catalyst makes it easier for the oxidizer to react with the fuel, and is mandatory for many of the less powerful explosives. Not all low explosives need a catalyst, and in many cases (such as flash powder) adding a catalyst can make the explosive dangerously sensitive.

There are many low-order explosives that can be purchased in gun stores and used in explosive devices. However, it is possible that a wise store owner would not sell these substances to a suspicious-looking individual. Such an individual would then be forced to resort to making his own low-order explosives.

There are many common materials which can be used to produce low explosives. With a strong enough container, almost any mixture of an oxidizer and a fuel can be used to make an explosive device.

Black Powder

First made by the Chinese for use in fireworks, black powder was first used in weapons and explosives in the 12th century. It is very simple to make, but it is not very powerful or safe. Only about half the mass of black powder is converted to hot gasses when it is burned; the other half is released as very fine burned particles. Black powder has one major danger: it can be ignited by static electricity. This is very hazardous,

and it means that the material must be made with wooden or clay tools to avoid generating a static charge.

MATERIALS

75 g potassium nitrate	distilled water
charcoal	wooden salad bowl
10 g sulfur	wooden spoon
heat source	breathing filter
grinding bowl	3 plastic bags
500 ml beaker	fine mesh screen

1) Place a small amount of the potassium or sodium nitrate in the grinding bowl and grind it to a very fine powder. Grind all of the potassium or sodium nitrate, and pass it through the screen to remove any large particles. Store the sifted powder in one of the plastic bags.

2) Repeat step one with the sulfur and charcoal, being careful to grind each chemical with a clean bowl and tool. store each chemical in a separate plastic bag.

3) Place all of the finely ground potassium or sodium nitrate in the beaker, and add just enough boiling water to the chemical to moisten it uniformly.

4) Add the contents of the other plastic bags to the wet potassium or sodium nitrate, and mix them well for several minutes. Do this until there is no more visible sulfur or charcoal, or until the mixture is universally black.

5) On a warm sunny day, put the beaker outside in the direct sunlight. Sunlight is really the best way to dry black powder, since it is seldom too hot, but it is usually hot enough to evaporate the water.

6) Using a wooden tool, scrape the black powder out of the beaker, and store it in a safe container. Static proof plastic is really the safest container, followed by paper. Never store black powder in a plastic bag, since plastic bags are prone to generate static electricity. If a small packet of desiccant is added the powder will remain effective indefinitely.

Nitrocellulose

Nitrocellulose is commonly called "gunpowder" or "guncotton". It is more stable than black powder, and it produces a much greater volume of hot gas. It also burns much faster than black powder when in a confined space.

Although the acids used can be very dangerous if safety precautions are not followed, nitrocellulose is fairly easy to make, as outlined by the following procedure:

MATERIALS

cotton (cellulose)	(2) 300 ml beakers
small funnel	blue litmus paper
concentrated nitric acid	concentrated sulfuric acid
distilled water	glass rod

1) Pour 10 cc of concentrated sulfuric acid into the beaker. Add to this 10 cc of concentrated nitric acid.

2) Immediately add 0.5 gm of cotton, and allow it to soak for exactly

3 minutes.

3) Remove the nitrated cotton, and transfer it to a beaker of distilled water to wash it in.

4) Allow the material to dry, and then re-wash it.

5) After the cotton is neutral when tested with litmus paper, it is ready to be dried and stored.

One common formula specifies 3 parts sulfuric acid to one part nitric acid. This has not been demonstrated to be more effective than equal volumes of each. Runaway nitration is commonplace, but it is usually not disastrous. It has been suggested that pre-washing the cotton cloth in a solution of lye, and rinsing it well in distilled water before nitrating can help prevent runaway nitration. If the reaction appears to be more vigorous than expected, water will quench the runaway reaction of cellulose.

WARNINGS

All the usual warnings about strong acids apply. H₂SO₄ has a tendency to spatter. When it falls on the skin, it destroys tissue very painfully. It dissolves all manner of clothing. Nitric also damages skin, turning it bright yellow in the process of eating away at your flesh. Nitric acid is a potent oxidizer and it can start fires. Most strong acids will happily blind you if you get them in your eyes, and these are no exception.

Nitrocellulose decomposes very slowly on storage if isn't correctly stabilized. The decomposition is auto-catalyzing, and can result in spontaneous explosion if the material is kept confined over time. The process is much faster if the material is not washed well enough. Nitrocellulose powders contain stabilizers such as diphenyl amine or ethyl centralite. Do not allow these to come into contact with nitric acid! A small amount of either substance added to the washed product will capture the small amounts of nitrogen oxides that result from decomposition. They therefore inhibit the autocatalysis. NC eventually will decompose in any case.

Commercially produced Nitrocellulose is stabilized by spinning it in a large centrifuge to remove the remaining acid, which is recycled. It is then boiled in acidulated water and washing thoroughly with fresh water. If the NC is to be used as smokeless powder it is boiled in a soda solution, then rinsed in fresh water.

The purer the acid used (lower water content) the more complete the nitration will be, and the more powerful the nitrocellulose produced. There are actually three forms of cellulose nitrate, only one of which is useful for pyrotechnic purposes. The mononitrate and dinitrate are not explosive, and are produced by incomplete nitration. The explosive trinitrate is only formed when the nitration is allowed to proceed to completion.

Perchlorates

As a rule, any oxidizable material that is treated with perchloric acid will become a low order explosive. Metals, however, such as potassium or sodium, become excellent bases for flash type powders. Some materials that can be perchlorated are cotton, paper, and sawdust. To produce potassium or sodium perchlorate, simply acquire the hydroxide of that metal, e.g. sodium or potassium hydroxide.

It is a good idea to test the material to be treated with a very small amount of acid, since some of the materials tend to react explosively when contacted by picric acid. Solutions of sodium or potassium hydroxide are ideal. Perchlorates are much safer than similar chlorates, and equally as

powerful. Mixtures made with perchlorates are somewhat more difficult to ignite than mixtures containing chlorates, but the increased safety outweighs this minor inconvenience.

Flash Powder

Flash powder is a fast, powerful explosive, and comes very close to many high explosives. It is a very hazardous mixture to work with, due to the sensitivity of the powder. It is extremely sensitive to heat or sparks, and should never be mixed with other chemicals or black powder. It burns very rapidly with a intense white flash, and will explode if confined. Large quantities may explode even when not confined. This is because a large pile of flash powder is self-confining, causing the explosion. Flash powder is commonly made with aluminum and/or magnesium. Other metals can be used, but most others are either too expensive (zirconium) or not reactive enough to be effective (zinc)

Here are a few basic precautions to take if you're crazy enough to produce your own flash powder:

1) Grind the oxidizer (KNO_3 , KClO_3 , KMnO_4 , KClO_4 etc) separately in a clean container. If a mortar and pestle is used, it should be washed out with alcohol before being used to grind any other materials.

2) NEVER grind or sift the mixed composition. Grinding and sifting can cause friction or static electricity.

3) Mix the powders on a large sheet of paper, by rolling the composition back and forth. This technique is described in detail on page 3

4) Do not store flash compositions for any amount of time. Many compounds, especially ones containing magnesium, will decompose over time and may ignite spontaneously.

5) Make very small quantities at first, so you can appreciate the power of such mixtures. Quantities greater than 10 grams should be avoided. Most flash powders are capable of exploding if a quantity of more than 50 grams is ignited unconfined, and all flash powders will explode even with minimal confinement (I have seen 10 g of flash wrapped in a single layer of waxed paper explode)

6) Make sure that all the components of the mixture are as dry as possible. Check the melting point of the substances, and dry them (separately) in a warm oven. If KNO_3 is used it must be very pure and dry, or it will evolve ammonia fumes.

Almost any potent oxidizer can be used for flash powder. Some materials may react with the fuel, especially if magnesium is used. KClO_4 with Al is generally found in commercial fireworks, this does not mean that it is safe, but it is safer than KClO_3 if handled correctly.

The finer the oxidizer and the finer the metal powder the more powerful the explosive, except in the case of aluminum. This of course will also increase the sensitivity of the flash powder. Beyond a certain point, the finer the aluminum powder the less powerful the explosive, due to the coating of aluminum oxide which forms on the surface of the aluminum granules.

NOTE: Flash powder in any container will detonate. This includes even a couple of layers of newspaper, or other forms of loosely confined flash. Potassium perchlorate is safer than sodium/potassium chlorate.

High Order Explosives

High order explosives can be made in the home without too much difficulty. The main problem is acquiring the nitric acid to produce the high explosive. Most high explosives detonate because their molecular structure is made up of some fuel and usually three or more nitrogen dioxide molecules. Trinitrotoluene is an excellent example of such a material. When a shock wave passes through a molecule of T.N.T., the nitrogen dioxide bond is broken, and the oxygen combines with the fuel, all in a matter of microseconds. This accounts for the great power of nitrogen-based explosives. Remembering that these procedures are never to be carried out, several methods of manufacturing high-order explosives in the home are listed.

R.D.X.

R.D.X., (also called cyclonite, or composition C-1 when mixed with plasticisers) is one of the most valuable of all military explosives. This is because it has more than 150% of the power of T.N.T., and is much easier to detonate. It should not be used alone, since it can be set off by a moderate shock. It is less sensitive than mercury fulminate or nitroglycerine, but it is still too sensitive to be used alone.

R.D.X. can be produced by the method given below. It is much easier to make in the home than all other high explosives, with the possible exception of ammonium nitrate.

MATERIALS

hexamine or methenamine	1000 ml beaker	ice bath
glass stirring rod	thermometer	funnel
filter paper	distilled water	ammonium nitrate
nitric acid (550 ml)	blue litmus paper	small ice bath

1) Place the beaker in the ice bath, (see page 15) and carefully pour 550 ml of concentrated nitric acid into the beaker.

2) When the acid has cooled to below 20°, add small amounts of the crushed fuel tablets to the beaker. The temperature will rise, and it must be kept below 30°, or dire consequences could result. Stir the mixture.

3) Drop the temperature below zero degrees celsius, either by adding more ice and salt to the old ice bath, or by creating a new ice bath. Continue stirring the mixture, keeping the temperature below zero for twenty minutes.

4) Pour the mixture into 1 liter of crushed ice. Shake and stir the mixture, and allow it to melt. Once it has melted, filter out the crystals, and dispose of the corrosive liquid.

5) Place the crystals into one half a liter of boiling distilled water. Filter the crystals, and test them with the blue litmus paper. Repeat steps 4 and 5 until the litmus paper remains blue. This will make the crystals more stable and safe.

6) Store the crystals wet until ready for use. Allow them to dry completely before using them. R.D.X. is not stable enough to use alone as an explosive.

Composition C-1 can be made by mixing (measure by weight)

R.D.X. 88%
mineral oil 11%
lecithin 1%

Knead these material together in a plastic bag. This is one way to desensitize the explosive.

HMX. is a mixture of TNT and RDX; the ratio is 50/50, by weight. it is not as sensitive as unadulterated RDX and it is almost as powerful as straight RDX.

By adding ammonium nitrate to the crystals of RDX produced in step 5, it is possible to desensitize the R.D.X. and increase its power, since ammonium nitrate is very insensitive and powerful. Sodium or potassium nitrate could also be added; a small quantity is sufficient to stabilize the RDX.

RDX. detonates at a rate of 8550 meters/second when it is compressed to a density of 1.55 g/cubic cm.

Ammonium Nitrate (NH₄NO₃)

Ammonium nitrate can be made by following the method given on page 10, or it could be obtained from a construction site, since it is commonly used in blasting, because it is very stable and insensitive to shock and heat. A well-funded researcher could also buy numerous "Instant Cold-Paks" from a drug store or medical supply store. The major disadvantage with ammonium nitrate, from a pyrotechnical point of view, is detonating it. A rather powerful priming charge must be used, or a booster charge must be added.

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

The primer explodes, detonating the T.N.T., which detonates, sending a tremendous shockwave through the ammonium nitrate, detonating it.

Ammonium Nitrate - Fuel Oil Solution

Ammonium Nitrate - Fuel Oil Solution, also known as ANFO, is a commonly used high explosive. ANFO solves one of the major problem with ammonium nitrate: its tendency to pick up water vapor from the air. This absorption results in the explosive failing to detonate when fired. This is less of a problem with ANFO because it consists of 94% (by weight) ammonium nitrate mixed with 6% fuel oil (kerosene). The kerosene helps keep the ammonium nitrate from absorbing moisture from the air.

This mixture, like straight ammonium nitrate, is very insensitive to shock. It requires a very powerful shockwave to detonate it, and is not very effective in small quantities. Usually a booster charge, consisting of dynamite or a commercial cast charge, is used for reliable detonation. Some commercial ANFO explosives have a small amount of aluminum added, increasing the power and sensitivity. These forms can often be reliably initiated by a No. 8 blasting cap.

These disadvantages are outweighed by two important advantages of ammonium nitrate explosives- cost, and safety. In industrial blasting these factors are much more important than in recreational activities, and this has contributed to the popularity of these explosives. If the explosive is initiated without confinement it not propagate well, and most of the ammonium nitrate will burn and scatter, rather than detonation as most other high explosives would.

Ammonium nitrate explosives are much cheaper per pound than most other explosives, with the price per pound at about 1/10 that of dynamite.

Straight ammonium nitrate can be transported to the blasting site without the extra expenses incurred when transporting high explosives. At the site, the ammonium nitrate, in the form of small pellets, or prills, can be mixed with the fuel oil just prior to blasting.

If too much oil is added the power of the mixture will decrease, because the extra oil will absorb some of the energy from the ammonium nitrate, and it tends to slow propagation. If commercial fertilizer is used to provide the ammonium nitrate, it must be crushed to be effective. This is because fertilizer grade ammonium nitrate is coated with a water resistant substance which helps keep moisture from decomposing the material. This material also keeps the fuel oil from soaking into the ammonium nitrate.

If fertilizer grade material is poured into a vat of warm, liquified wax, the coating will be displaced by the wax, which can also serve as fuel for the ammonium nitrate. This form is more sensitive than the fuel oil mixture, and does not require as much confinement as ANFO.

Trinitrotoluene

T.N.T., or 2,4,6 trinitrotoluene, is perhaps the second oldest known high explosive. Dynamite, of course, was the first. T.N.T. is certainly the best known high explosive, since it has been popularized by early morning cartoons, and because it is used as a standard for comparing other explosives.

In industrial production TNT is made by a three step nitration process that is designed to conserve the nitric and sulfuric acids, so that the only resource consumed in quantity is the toluene. A person with limited funds, however, should probably opt for the less economical two step method. This process is performed by treating toluene with very strong (fuming) sulfuric acid. Then, the sulfated toluene is treated with very strong (fuming) nitric acid in an ice bath. Cold water is added to the solution, and the T.N.T. is filtered out.

Potassium Chlorate (KClO₃)

Potassium chlorate itself cannot be made in the home, but it can be obtained from labs and chemical supply houses. It is moderately water soluble, and will explode if brought into contact with sulfuric acid. It is toxic and should not be brought into contact with organic matter, including human skin.

If potassium chlorate is mixed with a small amount of vaseline, or other petroleum jelly, and a shockwave is passed through it, the material will detonate, however it is not very powerful, and it must be confined to explode it in this manner. The procedure for making such an explosive is outlined below:

MATERIALS

potassium chlorate	zip-lock plastic bag	wooden spoon
petroleum jelly	grinding bowl	wooden bowl

1) Grind the potassium chlorate in the grinding bowl carefully and slowly, until the potassium chlorate is a very fine powder. The finer the powder, the faster it will detonate, but it will also decompose more quickly.

2) Place the powder into the plastic bag. Put the petroleum jelly into the plastic bag, getting as little on the sides of the bag as possible, i.e. put the vaseline on the potassium chlorate powder.

3) Close the bag, and knead the materials together until none of the

potassium chlorate is dry powder that does not stick to the main glob. If necessary, add a bit more petroleum jelly to the bag.

Over time the this material will decompose, and if not used immediately the strength will be greatly reduced.

Dynamite (various compositions)

The name dynamite comes from the Greek word "dynamis", meaning power. Dynamite was invented by Nobel shortly after he made nitroglycerine. He tried soaking the nitroglycerine into many materials, in an effort to reduce its sensitivity. In the process, he discovered that Nitrocellulose would explode if brought into contact with fats or oils. A misguided individual with some sanity would, after making nitroglycerine would immediately convert it to dynamite. This can be done by adding one of a number of inert materials, such as sawdust, to the raw nitroglycerine. The sawdust holds a large weight of nitroglycerine. Other materials, such as ammonium nitrate could be added, and they would tend to desensitize the explosive, while increasing the power. But even these nitroglycerine compounds are not really safe.

One way to reliably stabilize nitroglycerin is to freeze it. In its frozen state, nitroglycerine is much less sensitive to shock, and can safely be transported. The only drawback to this method is that the nitroglycerine may explode spontaneously while being thawed.

Nitrostarch Explosives

Nitrostarch explosives are simple to make, and are fairly powerful. All that need be done is treat any of a number of starches with a mixture of concentrated nitric and sulfuric acids. Nitrostarch explosives are of slightly lower power than T.N.T., but they are more readily detonated.

MATERIALS

filter paper
pyrex container (100 ml)
distilled water
glass rod
20 ml concentrated sulfuric acid
acid-resistant gloves
1 g starch
20 ml concentrated nitric acid

1) Add concentrated sulfuric acid to an equal volume of concentrated nitric acid in the pyrex container. Watch out for splattering acid.

2) Add 1 gram of starch of starch to the mixture, stirring constantly with the glass rod.

3) Carefully add cold water to dilute the acids, then pour the mixture through the filter paper (see page 13). The residue consists of nitrostarch with a small amount of acid, and should be washed under cold distilled water.

Picric Acid (C₆H₃N₃O₇)

Picric acid, or 2,4,6-trinitrophenol is a sensitive compound that can be used as a booster charge for moderately insensitive explosives, such as T.N.T. It is seldom used for explosives anymore, but it still has applications in many industries, including leather production, copper etching, and textiles. Picric acid is usually shipped mixed with 20% water for safety, and when dried it forms pale yellow crystals.

In small quantities picric acid deflagrates, but large crystals or moderate quantities of powdered picric acid will detonate with sufficient force to initiate high explosives (or remove the experimenter's fingers). Picric acid, along with all of it's salts, is very dangerous, and should

never be stored dry or in a metal container. Contact with bare skin should be avoided, and ingestion is often fatal.

Picric acid is fairly simple to make, assuming that one can acquire sulfuric and nitric acid in the required concentration. Simple procedures for its manufacture are given in many college chemistry lab manuals. The main problem with picric acid is its tendency to form dangerously sensitive and unstable picrate salts. While some of these salts, such as potassium picrate are stable enough to be useful, salts formed with other metals can be extremely unstable. For this reason, it is usually made into a safer form, such as ammonium picrate, also called explosive D. A procedure for the production of picric acid is given below.

MATERIALS

variable heat source	ice bath	distilled water
38 ml concentrated nitric acid	filter paper	500 ml flask
concentrated sulfuric acid (12.5 ml)	funnel	10g phenol
	1 L pyrex beaker	glass rod

1) Place 9.5 grams of phenol into the 500 ml flask, and carefully add 12.5 ml of concentrated sulfuric acid and stir the mixture.

2) Put 400 ml of tap water into the 1000 ml beaker or boiling container and bring the water to a gentle boil.

3) After warming the 500 ml flask under hot tap water, place it in the boiling water, and continue to stir the mixture of phenol and acid for about thirty minutes. After thirty minutes, take the flask out, and allow it to cool for seven minutes.

4) After allowing the flask to cool for 10 minutes. Place the 500 ml flask with the mixed acid and phenol in the ice bath. Add 38 ml of concentrated nitric acid in small amounts, stirring the mixture constantly. A vigorous reaction should occur. When the reaction slows, take the flask out of the ice bath.

5) Warm the ice bath container, if it is glass, and then begin boiling more tap water. Place the flask containing the mixture in the boiling water, and heat it in the boiling water for 1.5 to 2 hours.

6) Add 100 ml of cold distilled water to the solution, and chill it in an ice bath until it is cold.

7) Filter out the yellowish-white picric acid crystals by pouring the solution through the filter paper in the funnel. Collect the liquid and dispose of it in a safe place, since it is highly corrosive.

8) Wash out the 500 ml flask with distilled water, and put the contents of the filter paper in the flask. Add 300 ml of water, and shake vigorously.

9) Re-filter the crystals, and allow them to dry.

10) Store the crystals in a safe place in a glass container, since they will react with metal containers to produce picrates that could explode spontaneously.

Ammonium Picrate ($C_6H_2(OH)_4(NO_2)_3$)

Ammonium picrate, also called ammonium piconitrate, Explosive D, or carbazate, is a common safety explosive which can be produced from picric acid. It requires a substantial shock to cause it to detonate, slightly less

than that required to detonate ammonium nitrate. In many ways it is much safer than picric acid, since it does not have the tendency to form hazardous unstable salts when placed in metal containers. It is simple to make from picric acid and clear household ammonia. All that need be done is to dissolve picric acid crystals by placing them in a glass container and adding 15 parts hot, steaming distilled water. Add clear ammonia in excess, and allow the excess ammonia to evaporate. The powder remaining should be ammonium picrate. The water should not be heated, as ammonium picrate is sensitive to heat. Vacuum distillation and open evaporation are relatively safe ways to extract the picrate.

Ammonium picrate most commonly appears as bright yellow crystals, and is soluble in water. These crystals should be treated with the care due to all shock sensitive materials. Some illegal salutes have been found to contain ammonium picrate, which makes them much more hazardous.

Nitrogen Chloride (NCl₃)

Nitrogen chloride, also known as nitrogen trichloride, chlorine nitride, or Trichloride nitride, is a thick, oily yellow liquid. It explodes violently when it is heated to 93° C, exposed to bright light (sunlight), when brought into contact with organic substances, grease, ozone, and nitric oxide. Nitrogen chloride will evaporate if left in an open vessel, and will decompose within 24 hours. It has the interesting quality of exploding 13 seconds after being sealed in a glass container at 60° C. It can produce highly toxic byproducts, and should not be handled or stored.

Because of the hazards of chlorine gas, if this procedure should never be carried out without an adequate source of ventilation. If a fume hood is not available the procedure should be done outside, away from buildings, small children, and pets.

MATERIALS

ammonium nitrate	2 pyrex beakers	heat source	glass pipe
hydrochloric acid	one hole stopper	large flask	fume hood
potassium permanganate			

1) In a beaker, dissolve 5 teaspoons of ammonium nitrate in water. If too much ammonium nitrate is added to the solution and some of it remains undissolved in the bottom of the beaker, the solution should be poured off into a fresh beaker.

2) Collect a quantity of chlorine gas in a second beaker by mixing hydrochloric acid with potassium permanganate in a large flask with a stopper and glass pipe.

3) Place the beaker containing the chlorine gas upside down on top of the beaker containing the ammonium nitrate solution, and tape the beakers together. Gently heat the bottom beaker. When this is done, oily yellow droplets will begin to form on the surface of the solution, and sink down to the bottom. At this time, remove the heat source immediately.

4) Collect the yellow droplets with an eyedropper, and use them as soon as possible.

Alternately, the chlorine can be bubbled through the ammonium nitrate solution, rather than collecting the gas in a beaker, but this requires timing and a stand to hold the beaker and test tube.

The chlorine gas can also be mixed with anhydrous ammonia gas, by gently heating a flask filled with clear household ammonia. Place the glass tubes from the chlorine-generating flask and the tube from the ammonia

generating flask in another flask that contains water.

Lead Azide

Lead Azide is a material that is often used as a booster charge for other explosive, but it does well enough on its own as a fairly sensitive explosive. It does not detonate too easily by percussion or impact, but it is easily detonated by heat from an ignition wire, or a blasting cap. It is simple to produce, assuming that the necessary chemicals can be procured.

By dissolving sodium azide and lead acetate in water in separate beakers, the two materials are put into an aqueous state. Mix the two beakers together, and apply a gentle heat. Add an excess of the lead acetate solution, until no reaction occurs, and the precipitate on the bottom of the beaker stops forming.

Filter off the solution, and wash the precipitate in hot water. The precipitate is lead azide, and it must be stored wet for safety. If lead acetate cannot be found, simply acquire acetic acid, and put lead metal in it. Black powder bullets work well for this purpose.

Lead azide can also be produced by substituting lead nitrate for the acetate. the reaction is given below:



The result is the same precipitate of lead azide, leaving behind the sodium nitrate and traces of lead. The contaminated water should be disposed of in an environmentally safe manner.

Other Reactions

This section covers the other types of materials that can be used in pyrotechnic reactions. although none of the materials presented here are explosives, they are often as hazardous as explosives, and should be treated with due respect.

Thermite

Thermite is a fuel-oxidizer mixture that is used to generate tremendous amounts of heat. It was not presented earlier because it does not react nearly as readily as most mixtures. The most common form of thermite is a mixture of ferric oxide and aluminum, both coarsely powdered. When ignited, the aluminum burns by extracting oxygen from the ferric oxide. The thermite reaction is really two very exothermic reactions that produce a combined temperature of about 2200° C. It is difficult to ignite, however, but once it is ignited, thermite is one of the most effective fire starters around.

To produce thermite you will need one part powdered aluminum and three parts powdered iron oxide (ferric oxide or Fe₂O₃), measured by weight. There is no special procedure or equipment required to make thermite. Simply mix the two powders together. Take enough time to make the mixture as homogenous as possible. The ratio of iron oxide to aluminum isn't very important, and if no weighing equipment is available a 1/1 mixture by volume will work. If a small amount of finely powdered material is used as a starter, the bulk of the thermite mixture can be made up of larger sized material, in the same ratio.

There are very few safety hazards in making thermite. The aluminum dust can form an explosive mixture in air, and inhaling powdered metals can be very bad for your health. It is important to take precautions to insure that the powdered metals are very dry, or the water vapor produced during the reaction will cause the thermite to spray droplets of molten steel in a large radius.

Ignition of thermite can be accomplished by adding a small amount of potassium chlorate to a teaspoon of thermite, and pouring a few drops of sulfuric acid on it. This method and others are discussed on page 49. Another method of igniting thermite is with a magnesium strip. The important factor in igniting thermite is having a material that will produce concentrated heat in a very small region. For this reason, matches will not work, but sparklers and other aluminum based flares will.

Molotov Cocktails

One of the simplest incendiary devices invented, The Molotov cocktail is now employed in the defense of oppressed people worldwide. They range in complexity from the simple bottle and rag to complicated self-igniting firebombs, but in any form a molotov cocktail can produce devastating results.

By taking any highly flammable material, such as gasoline, diesel fuel, kerosene, ethyl or methyl alcohol, lighter fluid, turpentine, or any mixture of the above, and putting it into a large glass bottle, anyone can make an effective firebomb. After putting the flammable liquid in the bottle, simply put a piece of cloth that is soaked in the liquid in the top of the bottle so that it fits tightly.

Then, wrap some of the cloth around the neck and tie it, but be sure to leave a few inches of loose cloth to light. Light the exposed cloth, and throw the bottle. If the burning cloth does not go out, and if the bottle breaks on impact, the contents of the bottle will spatter over a large area near the site of impact, and burst into flame.

Flammable mixtures such as kerosene and motor oil should be mixed with a more volatile and flammable liquid, such as gasoline, to insure ignition. A mixture such as tar or grease and gasoline will stick to the surface that it strikes, burn hotter and longer, and be more difficult to extinguish. A bottle contain a mixture of different fuels must be shaken well before it is lit and thrown.

Other interesting additives can include alcohol, acetone or other solvents, which will generally thin the contents and possibly increase the size of the fireball. By adding a gelling agent such as disk soap, polystyrene, or other material the flaming material can be made sticky enough that it will adhere to a vertical surface, such as a wall or the side of a vehicle.

Chemical Fire Bottle

The chemical fire bottle is really nothing more than an advanced molotov cocktail. Rather than using burning cloth to ignite the flammable liquid, which has at best a fair chance of igniting the liquid, the chemical fire bottle utilizes the very hot and violent reaction between sulfuric acid and potassium chlorate. When the container breaks, the sulfuric acid in the mixture of gasoline sprays onto the paper soaked in potassium chlorate and sugar. The paper, when struck by the acid, instantly bursts into a white flame, igniting the gasoline. The chance of failure to ignite the gasoline is very low, and can be reduced further if there is enough potassium chlorate and sugar to spare.

MATERIALS

potassium chlorate (2 teaspoons)	12 oz.glass bottle w/lined cap	plastic spoon
gasoline (8 ounces)	sugar (2 teaspoons)	cooking pan
baking soda (1 teaspoon)	sulfuric acid (4 ounces)	paper towels
glass cup	glass or teflon coated funnel	rubber cement

1) Test the cap of the bottle with a few drops of sulfuric acid to make sure that the acid will not eat away the bottle cap during storage. If the acid eats through it, a new top must be found and tested, until a cap that the acid does not eat through is found. A glass top is excellent.

2) Carefully mix the gasoline with the sulfuric acid. This should be done in an open area and preferably from a distance. There is a chance that the sulfuric acid could react with an impurity in the gasoline, igniting it.

3) Using a glass funnel, slowly pour the mixture into the glass bottle. Wipe up any spills of acid on the sides of the bottle, and screw the cap on the bottle. Wash the outside with a solution of baking soda in cold water. Then carefully rinse the outside with plenty of cold water. Set it aside to dry.

4) Put about two teaspoons of potassium chlorate and about two teaspoons of sugar into the glass cup. Add about « cup of boiling water, or enough to dissolve all of the potassium chlorate and sugar.

5) Place a sheet of paper towel in the raised edge cooking pan. Fold the paper towel in half, and pour the solution of dissolved potassium chlorate and sugar on it until it is wet through, but not soaked. Allow the towel to dry.

6) When it is dry, put a line of cement about 1" wide down the side of the glass bottle. Starting halfway across the line of cement, wrap the paper towel around the bottle, with the bottom edge of the towel lining up with the bottom edge of the bottle. Coat the inside of the remaining edge of the towel with cement before pressing it into place. Store the bottle in a place where it will not be broken or tipped over.

7) When finished, the solution in the bottle should appear as two distinct liquids, a dark brownish-red solution on the bottom, and a clear solution on top. The two solutions will not mix. To use the chemical fire bottle, simply throw it at any hard surface.

8) NEVER OPEN THE BOTTLE, SINCE SOME SULFURIC ACID MIGHT BE ON THE CAP, WHICH COULD TRICKLE DOWN THE SIDE OF THE BOTTLE AND IGNITE THE POTASSIUM CHLORATE, CAUSING A FIRE AND/OR EXPLOSION.

9) To test the device, tear a small piece of the paper towel off the bottle, and put a few drops of sulfuric acid on it. The paper towel should immediately burst into a white flame.

If you intend to substitute other flammable liquids for the gasoline, first make sure that they will not react with the sulfuric acid. This can be done by mixing a small amount in a bottle, then testing the Ph after several days have passed.

:COMPRESSED GAS BOMBS

Compressed gas bombs come in several forms, but all of them utilize the square pressure law- as the temperature of the gas increases, the pressure increases at a much higher rate. Eventually the pressure will exceed the rating of the container, and it will burst, releasing the gas.

Bottled Gas Explosives

Bottled gas, such as butane for refilling lighters, propane for propane stoves or for bunsen burners, can be used to produce a powerful explosion. To make such a device, all that a destructive person would have to do would be to take his container of bottled gas and place it above a can of Sterno or other gelatinized fuel, light the fuel and leave the area in a hurry. Depending on the amount of gas, the fuel used, and on the thickness of the fuel container, the liquid gas will boil and expand to the point of bursting the container in anywhere from a few seconds to five minutes or more.

In theory, the gas would immediately be ignited by the burning gelatinized fuel, producing a large fireball and explosion. Unfortunately, the bursting of the bottled gas container often puts out the fuel, thus preventing the expanding gas from igniting. By using a metal bucket half filled with gasoline, however, the chances of ignition are better, since the gasoline is less likely to be extinguished. Placing a canister of bottled gas on a bed of burning charcoal soaked in gasoline would probably be the most effective way of securing ignition of the expanding gas, since although the bursting of the gas container may blow out the flame of the gasoline, the burning charcoal should immediately re-ignite it. Nitrous oxide, hydrogen, propane, acetylene, or any other flammable gas will do nicely.

Another interesting use of compressed flammable gases is in the production of explosive mixtures of gases. By mixing a flammable gas with the appropriate amount of oxygen, a very loud explosive combustion can be achieved.

The simplest form of gas device is based on the common oxygen-acetylene cutting torch. First the torch is lit and the mixture of gases is adjusted for a hot, bright flame.

Next, the gas is diverted into some form of container. This can be a soft, expandable container, such as a child's balloon or a rigid, inflexible container, such as a garbage can or metal pipe. It is much safer to use flexible containers that won't produce (much) shrapnel, however if a rigid container is used, it can be used to launch all sorts of interesting projectiles.

A major danger in using mixed gases is the high chance of stray sparks igniting the gases. A few simple safety measures can help reduce this dangerous problem:

- 1) Always store the gases in separate containers! This is the most important rule in working with flammable gases. Pressurizing oxygen with a flammable gas is asking for trouble, as under pressure the gases may react spontaneously, and compressing mixed gases greatly increases the chances of flashback.

- 2) Always work in the open. Flammable gases should never be used indoors. Large quantities of heavier or lighter than air gases could accumulate near the floor or ceiling.

3) Avoid static electricity. Static is less of a problem on humid days, and it can be reduced by wearing clothing made of natural fibers, removing all metal (such as jewelry, riveted clothes, etc) and wearing shoes with crepe soles.

4) Keep your distance. Gas explosions can be very powerful and unpredictable. A 55 gallon trash bag filled with the optimum mixture of oxygen and acetylene 100 feet away can blow out eardrums and crack brick walls.

6) Start out small. Work your way up from small plastic bags or children's balloons.

The best method for safe ignition is to mount a spark plug into a length of heavy steel pipe, and imbed this pipe 2-3 feet into the ground, with less than 2 feet above ground. If desired, a sealed (to prevent any sparks) switch can be wired across the wires to short the cable when you're working at the site. Run heavy cable underground from the pipe to a ditch or bunker at a safe distance, and terminate the cable in a pair of large alligator clips, like the ones used on auto jumper cables. The outer edge of these jumpers and the last foot of wire should be painted bright red. Now drive a second pipe 2 feet into the ground, leaving 3-4 feet above ground.

While working at the site, the shorting switch should be thrown and the two alligator clips attached to the top of the pipe at the bunker. Once the gas equipment is set up, check to ensure that both clips are on the pipe, then turn off the shorting switch and retreat to the bunker.

At the bunker, remove the clips from the pipe and take cover. The wires can now be attached to a high-voltage source. The spark plug will create a short electrical arc, igniting the gases. If the gas fails to ignite on the first try, wait a few seconds then power up the spark plug a second time. If this fails do not approach the site until all the gases have dispersed.

With the use of buried gas piping and anti-flashback devices, safety can be greatly improved. The safest method is to have 2 bunkers equidistant from the site, with one unmanned bunker containing the gas cylinders and remotely controlled valves, and the second bunker containing the controls and personnel.

During the recent gulf war, fuel/air bombs were touted as being second only to nuclear weapons in their devastating effects. These are basically similar to the above devices, except that an explosive charge is used to rupture the fuel container and disperse its contents over a wide area. a delayed second charge is used to ignite the fuel. The reaction is said to produce a massive shockwave and to burn all the oxygen in a large area, causing suffocation.

Another benefit of fuel-air explosives is that the vaporized gas will seep into fortified bunkers or other partially-sealed spaces, so a large bomb placed in a building would result in the destruction of the majority of surrounding rooms.

Dry Ice Bombs

(Or: How to recycle empty soda bottles)

Dry ice bombs have been discovered and rediscovered by many different people, and there is no sure way to know who first came up with the idea of putting dry ice (solid carbon dioxide) into an empty plastic soda bottle. There is no standard formula for a dry ice bomb, however a generic form is as follows:

Take a 2-liter soda bottle, empty it completely, then add about 3/4

Lb of dry ice (crushed works best) and (optional) a quantity of water. twist cap on tightly, and get as far away from it as possible.

Depending on the condition of the bottle, the weather, and the amount and temperature of the water added, the bottle may go off anywhere from 30 seconds to 5 minutes from when it was capped. Without any water added, the 2-liter bottles generally take from 3 to 7 minutes if dropped into a warm river, and 45 minutes to 1« hours in open air. It is possible for the bottle to reach an extreme pressure without reaching the bursting point, in which case any contact with the bottle would cause it to explode. This effect has resulted in several injuries, and is difficult to reliably reproduce.

The explosion sounds equivalent to an M-100, and usually results in the bottle breaking into several large, sharp pieces of frozen plastic, with the most dangerous projectile being the top section with the screw-on cap. Plastic 16 oz. soda bottles and 1 liter bottles work almost as well as do the 2-liters, however glass bottles aren't nearly as loud, and can produce dangerous shrapnel.

Remember, these are LOUD! Dorian, a classmate of mine, set up 10 bottles in a nearby park without adding water. After the first two went off (there was about 10 minutes between explosions) the Police arrived and spent the next hour trying to find the guy who they thought was setting off M-100's all around them...

Using anything other than plastic to contain dry ice bombs is suicidal. Even plastic 2-liter bottles can produce some nasty shrapnel: One source tells me that he caused an explosion with a 2-liter bottle that destroyed a metal garbage can. Because of the freezing temperatures, the plastic can become very hard and brittle, and when the bottle ruptures it may spray shards of sharp, frozen plastic. While plastic bottles can be dangerous, glass bottles may be deadly. It is rumored that several kids have been killed by shards of glass resulting from the use of a glass bottle.

For some reason, dry ice bombs have become very popular in the state of Utah. As a result, dry ice bombs have been classified as infernal devices, and in utah possession of a completed bomb is a criminal offense. Most other states do not have specific laws on the books outlawing these devices. There are several generic offenses which you could be charged with, including disturbing the peace, reckless endangerment, destruction of property, and construction of a nefarious device.

It is interesting to note that dry ice bombs are not really pyrotechnic devices. As the carbon dioxide sublimates into it's gaseous state, the pressure inside the bottle increases. When the bottle ruptures, the gas is released. This sudden release of pressure causes the temperature of the gases to drop. It is noticed that right after detonation, a cloud of white vapor appears. This may be the water vapor in the surrounding air suddenly condensing when it contacts the freezing cold gas.

Almost any reaction that produces large amounts of gas from a much smaller volume can be used. One common variation is the use of Drano* crystals and shredded aluminum foil. When water is added the Drano, which is mainly lye (an extremely caustic substance), dissolves in the water and reacts with the aluminum, producing heat and hydrogen gas. If the heat doesn't melt the bottle the pressure will eventually cause it to rupture, spraying caustic liquid and releasing a large quantity of (flammable) hydrogen gas, as well as some water vapor.

Another interesting reaction is adding managanese dioxide to hydrogen peroxide. The manganese dioxide is a catalyst that allows the hydrogen peroxide to release the extra oxygen atom, yielding free oxygen and water:



It may be possible to combine the drain opener reaction with the hydrogen peroxide reaction, yielding heat, oxygen, and hydrogen. When mixed in the proper proportion these three components can yield a very powerful

explosion from the violently exothermic reaction of the hydrogen and oxygen. Preliminary experiments have shown that the drain opener reaction tends to proceed much more quickly than the peroxide reaction, and it often produces enough excess heat to cause the bottle to rupture prematurely.

Another possible reaction is pool chlorine tablets (usually calcium hypochlorite) and household ammonia. This reaction produces poisonous chlorine gas. Baking soda and vinegar have been tried, but the reaction seems to become inhibited by the rising pressure.

There are also many variations possible when using dry ice. If a bottle that is not dissolved by acetone (such as most 2-L soda bottles) is used, the crushed dry ice can be mixed with acetone. This will greatly speed up the reaction, since unlike water, acetone remains a liquid at very low temperatures. One hazard (benefit?) of adding acetone is that the rupturing bottle will spray cold acetone around in liquid form. This can be very hazardous, since acetone is a very powerful solvent, and is extremely flammable.

:USING EXPLOSIVES

Once a person has produced his explosives, the next logical step is to apply them. Explosives have a wide range of uses, from entertainment to extreme destruction.

NONE OF THE IDEAS PRESENTED HERE ARE EVER TO BE CARRIED OUT, EITHER IN PART OR IN FULL. PLANNING OR EXECUTING ANY OF THESE IDEAS CAN LEAD TO PROSECUTION, FINES, AND IMPRISONMENT!

The first step a person that would use explosive would take would be to determine how big an explosive device would be needed to achieve the desired effect. Then, he would have to decide what materials to use, based on what is currently available. He would also have to decide on how he wanted to initiate the device, and determine where the best placement for it would be. Finally, one must produce the device without unacceptable risk to ones own life.

Ignition Devices

There are many ways to ignite explosive devices. There is the classic "place on ground, light fuse and get away" approach, and there are position or movement sensitive switches, and many things in between. Generally, electrical detonation systems are safer than fuses, but there are times when fuses are more appropriate than electrical systems; it is difficult to carry a sophisticated electrical detonation system into a stadium, for instance, without being caught. A device with a fuse or impact detonating fuze would be easier to hide.

Fuse Ignition

The oldest form of explosive ignition, fuses are perhaps the favorite type of ignition system. By simply placing a piece of waterproof fuse in a device, one can have almost guaranteed ignition. Fuses are certainly the the most economical and commonyl available means of ignition.

Modern waterproof fuse is extremely reliable, burning at a rate of about 2.5 seconds to the inch. It is available as model rocketry fuse in most hobby shops, and costs about \$3.00 for a package of ten feet. Cannon fuse is a popular ignition system for use in pipe bombs because of its simplicity and reliability. All that need be done is light it with a match or lighter. Of course, if the Army had only fuses like this, then the grenade, which uses a form of fuse ignition, would be very impractical. If a grenade ignition system can be acquired, by all means use it, it is the most effective. There are several varieties of pull-ring igniters available, sources for some are listed in the appendices. The next best thing to a pull-ring system is to prepare a fuse system which does not require the use of a match or lighter, but still retains a level of simplicity. One such method is described below:

MATERIALS

strike-on-cover type matches
electrical tape
waterproof fuse

1) To determine the burn rate of a particular type of fuse, simply measure a 6 inch or longer piece of fuse and ignite it. With a stopwatch, press the start button the at the instant when the fuse lights, and stop the

watch when the fuse reaches its end. Divide the time of burn by the length of fuse, and you have the burn rate of the fuse, in seconds per inch. This will be shown below:

Suppose an eight inch piece of fuse is burned, and its complete time of combustion is 20 seconds.

$20 \text{ seconds} / 8 \text{ inches} = 2.5 \text{ seconds per inch.}$

If a delay of 10 seconds was desired with this fuse, divide the desired time by the number of seconds per inch:

$10 \text{ seconds} / 2.5 \text{ seconds per inch} = 4 \text{ inches}$

Note: The length of fuse here means length of fuse to the powder. Some fuse, at least an inch, should extend inside the device. always add this extra inch, and always put it inside the device.

2) After deciding how long a delay is desired before the explosive device is to go off, add about « inch to the pre-measured amount of fuse, and cut it off.

3) Carefully remove the cardboard matches from the paper match case. Do not pull off individual matches; keep all the matches attached to the cardboard base. Take one of the cardboard match sections, and leave the other one to make a second igniter.

4) Wrap the matches around the end of the fuse, with the heads of the matches touching the very end of the fuse. Tape them there securely, making sure not to put tape over the match heads. Make sure they are very secure by pulling on them at the base of the assembly. They should not be able to move.

5) Wrap the cover of the matches around the matches attached to the fuse, making sure that the striker paper is below the match heads and the striker faces the match heads. Tape the paper so that is fairly tight around the matches. Do not tape the cover of the striker to the fuse or to the matches. Leave enough of the match book to pull on for ignition.

The match book is wrapped around the matches, and is taped to itself. The matches are taped to the fuse. The striker will rub against the match heads when the match book is pulled.

6) When ready to use, simply pull on the match paper. It should pull the striking paper across the match heads with enough friction to light them. In turn, the burning match heads will light the fuse, since it adjacent to the burning match heads.

Making Blackmatch Fuse

Take a flat piece of plastic or metal (brass or aluminum are easy to work with and won't rust). Drill a 1/16th inch hole through it. This is your die for sizing the fuse. You can make fuses as big as you want, but this is the right size for pipe bombs and other rigid casings.

To about « cup of black powder add water to make a thin paste. Add « teaspoon of corn starch. Cut some one foot lengths of cotton thread. Use cotton, not silk or thread made from synthetic fibers. Put these together until you have a thickness that fills the hole in the die but can be drawn through very easily.

Tie your bundle of threads together at one end. Separate the threads and hold the bundle over the black powder mixture. Lower the threads with a circular motion so they start curling onto the mixture. Press them under

with the back of a teaspoon and continue lowering them so they coil into the paste. Take the end you are holding and thread it through the die. Pull it through smoothly in one long motion.

To dry your fuse, lay it on a piece of aluminum foil and bake it in your 250° oven or tie it to a grill in the oven and let it hang down. The fuse must be baked to make it stiff enough for the uses it will be put to later. Air drying will not do the job. If you used Sodium Nitrate, it will not dry completely at room temperatures.

Cut the dry fuse with scissors into 2 inch lengths and store in an air tight container. Handle this fuse careful to avoid breaking it. You can also use a firecracker fuse if you have any available. The fuses can usually be pulled out without breaking. To give yourself some running time, you will be extending these fuses (blackmatch or firecracker fuse) with sulfured wick.

Finally, it is possible to make a relatively slow-burning fuse in the home. By dissolving about one teaspoon of black powder in about a cup of boiling water, and, while it is still hot, soaking in it a long piece of all cotton string, a slow-burning fuse can be made. After the soaked string dries, it must then be tied to the fuse of an explosive device. Sometimes, the end of the slow burning fuse that meets the normal fuse has a charge of black powder or gunpowder at the intersection point to insure ignition, since the slow-burning fuse does not burn at a very high temperature.

A similar type of slow fuse can be made by taking the above mixture of boiling water and black powder and pouring it on a long piece of toilet paper. The wet toilet paper is then gently twisted up so that it resembles a firecracker fuse, and is allowed to dry.

Making Sulfured Wick

There are several ways to make sulfured wick, One method is to use heavy cotton string about 1/8th inch in diameter. You can find it at a garden supply or hardware store, it is often used for tying up tomatoes. Be sure the string is cotton, and not some form of synthetic fabric. You can test it by lighting one end. It should continue to burn after the match is removed and when blown out will have a smoldering coal on the end. Put a small quantity of sulfur in a small container (a small pie pan works well) and melt it in the oven at 250 degrees Fahrenheit.

The sulfur will melt into a transparent yellow liquid. If it starts turning brown, it is too hot. Coil about a one foot length of string into it. The melted sulfur will soak in quickly. When saturated, pull it out and tie it up to cool and harden.

It can be cut to desired lengths with scissors. 2 inches is about right. These wicks will burn slowly with a blue flame and do not blow out easily in a moderate wind. They will not burn through a hole in a metal pipe, but are great for extending your other fuse. They will not throw off many sparks. This is quite unlike blackmatch, which generates sparks which can ignite it along its length causing much less predictable burning times.

Making Quickmatch Fuse

Sometimes it is desirable to have a reliable, fast burning fuse, rather than to use slow fuse. Quickmatch fuse burns almost instantaneously, and is useful when two items, located some distance apart, need to be ignited at the same time.

The simplest way to make quickmatch is to enclose a length of blackmatch fuse in a tube with an inside diameter about twice the diameter of the fuse. When one end is lit, the fuse will burn through the tube within a couple seconds. This is because the tube helps the sparks from the blackmatch to propagate down the length of the fuse.

Another simple method of making quickmatch is to purchase a roll of extra-wide masking tape (1½-2 inches works well). Unwind a few feet of tape,

then pour a trail of blackpowder or pyrodex down the middle, making sure to leave «" of the tape on the right side clean of powder. When the rest of the tape is completely covered with powder, fold the left side over to within 1/2" of the right edge, then fold the (clean) right side over the left and press it in place. The finished quickmatch should now be held by one end to allow the excess powder to drain out. If multiple devices are to be attached to the quickmatch, a small hole can be poked at the appropriate spot and an inch of blackmatch fuse should be inserted at that point.

Quickmatch is easily damaged by water, and should not be flattened out as that will limit its effectiveness. If the fuse has a tendency to go out, coarser grained powder should be used.

Impact Ignition

Impact ignition is an excellent method of ignition for any device that is intended to be employed as a projectile. The problem with an impact igniting device is that it must be kept in a very safe container so that it will not explode while being transported to the place where it is to be used. This can be done by having a removable impact initiator.

The best and most reliable impact initiator is one that uses factory made initiators or primers. A no. 11 cap for black powder firearms is one such primer. They usually come in boxes of 100, and cost about \$2.50.

To use such a cap, however, one needs a nipple that it will fit on. Black powder nipples are also available in gun stores. All that a person has to do is ask for a package of nipples and the caps that fit them. Nipples have a hole that goes all the way through them, one of the ends is threaded, and the other end has a flat area to put the cap on. A cutaway of a nipple is shown below:

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

When making using this type of initiator, a hole must be drilled into whatever container is used to make the bomb out of. The nipple is then screwed into the hole so that it fits tightly. Then, the cap can be carried and placed on the bomb when it is to be thrown. The cap should be bent a small amount before it is placed on the nipple, to make sure that it stays in place. The only other problem involved with an impact detonating bomb is that it must strike a hard surface on the nipple to set it off. By attaching fins or a small parachute on the end of the bomb opposite the primer, the bomb, when thrown, should strike the ground on the primer, and explode. Of course, a bomb with mercury fulminate in each end will go off on impact regardless of which end it strikes on, but mercury fulminate is also likely to go off if the person carrying the bomb is bumped hard.

MAGICUBE* Ignitor

A very sensitive and reliable impact initiator can be produced from the common MAGICUBE type camera flashbulbs. Simply crack the plastic cover off, remove the reflector, and you will see 4 bulbs, each of which has a small metal rod holding it in place.

Carefully grasp this rod with a pair of needle-nose pliers, and pry gently upwards, making sure that no force is applied to the glass bulb.

Each bulb is coated with plastic, which must be removed for them to be effective in our application. This coating can be removed by soaking the bulbs in a small glass of acetone for 30-45 minutes, at which point the plastic can be easily peeled away.

The best method of using these is to dissolve some nitrocellulose based smokeless powder (or make your own nitrocellulose see page 19) in a

small quantity of acetone and/or ether, forming a thick glue-like paste. Coat the end of the fuse with this paste, then stick the bulb (with the metal rod facing out) into the paste. About half the bulb should be completely covered, and if a VERY THIN layer of nitrocellulose is coated over the remainder of the bulb then ignition should be very reliable.

To insure that the device lands with the bulb down, a small streamer can be attached to the opposite side, so when it is tossed high into the air the appropriate end will hit the ground first.

Electrical Ignition

Electrical ignition systems for detonation are usually the safest and most reliable form of ignition. Electrical systems are ideal for demolition work, if one doesn't have to worry so much about being caught. With two spools of 500 ft of wire and a car battery, one can detonate explosives from a comfortable and relatively safe distance, and be sure that there is nobody around that could get hurt. With an electrical system, one can control exactly what time a device will explode, within fractions of a second. Detonation can be aborted in less than a second's warning, if a person suddenly walks by the detonation sight, or if a police car chooses to roll by at the time. The two best electrical igniters are military squibs and model rocketry igniters. Blasting caps for construction also work well. Model rocketry igniters are sold in packages of six, and cost about \$1.00 per pack. All that need be done to use them is connect it to two wires and run a current through them. Military squibs are difficult to get, but they are a little bit better, since they explode when a current is run through them, whereas rocketry igniters only burst into flame. Most squibs will NOT detonate KClO₃/petroleum jelly or RDX. These relatively insensitive explosives require a blasting cap type detonation in most cases. There are, however, military explosive squibs which will do the job.

Igniters can be used to set off black powder, mercury fulminate, HMDT, or guncotton, which in turn, can set off a high order explosive.

A Simple Electric Fuze

Take a flashlight bulb and place it glass tip down on a file. Grind it down on the file until there is a hole in the end. Solder one wire to the case of the bulb and another to the center conductor at the end. Fill the bulb with black powder or powdered match head. One or two flashlight batteries will heat the filament in the bulb causing the powder to ignite.

Another Electric Fuze

Take a medium grade of steel wool and pull a strand out of it. Attach it to the ends of two pieces of copper wire by wrapping it around a few turns and then pinch on a small piece of solder to bind the strand to the wire. You want about « inch of steel strand between the wires. Number 18 or 20 is a good size wire to use.

Cut a « by 1 inch piece of thin cardboard of (the type used in match covers is ideal). Place a small pile of powdered match head in the center and press it flat. place the wires so the steel strand is on top of and in contact with the powder. Sprinkle on more powder to cover the strand.

The strand should be surrounded with powder and not touching anything else except the wires at its ends. Place a piece of blackmatch in contact with the powder. Now put a piece of masking tape on top of the lot, and fold it under on the two ends. Press it down so it sticks all around the powder. The wires are sticking out on one side and the blackmatch on the other. A single flashlight battery will set this off.

Electro-mechanical Ignition

Electro-mechanical ignition systems are systems that use some type of mechanical switch to set off an explosive charge electrically. This type of switch is typically used in booby traps or other devices in which the person who places the bomb does not wish to be anywhere near the device when it explodes. Several types of electro-mechanical detonators will be discussed.

Mercury Switches

Mercury switches are a switch that uses the fact that mercury metal conducts electricity, as do all metals, but mercury metal is a liquid at room temperatures. A typical mercury switch is a sealed glass tube with two electrodes and a bead of mercury metal. It is sealed because of mercury's nasty habit of giving off brain-damaging vapors. The diagram below may help to explain a mercury switch.

When the drop of mercury ("Hg" is mercury's atomic symbol) touches both contacts, current flows through the switch. If this particular switch was in its present position, A---B, current would not be flowing. If the switch was rotated 90 degrees so the wires were pointed down, the mercury would touch both contacts in that vertical position.

If, however, it was in the vertical position, the drop of mercury would only touch the + contact on the A side. Current, then couldn't flow, since mercury does not reach both contacts when the switch is in the vertical position. This type of switch is ideal to place by a door. If it were placed in the path of a swinging door in the vertical position, the motion of the door would knock the switch down, if it was held to the ground by a piece of tape. This would tilt the switch into the horizontal position, causing the mercury to touch both contacts, allowing current to flow through the mercury, and to the igniter or squib in an explosive device.

Trip wire Switches

A trip wire is an element of the classic booby trap. By placing a nearly invisible line of string or fishing line in the probable path of a victim, and by putting some type of trap there also, nasty things can be caused to occur. If this mode of thought is applied to explosives, how would one use such a trip wire to detonate a bomb. The technique is simple. By wrapping the tips of a standard clothespin with aluminum foil, and placing something between them, and connecting wires to each aluminum foil contact, an electric trip wire can be made. If a piece of wood attached to the trip wire was placed between the contacts on the clothespin, the clothespin would serve as a switch. When the trip wire was pulled, the clothespin would snap together, allowing current to flow between the two pieces of aluminum foil, thereby completing a circuit, which would have the igniter or squib in it. Current would flow between the contacts to the igniter or squib, heating the igniter or squib and causing it to explode. Make sure that the aluminum foil contacts do not touch the spring, since the spring also conducts electricity.

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

Radio Control Detonators

In the movies, every assassin and criminal uses a radio controlled detonator to set off explosives. With a good radio detonator, one can be several miles away from the device, and still control exactly when it explodes, in much the same way as an electrical switch. The problem with radio detonators is that they are rather costly. However, there could possibly be a reason that one would be willing to spend the amounts of money involved with a radio control system and use it as a detonator. If such an individual wanted to devise an radio controlled detonator, all he would need to do is visit the local hobby store or toy store, and buy a radio controlled toy. Taking it back to his/her abode, all that he/she would have to do is detach the solenoid/motor that controls the motion of the front wheels of a car, or detach the solenoid/motor of the elevators/rudder of a radio controlled airplane, or the rudder of a boat, and re-connect the squib or rocket engine igniter to the contacts for the solenoid/motor. The device should be tested several times with squibs or igniters, and fully charged batteries should be in both the controller and the receiver (the part that used to move parts before the device became a detonator).

One interesting variation on this method is to adapt a mundane device to serve as a remote detonator. Radio pagers are ideal for this purpose. Alpha-numeric display pagers can be rented for around \$20 per month, and the display can easily be wired to a detonation device. The pager number can be called from anywhere in the world, and when the appropriate message is entered the device is triggered. Similarly, a cellular telephone could be adapted to respond in the same manner.

Delays

A delay is a device which causes time to pass from when a device is set up to the time that it explodes. A regular fuse is a delay, but it would cost quite a bit to have a 24 hour delay with a fuse. This section deals with the different types of delays that can be employed by an antisocial person who wishes to be sure that his bomb will go off, but wants to be out of the country when it does.

Fuse Delays

It is extremely simple to delay explosive devices that employ fuses for ignition. Perhaps the simplest way to do so is with a cigarette. An average cigarette burns for between 8-11 minutes. The higher the tar and nicotine rating, the slower the cigarette burns. Low tar and nicotine cigarettes burn quicker than the higher tar and nicotine cigarettes, but they are also less likely to go out if left unattended, i.e. not smoked. Depending on the wind or draft in a given place, a high tar cigarette is better for delaying the ignition of a fuse, but there must be enough wind or draft to give the cigarette enough oxygen to burn. People who use cigarettes for the purpose of delaying fuses will often test the cigarettes that they plan to use in advance to make sure they stay lit and to see how long it will burn. Once the burning rate of a brand of cigarette is determined, it is a simple matter of carefully putting a hole all the way through a cigarette with a toothpick at the point desired, and pushing the fuse for a device in the hole formed.

Improved Cigarette Delay

A variation on the standard cigarette display was invented by my good friend John A. (THE Pyromaniac). Rather than inserting the fuse into the SIDE of the cigarette (and risk splitting it) half of the filter is cut off, and a small hole is punched THROUGH the remainder of the filter and into the tobacco.

The fuse is inserted as far as possible into this hole, then taped or glued in place, or the cigarette can be cut and punched ahead of time and lit as if you intended to smoke it, then attached to the fuse at the scene. Taking a few puffs can help prevent the cigarette from going out, as well as improving your chances of dying from lung cancer.

A similar type of device can be made from powdered charcoal and a sheet of paper. Simply roll the sheet of paper into a thin tube, and fill it with powdered charcoal. Punch a hole in it at the desired location, and insert a fuse. Both ends must be glued closed, and one end of the delay must be doused with lighter fluid before it is lit. Or, a small charge of gunpowder mixed with powdered charcoal could conceivably be used for igniting such a delay. A chain of charcoal briquettes can be used as a delay by merely lining up a few bricks of charcoal so that they touch each other, end on end, and lighting the first brick. Incense, which can be purchased at almost any novelty or party supply store, can also be used as a fairly reliable delay. By wrapping the fuse about the end of an incense stick, delays of up to an hour are possible.

Random Electronic Delay

An interesting delay mechanism that provides a random delay can be produced from the following items:

Relay (2) 9V batteries Wire

Soldering Iron(2) 9V battery connectors(2) SPST switches

1) Solder 2 wires to the relay. The first wire should be soldered to one side of the coil (or the appropriate contact) and the other wire should be soldered to the center contact of the relay switch.

2) Solder a SPST switch to each of the wires, and solder the red wire from each of the 9V battery connectors to the other pole of each switch.

3) Solder the other wire from the 9V connector that is attached to the switch for the relay coil to the other side of the relay coil.

4) Solder the other wire from the second 9V connector to one wire from an electric squib or detonator. The other wire from the squib is soldered to the normally closed contact of the relay.

5) Making sure that both switches are open, attach both batteries to their respective connector.

When you're ready to use the device, close the first switch (the one that energizes the relay's coil). Make sure that you hear a CLICK! The click signifies that it is safe to throw the second switch.

The squib will blow when the 9V battery that is powering the relay's coils runs out of power, or if the first switch (the one powering the relay) is thrown before the second switch.

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

Timer Delays

Timer delays, or "time bombs" are usually employed by an individual who wishes to preset the exact moment of detonation. There are several ways to build a timer delay. By simply using a screw as one contact at the time that detonation is desired, and using the hour hand of a clock as the other contact, a simple timer can be made. The minute hand of a clock should be removed, unless a delay of less than an hour is desired. One problem with this method is that many new alarm clocks do not have sufficient torque to make a good contact between the hour hand and the screw or metal pin. Also, many clocks have plastic hands, or the metal hands may be coated with an insulating substance. Any timer made in this manner should be tested several times to ensure that the circuit closes consistently.

The main disadvantage with this type of timer is that it can only be set for a maximum time of 12 hours. If an electronic timer is used, such as that in an electronic clock, then delays of up to 24 hours are possible. First the speaker should be removed and a meter attached to the wires, to check if there is any current flowing when the alarm is not active. You should also check to see how much current is provided when the alarm goes off. The wires should be attached to a small switch, and then to a squib or igniter. In this manner a timer with a delay of over 23 hours can be made. All that one has to do is set the alarm time of the clock to the desired time, connect the leads, and leave the area. This could also be done with an electronic watch, if a larger battery were used, and the current to the speaker of the watch was stepped up via a transformer. This could be very effective, since such a timer could be extremely small.

There are a few dangers inherent in this method of making timers. Several people have blown themselves up by not taking into account some of the factors. Some clocks will activate the speaker when the time is set, or when the power is turned on or off.

The timer in a VCR (Video Cassette Recorder) is ideal. VCR's can usually be set for times of up to a week. The leads from the timer to the recording equipment would be the ones that an igniter or squib would be connected to. Also, one can buy timers from electronics stores that would work well. Finally, one could employ a digital watch, and use a relay, or electro-magnetic switch to fire the igniter, and the current of the watch would not have to be stepped up.

Chemical Delays

Chemical delays are uncommon, but they can be extremely effective in some cases. These were often used in the bombs the Germans dropped on England. The delay would ensure that a bomb would detonate hours or even days after the initial bombing raid, thereby increasing the terrifying effect on the British citizenry.

If a glass container is filled with concentrated sulfuric acid, and capped with several thicknesses of aluminum foil, or a cap that it will eat through, then it can be used as a delay. Sulfuric acid will react with aluminum foil to produce aluminum sulfate and hydrogen gas, and so the container must be open to the air on one end so that the pressure of the hydrogen gas that is forming does not break the container.

The aluminum foil is placed over the bottom of the container and secured there with tape. When the acid eats through the aluminum foil, it can be used to ignite an explosive device in several ways.

Sulfuric acid is a good conductor of electricity. If the acid that eats through the foil is collected in a glass container placed underneath the foil, and two wires are placed in the glass container, a current will be able to flow through the acid when both of the wires are immersed in the acid. The acid will also react with potassium chlorate or potassium permanganate, see below.

Spontaneous Combustion

Some of the ingredients for these can only be had from a chemical supply while others can be obtained with a little effort.

Scatter out approx. 5 g of chromic anhydride. add 2 drops of ethyl alcohol. It will burst into flame immediately.

Measure by weight, four parts ammonium chloride, one part ammonium nitrate, four parts powdered zinc. Make sure that all the powders are very dry, and mix in a clean dry vessel. Pour out a small pile of this and make a depression on top. Put one or two drops of water in the depression. Stay well back from this.

Spoon out a small pile of powdered aluminum. Place a small amount of sodium peroxide on top of this. A volume the size of a small pea is about right. One drop of water will cause this to ignite in a blinding flare.

Measure by volume 3 parts concentrated sulfuric acid with 2 parts concentrated nitric acid. Mix the two acids in a large pyrex beaker. Hold a dropper of turpentine about 2 feet above the mixture. When drops strike the acid they will burst into flame.

Sulfuric acid reacts very violently with potassium chlorate and potassium permanganate. If a few drops of sulfuric acid are added to a pile of either of these oxidizers, the pile will burst into flame within seconds.

Most of the above mixtures can have other chemicals added to them (oxidizers, powdered metals) and can be placed on the top of a pile of a flammable substance, or used to start a fuse.

:EXPLOSIVE CASINGS

This section will cover everything from making a simple firecracker to a complicated scheme for detonating an insensitive high explosive, both of which are methods that could be utilized by protectors of the rights of the common man.

Paper Containers

Paper was the first container ever used for explosives, since it was first used by the Chinese to make fireworks. Paper containers are usually very simple to make, and are certainly the cheapest. There are many possible uses for paper in containing explosives, and the two most obvious are in firecrackers and rocket engines. Simply by rolling up a long sheet of paper, and gluing it together, one can make a simple rocket engine. Perhaps a more interesting and dangerous use is in the firecracker. The firecracker shown here is one of Mexican design. It is called a "polumna", meaning "dove". The process of their manufacture is not unlike that of making a paper football. If one takes a sheet of paper about 16 inches in length by 1.5 inches wide, and folds one corner into a triangle which lines up on the top of the sheet, then folds that end of the paper over in another triangle, a pocket is formed. This pocket can be filled with black powder, pyrodex, flash powder, gunpowder, or any of the quick-burning fuel-oxidizer mixtures that occur in the form of a fine powder. A fuse is then inserted, and one continues the triangular folds, being careful not to spill out any of the explosive. When the polumna is finished, it should be taped together very tightly, since this will increase the strength of the container, and produce a louder and more powerful explosion when it is lit. The finished polumna should look like a thin triangle of paper, less than « inch thick.

Metal Containers

The classic pipe bomb is the best known example of a metal-contained explosive. Less fortunate pyrotechnicians take white tipped matches and cut off the heads. They pound one end of a pipe closed with a hammer, pour in the white tipped matches, and then pound the other end closed. This process often kills the fool, since when he pounds the pipe closed, he could very easily cause enough friction between the match heads to cause them to ignite and explode the unfinished bomb. By using pipe caps, the process is somewhat safer, and any person who desires to retain of their limbs would never use white tipped matches in a bomb. Regular matches may still be ignited by friction, but it is far less likely than with "strike-anywhere" matches.

First, one needs to obtain a length of water pipe and two caps. For obvious reasons, it is best not to buy all three items from the same store. The pipe should not be more than six times as long as its diameter.

Next, the pipes and caps are cleaned with rubbing alcohol, and rubber gloves are put on. The pipe is allowed to dry, and never handled with bare hands. If the outside of a glove it touched, and then the pipe is handled with that glove, it is possible to transfer a fingerprint onto the pipe.

A hole is drilled one pipe cap, and a fuse is placed through the hole. If a bit of tissue paper is packed around the fuse on the inside of the cap, the fuse will not come out during handling, and powder will be unable to escape if the pipe is inverted. The fuse would extend at least an inch inside the pipe. There are several possible variations in fusing pipes.

One bomber in New York City used 3 inch diameter pipes, each a foot long. He would solder a six inch piece of copper tubing to the inside of the pipe cap, and extend the fuse down this tube. The end of the fuse was tied into a knot, just big enough to block the copper pipe so powder would not enter. This added some delay once the fuse burned down into the pipe, and it also caused the powder to start burning from the center outward, creating a more uniform blast effect.

One famous pipe bomber used large diameter pipes with four holes drilled into each of the end caps. Each hole had a length of threaded steel rod run through it, and extending about « inch from both end caps. These rods were held in place by heavy nuts on both ends of all four rods. The intention of this was to help the pipe stay intact until all the powder had burned, to increase the effective power of the bomb.

Once the fused end cap is prepared, the cap would be screwed on tightly. To help secure it, a drop of Loctite* could be added to the threads. The pipe could now be filled with any fast burning powder. Packing the powder down is very dangerous, and does not increase the force of the explosion. It will increase the amount of smoke and flames produced by the bomb.

The pipe is usually filled to within an inch of the end, and a large wad of tissue paper (Many brands of tissue paper, including Kleenex*, are moisturized and should not be used) is packed into the pipe to keep any powder from getting onto the threads.

Finally, the other pipe cap would be screwed in place. If the tissue paper is not used, some of the powder could be caught in the threads of the pipe or pipe cap. This powder would be crushed, and the friction can ignite the powder, which could be very detrimental to the health of the builder.

NOTE: The metal caps are very difficult to drill holes in, it is much easier to drill a hole into the middle of the pipe (before it is filled!) and thread the fuse through this opening.

Many people have had great success with this design. According to an old german by the name of Lionel. After detonating one of these inside a cookie tin, found the lid about 1/2 block away, the sides of the tin blown out, and an impression of the pipe, (which was later found blown flat) threads and all on the bottom of the tin... it seems that the welded seam gives out on most modern rolled pipes, however a cast pipe (no seam) would produce more shrapnel (which may or may not be desirable).

This is one possible design. If, however, one does not have access to threaded pipe with end caps, you could always use a piece of copper or aluminum pipe, since it is easily bent into a suitable configuration. A major problem with copper piping, however, is bending and folding it without tearing it; if too much force is used when folding and bending copper pipe, it will split along the fold. The safest method for making a pipe bomb out of copper or aluminum pipe is similar to the method with pipe and end caps.

Pipe Bombs From Soft Metal Pipes

First, one flattens one end of a copper or aluminum pipe carefully, making sure not to tear or rip the piping. Then, the flat end of the pipe should be folded over at least once, carefully so as not to rip the pipe. A fuse hole should be drilled in the pipe near the now closed end, and the fuse should be inserted.

Next, the bomb-builder would partially fill the casing with a low order explosive, and pack the remaining space with a large wad of tissue paper. He would then flatten and fold the other end of the pipe with a pair of pliers. If he was not too dumb, he would do this slowly, since the process of folding and bending metal gives off heat, which could set off the explosive.

Carbon Dioxide "Pellet Gun" or Seltzer cartridges.

A CO2 cartridge from a B.B gun is another excellent container for a low-order explosive. It has one minor disadvantage: it is time consuming to fill. But this can be rectified by widening the opening of the cartridge with a pointed tool. Then, all that would have to be done is to fill the CO2 cartridge with any low-order explosive, or any of the fast burning fuel-oxidizer mixtures, and insert a fuse. These devices are commonly called "crater makers".

A cartridge is easiest to fill if you take a piece of paper and tape it around the opening to form a sort of funnel. A new, full cartridge must be emptied before it can be used. Once the gas is released, some condensation may form on the inside. Use a punch or sharp phillips (+) screwdriver to enlarge the pin-hole opening on a used cartridge. You can place the empty cartridge in a warm oven to drive out any moisture. It may not be necessary to seal the hole, but if you must do so, epoxy and electrical tape should work quite well.

These cartridges also work well as a container for a thermite incendiary device, but they must be modified. The opening in the end must be widened, so that the ignition mixture, such as powdered magnesium, does not explode. The fuse will ignite the powdered magnesium, which, in turn, would ignite the thermite. The burning thermite will melt the container and release liquid iron.

Primed Explosive Casings

The previously mentioned designs for explosive devices are fine for low order explosives, but are unsuitable for high order explosives, since the latter requires a shockwave to be detonated. A design employing a smaller low order explosive device inside a larger device containing a high order explosive would probably be used.

If the large high explosive container is relatively small, such as a CO2 cartridge, then a segment of a hollow radio antenna can be made into a detonator and fitted with a fuse. This tiny detonator can be inserted into the cartridge.

Glass Containers

Glass containers can be suitable for low order explosives, but there are problems with them. First, a glass container can be broken relatively easily compared to metal or plastic containers. Secondly, in the not too unlikely event of an "accident", the person making the device would probably be seriously injured, even if the device was small. A bomb made out of a sample perfume bottle-sized container exploded in the hands of one boy, and he still has pieces of glass in his hand. He is also missing the final segment of his ring finger, which was cut off by a sharp piece of flying glass.

Nonetheless, glass containers such as perfume bottles can be used by a demented individual, since such a device would not be detected by metal detectors in an airport or other public place. All that need be done is fill the container, and drill a hole in the plastic cap that the fuse fits tightly in, and screw the cap-fuse assembly on.

Large explosive devices made from glass containers are not practical, since glass is not an exceptionally strong container. Much of the explosive that is used to fill the container is wasted if the container is much larger than a 16 oz. soda bottle. Also, glass containers are usually unsuitable for high explosive devices, since a glass container would probably not withstand the explosion of the initiator; it would shatter before the high explosive was able to detonate.

Plastic Containers

Plastic containers are perhaps the best containers for explosives, since they can be any size or shape, and are not fragile like glass. Plastic piping can be bought at hardware or plumbing stores, and a device much like the ones used for metal containers can be made. The high-order version works well with plastic piping. If the entire device is made out of plastic, it is not detectable by metal detectors. Plastic containers can usually be shaped by heating the container, and bending it at the appropriate place. They can be glued closed with epoxy or other cement for plastics. Epoxy alone can be used as an end cap, if a wad of tissue paper is placed in the piping. Epoxy with a drying agent works best in this type of device.

One end must be made first, and be allowed to dry completely before the device can be filled with powder and fused. Then, with another piece of tissue paper, pack the powder tightly, and cover it with plenty of epoxy. PVC pipe works well for this type of device, but it cannot be used if the pipe had an inside diameter greater than 3/4 of an inch. Other plastic putties can be used in this type of device, but epoxy with a drying agent works best.

In my experience, epoxy plugs work well, but epoxy is somewhat expensive. One alternative is auto body filler, a grey paste which, when mixed with hardener, forms into a rock-like mass which is stronger than most epoxy. The only drawback is the body filler generates quite a bit of heat as it hardens, which might be enough to set off a overly sensitive explosive. One benefit of body filler is that it will hold it's shape quite well, and is ideal for forming rocket nozzles and entire bomb casings.

Film Canisters

For a relatively low shrapnel explosion, you could try pouring it into an empty 35mm film canister. Poke a hole in the plastic lid for a fuse. These goodies make an explosion that is easily audible a mile away, but creates almost no shrapnel. One a day with no wind, adding extra fuel (like fine charcoal) can produce the classic mushroom cloud.

There are several important safety rules to follow, in addition to the usual rules for working with flash powder.

- 1) Make a hole and insert the fuse before putting any powder into the canister.
- 2) Don't get any powder on the lip of the canister.
- 3) Only use a very small quantity to start with, and work your way up to the desired effect.
- 4) Do not pack the powder, it works best loose and friction can cause ignition.
- 5) Use a long fuse, these are very dangerous close up.

Book Bombs

One approach to disguising a bomb is to build what is called a book bomb; an explosive device that is entirely contained inside of a book. Usually, a relatively large book is required, and the book must be of the hardback variety to hide any protrusions of a bomb. Dictionaries, law books, large textbooks, and other such books work well. When an individual makes a book into a bomb, he/she must choose a type of book that is appropriate for the place where the book bomb will be placed. The actual construction of a book bomb can be done by anyone who possesses an electric drill and a coping saw. First, all of the pages of the book must be glued

together. By pouring an entire container of water-soluble glue into a large bucket, and filling the bucket with boiling water, a glue-water solution can be made that will hold all of the book's pages together tightly. After the glue-water solution has cooled to a bearable temperature, and the solution has been stirred well, the pages of the book must be immersed in the glue-water solution, and each page must be thoroughly soaked.

It is extremely important that the covers of the book do not get stuck to the pages of the book while the pages are drying. Suspending the book by both covers and clamping the pages together in a vise works best. When the pages dry, after about three days to a week, a hole must be drilled into the now rigid pages, and they should drill out much like wood. Then, by inserting the coping saw blade through the pages and sawing out a rectangle from the middle of the book, the individual will be left with a shell of the book's pages.

The rectangle must be securely glued to the back cover of the book. After building his/her bomb, which usually is of the timer or radio controlled variety, the bomber places it inside the book. The bomb itself, and whatever timer or detonator is used, should be packed in foam to prevent it from rolling or shifting about. Finally, after the timer is set, or the radio control has been turned on, the front cover is glued closed, and the bomb is taken to its destination.

:ADVANCED USES FOR EXPLOSIVES

The techniques presented here are those that could be used by a person who had some degree of knowledge of the use of explosives. Advanced uses for explosives usually involved shaped charges, or utilize a minimum amount of explosive to do a maximum amount of damage. They almost always involve high-order explosives.

Shaped Charges

A shaped charge is an explosive device that, upon detonation, directs the explosive force of detonation at a small target area. This process can be used to breach the strongest armor, since forces of literally millions of pounds of pressure per square inch can be generated. Shaped charges employ high-order explosives, and usually electric ignition systems. Keep in mind that all explosives are dangerous, and should never be made or used!! all the procedures described in this book are for informational purposes only.

If a device such as this is screwed to a safe, for example, it would direct most of the explosive force at a point about 1 inch away from the opening of the pipe. The basis for shaped charges is a cone-shaped opening in the explosive material. This cone should be formed with a 45° angle. A device such as this one could also be attached to a metal surface with a powerful electromagnet.

Tube Explosives

A variation on shaped charges, tube explosives can be used in ways that shaped charges cannot. If a piece of 1/2 inch diameter plastic tubing was filled with a sensitive high explosive like R.D.X., and prepared as the plastic explosive container on page 53, a different sort of shaped charge could be produced; a charge that directs explosive force in a circular manner. This type of explosive could be wrapped around a column, or a doorknob, or a telephone pole. The explosion would be directed in and out, and most likely destroy whatever it was wrapped around.

When the user wishes to use a tube bomb, it must first be wrapped around the object to be demolished, after which the ends are connected together. The user can connect wires to the squib wires, and detonate the bomb with any method of electric detonation.

Atomized Particle Explosions

If a highly flammable substance is atomized, or, divided into very small particles, and large amounts of it is burned in a confined area, an explosion similar to that occurring in the cylinder of an automobile is produced. The vaporized gasoline/air mixture burns explosively, and the hot gasses expand rapidly, pushing the cylinder up. Similarly, if a gallon of gasoline was atomized and ignited in a building, it is very possible that the expanding gasses could push the walls of the building down. This phenomenon is called an atomized particle explosion if a solid is used, or a fuel/air explosive if the material is a gas or liquid.

If a person can effectively atomize a large amount of a highly flammable substance and ignite it, he could bring down a large building, bridge, or other structure. Atomizing a large amount of gasoline, for example, can be extremely difficult, unless one has the aid of a high

explosive. If a gallon jug of gasoline was placed directly over a high explosive charge, and the charge was detonated, the gasoline would instantly be atomized and ignited.

If this occurred in a building, for example, an atomized particle explosion would surely occur. Only a small amount of high explosive would be necessary to accomplish this, 7 ounces of T.N.T. or 3 ounces of R.D.X should be sufficient to atomize the contents of a gallon container. Also, instead of gasoline, powdered aluminum, coal dust or even flour could be used for a similar effect.

It is necessary that a high explosive be used to atomize a flammable material, since a low-order explosion does not occur quickly enough to atomize and will simply ignite the flammable material.

:SPECIAL AMMUNITION FOR PROJECTILE WEAPONS

Explosive and/or poisoned ammunition is an important part of a social deviant's arsenal. Such ammunition gives the user a distinct advantage over individual who use normal ammunition, since a grazing hit can cause extreme damage. Special ammunition can be made for many types of weapons, from crossbows to shotguns.

Special Ammunition For Primitive Weapons

For the purposes of this publication, we will call any weapon primitive that does not employ burning gunpowder to propel a projectile forward. This means blowguns, bows and crossbows, and slingshots. Primitive weapons can be made from commonly available materials, and a well made weapon will last for years.

Bow and Crossbow Ammunition

Bows and crossbows both fire arrows or bolts as ammunition. It is extremely simple to poison an arrow or bolt, but it is a more difficult matter to produce explosive arrows or bolts. If, however, one can acquire aluminum piping that is the same diameter of an arrow or crossbow bolt, the entire segment of piping can be converted into an explosive device that detonates upon impact, or with a fuse.

All that need be done is find an aluminum tube of the right length and diameter, and plug the back end with tissue paper and epoxy. Fill the tube with any type of low-order explosive or sensitive high-order explosive up to about « inch from the top.

Cut a slot in the piece of tubing, and carefully squeeze the top of the tube into a round point, making sure to leave a small hole. Place a no. 11 percussion cap over the hole, and secure it with super glue or epoxy.

Finally, wrap the end of the device with electrical or duct tape, and make fins out of tape. Or, fins can be bought at a sporting goods store, and glued to the shaft.

When the arrow or bolt strikes a hard surface, the percussion cap explodes, igniting or detonating the explosive.

Special Ammunition for Blowguns

The blowgun is an interesting weapon which has several advantages. A blowgun can be extremely accurate, concealable, and deliver an explosive or poisoned projectile. The manufacture of an explosive dart or projectile is not difficult.

Perhaps the most simple design for such involves the use of a pill capsule, such as the kind that are taken for headaches or allergies. Empty gelatin pill capsules can be purchased from most health-food stores. Next, the capsule would be filled with an impact-sensitive explosive, such as mercury fulminate. An additional high explosive charge could be placed behind the impact sensitive explosive, if one of the larger capsules were used.

Finally, the explosive capsule would be reglued back together, and a tassel or cotton would be glued to the end containing the high explosive, to insure that the impact-detonating explosive struck the target first.

Care must be taken- if a powerful dart went off in the blowgun, you could easily blow the back of your head off.

Special Ammunition for Slingshots

A modern slingshot is a formidable weapon. It can throw a shooter marble about 500 ft. with reasonable accuracy. Inside of 200 ft., it could well be lethal to a man or animal, if it struck in a vital area. Because of the relatively large sized projectile that can be used in a slingshot, the sling can be adapted to throw relatively powerful explosive projectiles.

A small segment of aluminum pipe could be made into an impact-detonating device by filling it with an impact sensitive explosive material.

Also, such a pipe could be filled with a low order explosive, and fitted with a fuse, which would be lit before the device was shot. One would have to make sure that the fuse was of sufficient length to insure that the device did not explode before it reached its intended target.

Finally, .22 caliber caps, such as the kind that are used in .22 caliber blank guns, make excellent exploding ammunition for slingshots, but they must be used at a relatively close range, because of their light weight.

One company, Beeman, makes an extremely powerful slingshot which can fire short arrows, as well as the usual array of ball ammo. These slingshots can be used with the modified crossbow ammunition.

[ILLUSTRATIONS ARE AVAILABLE WITH THE COMMERCIAL PRINTED RELEASE]

Special Ammunition For Firearms

Firearms were first invented by the ancient chinese. They soon realized that these weapons, even in a primitive form, were one of the most potent to overthrow a government. The authorities encouraged the metalworkers to apply their skills to less socially threatening weapons, upon pain of death.

When special ammunition is used in combination with the power and rapidity of modern firearms, it becomes very easy to take on a small army with a single weapon. It is possible to buy explosive ammunition, but that can be difficult to do. Such ammunition can also be manufactured in the home. There is, however, a risk involved with modifying any ammunition. If the ammunition is modified incorrectly, in such a way that it makes the bullet even the slightest bit wider, an explosion in the barrel of the weapon will occur. For this reason, nobody should ever attempt to manufacture such ammunition.

Pipe Guns (zip guns)

Commonly known as "zip" guns, guns made from pipe have been used for years by juvenile punks. Today's militants make them just for the hell of it or to shoot once in an assassination or riot and throw away if there is any danger of apprehension.

They can often be used many times before exploding in the user's face. With some designs, a length of dowel is needed to force out the spent shell. There are many variations but the illustration shows the basic design.

First, a wooden stock is made and a groove is cut for the barrel to rest in. The barrel is then taped securely to the stock with a good, strong tape.

The trigger is made from galvanized tin. A slot is punched in the trigger flap to hold a roofing nail, which is wired or soldered onto the flap. The trigger is bent and nailed to the stock on both sides.

The pipe is a short length of one-quarter inch steel gas or water pipe with a bore that fits in a cartridge, yet keeps the cartridge rim from passing through the pipe.

The cartridge is put in the pipe and the cap, with a hole bored

through it, is screwed on. Then the trigger is slowly released to let the nail pass through the hole and rest on the primer.

To fire, the trigger is pulled back with the left hand and held back with the thumb of the right hand. The gun is then aimed and the thumb releases the trigger and the thing actually fires.

Pipes of different lengths and diameters are found in any hardware store. All caliber bullets, from the .22 to the .45 are used in such guns.

Some zip guns are made from two or three pipes nested within each other. For instance, a .22 shell will fit snugly into a length of a car's copper gas line. Unfortunately, the copper is too weak to withstand the pressure of the firing. So the length of gas line is spread with glue and pushed into a wider length of pipe. This is spread with glue and pushed into a length of steel pipe with threads and a cap.

Using this method, you can accommodate any cartridge, even a rifle shell. The first (innermost) size of pipe for a rifle shell accommodates the bullet. The second or outermost layer accommodates its wider powder chamber.

A simple and very dangerous (to the user and to the target) 12-gauge shotgun can be made from a 3/4 inch steel pipe. If you want to reduce the number of gun law violations, the barrel should be at least eighteen inches long.

The shotgun's firing mechanism is the same as that for the pistol. It naturally has a longer stock and its handle is lengthened into a rifle butt. Also, a small nail is driven half way into each side of the stock about four inches in the front of the trigger. The rubber band is put over one nail and brought around the trigger and snagged over the other nail.

In case a person actually made a zip gun, he would test it before firing it by hand. This is done by securely mounting gun to a tree or post, pointed to where it will do no damage. Then a long string is tied to the trigger and the maniac holds it from several yards away. The string is then pulled back and let go. If the barrel does not blow up, the gun might be safe to fire by hand. Repeat firings may weaken the barrel, so NO zip gun can be considered "safe" to use.

Special Ammunition for Handguns

If an individual wished to produce explosive ammunition for his/her handgun, he/she could do it, provided that the person had an impact-sensitive explosive and a few simple tools. One would first purchase all lead bullets, and then make or acquire an impact-detonating explosive. By drilling a hole in a lead bullet with a drill, a space could be created for the placement of an explosive. After filling the hole with an explosive, it would be sealed in the bullet with a drop of hot wax from a candle.

This hollow space design also works for putting poison in bullets. In many spy thrillers, an assassin is depicted as manufacturing "exploding bullets" by placing a drop of mercury in the nose of a bullet. Through experimentation it has been found that this will not work. Mercury reacts with lead to form an inert silvery compound, which may be poisonous, but will not affect the terminal ballistics of the bullet.

Special Ammunition for Shotguns

Because of their large bore and high power, it is possible to create some extremely powerful special ammunition for use in shotguns. If a shotgun shell is opened at the top, and the shot removed, the shell can be re-closed. Special grenade-launching blanks can also be purchased. Then, if one can find a very smooth, lightweight wooden dowel that is close to the bore width of the shotgun, a person can make several types of shotgun-launched weapons.

With the modified shell in the firing chamber, lightly insert the

dowel into the barrel of the shotgun. Mark the dowel about six inches above the muzzle, and remove it from the barrel. The dowel should be cut at this point, and the length recorded. Several rods can be cut from a single length of dowel rod.

Next, a device should be chosen. Moderately impact-sensitive igniters are ideal, or a long fuse can be used. This device can be a chemical fire bottle (see page 31), a pipe bomb (page 52), or a thermite bomb (page 30). After the device is made, it must be securely attached to the dowel. When this is done, place the dowel back in the shotgun when ready to fire.

After checking that the device has a long enough fuse, or that the impact igniter is armed, light the fuse (if necessary), and fire the shotgun at an angle of 45 degrees or greater. If the projectile is not too heavy, ranges of up to 300 ft are possible if special "grenade-launcher blanks" are used- use of regular blank ammunition may cause the device to land perilously close to the user.

Special Ammunition for Compressed Air/Gas Weapons

This section deals with the manufacture of special ammunition for compressed air or compressed gas weapons, such as pump B.B guns, gas powered B.B guns, and .22 cal pellet guns. These weapons, although usually thought of as kids toys, can be made into rather dangerous weapons.

Special Ammunition for BB Guns

A BB gun, for this manuscript, will be considered any type of rifle or pistol that uses compressed air or gas to fire a projectile with a caliber of .177, either B.B, or lead pellet. Such guns can have almost as high a muzzle velocity as a modern firearm rifle. Because of the speed at which a .177 caliber projectile flies, an impact detonating projectile can easily be made that has a caliber of .177.

Most ammunition for guns of greater than .22 caliber use primers to ignite the powder in the bullet. These primers can be bought at gun stores, since many people like to reload their own bullets. Such primers detonate when struck by the firing pin of a gun. They will also detonate if they impact any a hard surface at high speed.

Usually, they will also fit in the barrel of a .177 caliber gun. If they are inserted flat end first, they will detonate when the gun is fired at a hard surface. If such a primer is attached to a piece of thin metal tubing, such as that used in an antenna, the tube can be filled with an explosive, be sealed, and fired from a B.B gun. A diagram of such a projectile appears below:

(Ill. 5.31)

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

The front primer is attached to the tubing with a drop of super glue. The tubing is then filled with an explosive, and the rear primer is glued on. Finally, a tassel, or a small piece of cotton is glued to the rear primer, to insure that the projectile strikes on the front primer. The entire projectile should be about 3/4 of an inch long.

Special Ammunition for .22 Caliber Pellet Guns

A .22 caliber pellet gun usually is equivalent to a .22 cal rifle, at close ranges. Because of this, relatively large explosive projectiles can be adapted for use with .22 caliber air rifles.

A design based on glycerine medicine capsules is suitable, since some capsules are about .22 caliber or smaller. Or, a design similar to that in section 5.31 could be used, only one would have to purchase black powder percussion caps, instead of ammunition primers, since there are percussion caps that are about .22 caliber. A #11 cap is too small, but anything larger will do nicely.

ROCKETS AND CANNONS

Rockets and cannon are generally thought of as heavy artillery. Private citizens do not usually employ such devices, because they are difficult or impossible to acquire. They are not, however, impossible to make. Any individual who can make or buy black powder or pyrodex can produce and fire long range cannons and rockets.

Rockets

Rockets were first developed by the Chinese several hundred years before the myth of christ began. They were used for entertainment, in the form of fireworks. They were not usually used for military purposes because they were inaccurate, expensive, and unpredictable. In modern times, however, rockets are used constantly by the military, since they are cheap, reliable, and have no recoil. Perpetrators of violence, fortunately, cannot obtain military rockets, but they can make or buy rocket engines. Model rocketry is a popular hobby of the space age, and to launch a rocket, an engine is required.

Estes, a subsidiary of Damon, is the leading manufacturer of model rockets and rocket engines. Their most powerful engine, the "D" engine, can develop almost 12 lbs. of thrust; enough to send a relatively large explosive charge a significant distance. Other companies, such as Centuri, produce even larger rocket engines, which develop up to 30 ft lbs. of thrust. These model rocket engines are quite reliable, and are designed to be fired electrically. Most model rocket engines have three basic sections.

[ILLUSTRATIONS AVAILABLE ONLY IN COMMERCIAL PRINTED RELEASE]

The clay nozzle at the bottom is where the igniter is inserted. When the area labelled "thrust" is ignited, the "thrust" material, usually a large single grain of a propellant such as black powder or pyrodex, burns, forcing large volumes of hot, rapidly expanding gasses out the narrow nozzle, pushing the rocket forward.

After the material has been consumed, the smoke section of the engine is ignited. It is usually a slow burning material, similar to black powder that has had various compounds added to it to produce visible smoke, usually black, white, or yellow in color. This section exists so that the rocket will be seen when it reaches its maximum altitude, or apogee.

When it is burned up, it ignites the ejection charge. The ejection charge consists of finely powdered black powder. It burns very rapidly, and produce a large volume of hot gases. The explosion of the ejection charge pushes out the parachute of the model rocket. It could also be used to ignite a second stage, or to start a fuse.

Rocket engines have their own peculiar labeling system. Typical engine labels are: A-2T, A-3T, A8-3, B6-4, C6-7, and D12-5. The letter is an indicator of the power of an engine. "B" engines are twice as powerful as "A" engines, and "C" engines are twice as powerful as "B" engines, and so on. The number following the letter is the approximate thrust of the engine, in pounds. the final number and letter is the time delay, from the time that the thrust period of engine burn ends until the ejection charge fires; "3T" indicates a 3 second delay.

NOTE: an extremely effective rocket propellant can be made by mixing aluminum dust with ammonium perchlorate and a very small amount of iron oxide. The mixture is usually bound together by an epoxy.

Basic Rocket Bomb

A rocket bomb is simply what the name implies: a bomb that is delivered to its target by means of a rocket. Most people who would make such a device would use a model rocket engine to power the device. By cutting fins from balsa wood and gluing them to a large rocket engine, such as the Estes "C" engine, a basic rocket could be constructed. Then, a small explosive device would be added. To insure that the fuse of the device is ignited, the clay over the ejection charge of the engine should be scraped off with a plastic tool.

Duct tape is the best way to attach an explosive charge to the rocket engine. Note in the diagram the absence of the clay over the ejection charge. Many different types of explosive payloads can be attached to the rocket, such as a high explosive, an incendiary device, or a chemical fire bottle.

Either four or three fins must be glued to the rocket engine to insure that the rocket flies straight. The fins should be symmetrically spaced. The leading edge and trailing edge should be sanded with sandpaper so that they are rounded. This will help make the rocket fly straight. A two inch long section of a plastic straw can be attached to the rocket to launch it from. A clothes hanger can be cut and made into a launch rod. The segment of a plastic straw should be glued to the rocket engine adjacent to one of the fins of the rocket.

By cutting a coat hanger and straightening it, a launch rod can be made. After a fuse is inserted in the engine, the rocket is simply slid down the launch rod, which is put through the segment of plastic straw. The rocket should slide easily along a coat hanger.

Long Range Rocket Bomb

Long range rockets can be made by using multi stage rockets. Model rocket engines with an "0" for a time delay are designed for use in multi-stage rockets. An engine such as the D12-0 is an excellent example of such an engine. Immediately after the thrust period is over, the ejection charge explodes. If another engine is placed directly against the back of an "0" engine, the explosion of the ejection charge will send hot gasses and burning particles into the nozzle of the engine above it, and ignite the thrust section. This will push the used "0" engine off of the rocket, causing an overall loss of weight.

The main advantage of a multi-stage rocket is that it loses weight as travels, and it gains velocity. A multi-stage rocket must be designed somewhat differently than a single stage rocket, since, in order for a rocket to fly straight, its center of gravity must be ahead of its center of drag. This is accomplished by adding weight to the front of the rocket, or by moving the center of drag back by putting fins on the rocket that are well behind the rocket. The fuse is put in the bottom engine.

Two, three, or even four stages can be added to a rocket bomb to give it a longer range. It is important, however, that for each additional stage, the fin area gets larger.

Cannon

The cannon is a piece of artillery that has been in use since the 11th century. It is not unlike a musket, in that it is filled with powder, loaded, and fired. Cannons of this sort must also be cleaned after each shot, otherwise, the projectile may jam in the barrel when it is fired, causing the barrel to explode.

Basic Pipe Cannon

Almost anyone can make a simple cannon can be made from a thick pipe. The only difficult part is finding a pipe that is extremely smooth on its interior. This is absolutely necessary; otherwise, the projectile may jam. Copper or aluminum piping is usually smooth enough, but it must also be extremely thick to withstand the pressure developed by the expanding hot gasses in a cannon.

If one uses a projectile, such as a modified M-100 or similar device, a pipe that is about 1.5 - 2 feet long is ideal. Such a pipe must have walls that are at least « inch thick, and be very smooth on the interior. If possible, screw an end plug into the pipe. Otherwise, the pipe must be crimped and folded closed, without cracking or tearing the pipe. A small hole is drilled in the back of the pipe near the crimp or end plug. Then, all that need be done is fill the pipe with about two teaspoons of grade blackpowder or pyrodex, insert a fuse, pack it lightly by ramming a wad of tissue paper down the barrel, and drop in a CO2 cartridge. Brace the cannon securely against a strong structure, light the fuse, and run. If the person is lucky, he will not have overcharged the cannon, and he will not be hit by pieces of exploding barrel.

An exploding projectile can be made for this type of cannon with a CO2 cartridge. It is relatively simple to do. Just make a crater maker, and construct it such that the fuse projects about an inch from the end of the cartridge. Then, wrap the fuse with duct tape, covering it entirely, except for a small amount at the end. Put this in the pipe cannon without using a tissue paper packing wad.

When the cannon is fired, it will ignite the end of the fuse, and launch the cartridge. The explosive-filled cartridge will explode in about three seconds, if all goes well.

Rocket Firing Cannon

A rocket firing cannon can be made exactly like a normal cannon; the only difference is the ammunition. A rocket fired from a cannon will fly further than a rocket launched alone, since the action of shooting it overcomes the initial inertia. A rocket that is launched when it is moving will go further than one that is launched when it is stationary. Such a rocket would resemble a normal rocket bomb, except it would have no fins.

The fuse on such a device would, obviously, be short, but it would not be ignited until the rocket's ejection charge exploded. Thus, the delay before the ejection charge, in effect, becomes the delay before the bomb explodes. Note that no fuse need be put in the rocket; the burning powder in the cannon will ignite it, and simultaneously push the rocket out of the cannon at a high velocity.

Reinforced Pipe Cannon

In high school, a friend of mine built cannons and launched CO2 cartridges, etc. However, the design of the cannon is of interest here. It was made from two sections of plain steel water pipe reinforced with steel wire, and lead. The first section had an inside diameter of one inch, and an outside diameter of an inch less than the inside diameter of the second length of pipe. The smaller pipe was wrapped with steel wire and placed inside the larger section.

They dug into the side of a sand pile and built a chimney out of firebrick. Then they stood the assembled pipe and wire on end in the chimney, sitting on some bricks. By using a blowtorch to heat up the chimney, the pipe was heated until it was red hot. Then molten lead was poured into the space between the pipes.

If the caps aren't screwed on tight, some of the lead will leak out. If that happens, turn off the blowtorch and the pipe will cool enough and the lead will stiffen and stop the leak.

They used both homemade and commercial black powder, and slow smokeless shotgun powder in the cannon. Fast smokeless powder is not recommended, as it can generate pressures which will transform your cannon into a large bomb.

After hundreds of shots they cut the cannon into several sections, and cut two of these the long way and separated the components. There was no visible evidence of cracking or swelling of the inner pipe.

:VISUAL PYROTECHNICS

There are many other types of pyrotechnics that can be used. Smoke bombs can be purchased in magic stores, and large military smoke bombs can be bought through advertisements in gun and military magazines. Even the "harmless" pull-string fireworks, which consists of a sort of firecracker that explodes when the strings running through it are pulled, could be placed inside a large charge of a sensitive explosive.

Smoke Bombs

One type of pyrotechnic device that might be deployed in many way would be a smoke bomb. Such a device could conceal the getaway route, or cause a diversion, or simply provide cover. Such a device, were it to produce enough smoke that smelled bad enough, could force the evacuation of a building, for example. Smoke bombs are not difficult to make. Although the military smoke bombs employ powdered white phosphorus or titanium compounds, these raw materials are difficult to obtain. Instead, these devices can often be purchased through surplus stores, or one might make the smoke bomb from scratch.

Most homemade smoke bombs usually employ some type of base powder, such as black powder or pyrodex, to support combustion. The base material will burn well, and provide heat to cause the other materials in the device to burn, but not completely or cleanly. Table sugar, mixed with sulfur and a base material, produces large amounts of smoke. Sawdust, especially if it has a small amount of oil in it, and a base powder works well also. Other excellent smoke ingredients are small pieces of rubber, finely ground plastics, and many chemical mixtures. The material in road flares can be mixed with sugar and sulfur and a base powder produces much smoke. Most of the fuel-oxidizer mixtures, if the ratio is not correct, produce much smoke when added to a base powder. The list of possibilities goes on and on. The trick to a successful smoke bomb also lies in the container used. A plastic cylinder works well, and contributes to the smoke produced. The hole in the smoke bomb where the fuse enters must be large enough to allow the material to burn without causing an explosion. This is another plus for plastic containers, since they will melt and burn when the smoke material ignites, producing an opening large enough to prevent an explosion.

Simple Smoke

There are many ways to produce moderate quantities of dense smoke from simple materials. Motor oil works well, but is not good for the environment. You can also mix six parts powdered zinc with one part powdered sulfur. This mixture can be ignited by safety fuse or a red hot wire. This formula is very similar to the zinc and sulfur rocket propellants used in some amateur rocketry, and will produce pressure and much less smoke if confined.

Colored Flames

Colored flames can often be used as a signaling device. by putting a ball of colored flame material in a rocket; the rocket, when the ejection charge fires, will send out a burning colored ball. The materials that produce the different colors of flames appear below.

COLOR	MATERIAL	USED IN
red	strontium nitrate	road flares
green	barium nitrate	green sparklers
yellow	Sodium nitrate	salt
blue	copper (+ PVC)	old pennies
white	magnesium (use alone!)	fire starters, tubing
purple	potassium permanganate	treating sewage

Fireworks

While fireworks are becoming much more difficult to obtain, it isn't very difficult to produce quality hand-made pieces. The most important factor in achieving a reliable firework is practice. While your first few attempts are likely to be spectacular failures, you can learn from your mistakes. There is no fast way to become proficient at hand production-patient practice is the key to consistent, reliable displays.

Firecrackers

A simple firecracker can be made from cardboard tubing and epoxy. The common spiral wound tubes are not very effective for firecrackers made from slower burning powders, though they will work with flash powder. The tubing used should be reasonably thick-walled, and can be produced by winding kraft paper on a steel core. after winding two layers on the core the paper should be coated with a thin layer of glue (any light glue will work) for the remaining layers. The core should be removed after winding, as the tube will shrink slightly as it dries.

1) Cut a small piece of cardboard tubing from the tube you are using. "Small" means anything less than 4 times the diameter of the tube.

2) Set the section of tubing down on a piece of wax paper, and fill it with epoxy and the drying agent to a height of 3/4 the diameter of the tubing. Allow the epoxy to dry to maximum hardness, as specified on the package.

3) When it is dry, put a small hole in the middle of the tube, and insert a desired length of fuse.

4) Fill the tube with any type of flame sensitive explosive. Flash powder, pyrodex, black powder, nitrocellulose, or any of the fast burning fuel-oxidizer mixtures will do nicely. Fill the tube almost to the top.

5) Fill the remainder of the tube with the epoxy and hardener, and allow it to dry.

6) For those who wish to make spectacular firecrackers, use flash powder, mixed with a small amount of other material for colors. By adding powdered iron, orange sparks will be produced. White sparks can be produced from magnesium shavings, or from small, LIGHTLY crumpled balls of aluminum foil.

Skyrockets

Impressive skyrockets can be easily produced from model rocket engines, with a few minor modifications. While rocket engines for rockets can be made from scratch, it is difficult to produce a reliable product.

MATERIALS

Model Rocket engine (see below)	Paper tubing	flash powder
Bamboo stick	glue	plastic scraper

Commercially produced model rocket engines are available from most hobby stores. They are discussed in detail on page 65. If bamboo rods are not available, any thin dowel rod can be used. The rod serves as a stabilizer to help maintain the skyrocket's path. If the rod is too heavy it will cause the rocket to spiral, or even to double back.

Either buy a section of body tube for model rockets that exactly fits the engine, or make a tube from several thicknesses of paper and glue.

Scrape out the clay backing on the back of the engine, so that the powder is exposed. Glue the tube to the engine, so that the tube covers at least half the engine. Pour a small charge of flash powder in the tube, about « an inch.

By adding materials as detailed in the section on firecrackers, various types of effects can be produced. By putting Jumping Jacks or bottle rockets with the stick removed in the tube, spectacular displays with moving fireballs can be produced. Finally, by mounting many home made firecrackers on the tube with the fuses in the tube, multiple colored bursts can be made.

Roman Candles

Roman candles are impressive to watch. They are relatively difficult to make, compared to the other types of home-made fireworks, but they are well worth the trouble.

1) Buy a « inch thick model rocket body tube, and reinforce it with several layers of paper and/or masking tape. This must be done to prevent the tube from exploding. Cut the tube into about 10 inch lengths.

2) Put the tube on a sheet of wax paper, and seal one end with epoxy and the drying agent. Half an inch is sufficient.

3) Put a hole in the tube just above the bottom layer of epoxy, and insert a desired length of water proof fuse. Make sure that the fuse fits tightly.

4) Pour an inch of pyrodex or gunpowder down the open end of the tube.

5) Make a ball by powdering about two 6 inch sparklers of the desired color. Mix this powder with a small amount of flash powder and a small amount of pyrodex, to have a final ratio (by volume) of:

60% sparkler material
20% flash powder
20% pyrodex.

After mixing the powders well, add water, one drop at a time, and mixing continuously, until a damp paste is formed.

This paste should be moldable by hand, and should retain its shape

when left alone. Make a ball out of the paste that just fits into the tube. Allow the ball to dry.

6) When it is dry, drop the ball down the tube. It should slide down fairly easily. Put a small wad of tissue paper in the tube, and pack it gently against the ball with a pencil.

7) Repeat steps 4 through 6 for each "shot" the candle will have.

8) When ready to use, put the candle in a hole in the ground, pointed in a safe direction, light the fuse, and run. If the device works, a colored fireball should shoot out of the tube. The height can be increased by adding a slightly larger powder charge in step 4, or by using a slightly longer tube.

If the ball does not ignite, add slightly more pyrodex to the paste made in step 5.

The balls made for roman candles also function very well in rockets, producing an effect of colored falling fireballs.

:LISTS OF SUPPLIERS AND MORE INFORMATION

Most, if not all, of the information in this publication can be obtained through a public or university library. There are also many publications that are put out by people who want to make money by telling other people how to make explosives at home.

Advertisements for such appear frequently in paramilitary magazines and newspapers. This list is presented to show the large number of places that information and materials can be purchased from. This listing also includes fireworks companies. The fact that a company is listed here does not imply any endorsement or relationship with them.

COMPANY NAME AND ADDRESS WHAT COMPANY SELLS

Full Auto Co. Inc.
P.O. Box 1881
MURFREESBORO, TN 37133

Explosive Formulas
paper tubing, plugs

MJ Distributing
P.O. Box 10585
YAKIMA, WA 98909

Fireworks Formulas

American Fireworks News
SR Box 30
DINGMAN'S FERRY,
PENNSYLVANIA 18328

Fireworks News Magazine.
sources and techniques
accurate source of info

Barnett Int'l Inc.
125 Runnels St.
P.O. Box 226
PORT HURON,
MICHIGAN 48060

Bows, Crossbows, archery
equipment, some air rifles
quality varies by price

Crossman Air Guns
P.O. Box 22927
ROCHESTER,
NEW YORK 14692

Large assortment of air
guns, quality varies.

R. Allen
P.O. BOX 146
WILLOW GROVE, PA 19090

Professional Construction
books and formulas

Executive Protection
Products
316 California Ave.
RENO, NEVADA 89509

gas grenades, cutlery
and protection devices

Unlimited
Box 1378-SN
HERMISTON, OREGON 97838

Chemicals
Cannon Fuse

Badger Fireworks Co.
Box 1451 Janesville,
WISCONSIN 53547

Class "B" and "C" Fireworks

New England Fireworks
P.O. Box 3504

Class "C" Fireworks

STANFORD, CONNECTICUT 06095

Rainbow Trail
Box 581
EDGEMONT, PENNSYLVANIA 19028

Class "C" Fireworks

Stonington Fireworks Inc.
4010 New Wilsey Bay U.25 Road
RAPID RIVER, MICHIGAN 49878

Class "C" and "B" Fireworks

Windy City Fireworks
P.O. BOX 11
ROCHESTER, INDIANA 46975
Loompanics
P.O. Box 1197
Port Townsend, WA 98368.

Class "C" and "B" Fireworks

Books on Explosives,
Survival, etc

Sierra Supply
PO Box 1390
Durrango, CO 81302
(303)-259-1822.

Army Surplus,
Technical Manuals

Paladin Press
P.O. Box 1307
Boulder, CO 80306

The most well known
dealer of books on
explosives, etc

Delta Press Ltd
P.O. Box 1625 Dept. 893
El Dorado, AR 71731

Books

Phoenix Systems
P.O. Box 3339
Evergreen CO 80439

Cannon Fuse, Mil surplus
and many books
Wide selection

U.S. Cavalry
2855 Centennial Ave.
Radcliff, KY 40160-9000
(502)351-1164

Military and adventure
equipment

BOOKS

The Anarchist's Cookbook (highly inaccurate)

Blaster's Handbook [Dynamite user's manual] Dupont (explosives manufacturer)

This manual is reasonably priced at around \$20, and has a lot of material on rock removal and other common blasting operations. Includes information on propagation blasting and charge calculation.

Manual Of Rock Blasting [Dynamite user's manual]

This manual from Atlas is a bit expensive at \$60, but it covers everything found in the Blaster's Handbook, as well as demolition and other operations.

The Anarchist Arsenal: Incendiary and Explosive Techniques [Erroneous]

112p. 1990, ISBN 0-585-38217-6, Paladin Press

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

Benson, Ragnar. 120p. 1988, ISBN 0-87364-478-6, Paladin Press

Part of a series of very inaccurate books, anything with Benson Ragnar's name on it should be taken with a grain of salt.

Deadly Brew: Advanced Improvised Explosives [highly unsafe]

Lecker, Seymour. 64p. 1987, ISBN 0-87364-418-2, Paladin Press

Explosive Dust: Advanced Improvised Explosives [death trap]

Lecker, Seymour. 60p. 1991 ISBN 0-87364-587-1, Paladin Press

Improvised Explosives: How to Make Your Own [almost correct]

Lecker, Seymour. 80p. 1985 ISBN 0-87364-320-8, Paladin Press

The Poor Man's James Bond: Homemade Poisons, Explosives, Improvised Firearms, Pyrotechnics... [Criminology series]

Saxon, K. 1986 ISBN 0-8490-3675-5 Atlan Formularies

The New Improved Poor Mans's James Bond, No. 1 (6th ed.) [lab manual]

Saxon, Kurt 477p. 1988 ISBN 0-318-41070-2 Atlan

This volume includes material from Weingarts Pyrotechnics as well as some original material. This is one of the most well known books in the field.

The Poor Man's James Bond, Vol 2 [lab manual, reprints from asstd. sources]

Saxon, K. 484p. 1987 ISBN 0-318-41071-0 Atlan

Explosives and Demolitions

U.S. Army Staff. 188p. 1967 ISBN 0-87364-077-2 Paladin Press.

This manual is US Army, and is very complete and accurate, although it is somewhat outdated. Prices range from \$5.00 to \$15.00 .

Improvised Munitions Handbook

U.S. Army Staff, Technical Manual 31-210

The procedures given are feasible, but they written are with the presumption that the maker is willing to accept a high degree of risk.

Pyrotechnics

George W. Weingart.

Gives ingredients, proper handling techniques, and several formulas for the production of a number of professional pyrotechnic devices.

Explosives

Arthur Marshall - Chemical Inspector, Ordnance Dept. England

Published by P. Blakiston's Son & Co. in 2 volumes

Volume one covers production and volume two covers properties and tests. Both are illustrated, very comprehensive and well written.

Hazardous Chemical Desk Reference

N. Irving Sax and R.J. Lewis, SR. Reinhold Press 1096pp

A quick reference guide to 4,700 of the most commonly used hazardous chemicals and compounds, includes incompatibilities and hazards.

The Merck Index [11th Edition]

S. Budavari et al Eds: Merck, Rahway, Nj 2368pp

Covers more than 10,000 chemicals with information on properties, production, uses, and other essential facts. The ultimate desk reference for all chemists, this volume is available for \$44 from a number of sources.

CRC Handbook of Laboratory Safety [2nd Edition]

Ed. N.U. Steere, CRC Press 864pp

The CRC Handbook is a valuable resource, and includes standard laboratory safety measures as well as procedures for using and disposing of many commonly encountered materials. Well worth the \$90 list price.

Explosives

R. Meyer. 3rd Edition UCH Publisher, Weinheim, FRG 1987 452pp

Covers the entire field, with nearly 500 entries including formulas and descriptions for 120 explosive chemicals as well as 60 fuels and oxidizing agents. This softcover manual is available from Aldrich Chemical for \$128

:LIST OF USEFUL HOUSEHOLD CHEMICALS

Anyone can get many chemicals from hardware stores, supermarkets, and drug stores to get the materials needed to produce explosives or other dangerous compounds. Household sources often contain impurities which can have an adverse effect when used in pyrotechnic reactions. The presence of impurities will often change the sensitivity of an explosive. Whenever possible, it is best to use pure technical grade supplies.

Chemical	Used In	Available at
acetone	nail polish rmvr, paint thnr	Hardware, Drug
alcohol, ethyl	alcoholic drinks, solvents	liquor, hardware
aluminum (foil)	packaging, baking	grocery
aluminum (pwdr/dust)	bronzing powder	paint store
ammonium hydroxide	CLEAR household ammonia	supermarkets
ammonium nitrate	cold packs, fertilizer	drug stores
butane	Cig. lighter refills	drug store
calcium chloride	sidewalk de-icer	hardware
carbon	carbon batter	hardware
ethanol	denatured alcohol	drug store
ethyl ether	auto quick start fluid	auto supply
fuel oil	diesel vehicles	gas stations
glycerine		drug stores
hexamine	Hexamine camp stoves	camping, surplus
hydrochloric acid	muriatic acid (cleaning)	hardware
hydrogen peroxide	hair bleaching solution	salon
iodine	disinfectant(soln in alcohol)	drug store
magnesium	fire starters, heater anodes	camping, plumbing
methenamine	hexamine camp stoves	camping, surplus
nitrous oxide	whipped cream cans, poppers	Gas suppliers, head shops
potassium permanganate	water purification	purification supplier
propane	bottled stove gas	camping, hardware
sulfuric acid	Car battery (refills)	automotive
sulfuric acid	Root destroyer (with solids)	hardware, garden
sulfur	gardening (many impurities)	hardware
sodium hydroxide	Lye, oven cleaners	hardware, grocery
sodium nitrate	fertilizer "nitre"	gardening
sodium perchlorate	solidox (torch pellets)	hardware
toluene	lacquer thinner	paint supply

CHECKLIST OF USEFUL CHEMICALS

The serious explosives researcher soon realizes that if he wishes to make a truly useful explosive, he will have to obtain the chemicals through any of a number of channels. Many chemicals can be ordered through chemical supply companies. To avoid embarrassment, place an order for large quantities of a few unrelated chemicals at each of several companies, and if possible, use separate addresses for each order. A list of useful chemicals in order of priority would probably resemble the following:

LIQUIDS

Nitric Acid
Sulfuric Acid
95% Ethanol
Toluene
Perchloric Acid
Hydrochloric Acid

GASES

Hydrogen
Oxygen
Chlorine
Carbon Dioxide
Nitrogen
Helium

SOLIDS

Potassium Perchlorate
Potassium Chlorate
Picric Acid (powder)
Ammonium Nitrate
Powdered Magnesium
Powdered Aluminum
Potassium Permanganate
Sulfur (flowers of)
Mercury
Potassium Nitrate
Potassium Hydroxide
Phosphorus
Sodium Azide
Lead Acetate
Barium Nitrate

:FUEL-OXIDIZER MIXTURES

There are nearly an infinite number of fuel-oxidizer mixtures that can be produced in the home. Some are very effective and dangerous, while others are safer and (usually) less effective. A list of working fuel- oxidizer mixtures is presented, but the exact measurements of each compound are not set in stone. A rough estimate is given of the percentages of each fuel and oxidizer.

NOTE: Mixtures that uses substitutions of sodium perchlorate for potassium perchlorate become moisture-absorbent and less stable. In general, sodium compounds are much more hygroscopic than their potassium equivalents.

Magnesium can usually be substituted for aluminum. Using magnesium makes the mixture more powerful, but it also increases instability and makes it more shock sensitive. There are some chemicals with which magnesium will react spontaneously, and it decomposes in the presence of any moisture.

Perchlorates can usually be substituted for chlorates. The perchlorate is much more stable, and has a lower safety risk than chlorates. If chlorates must be used they should never be mixed with sulfur or gunpowder. It is a good idea to add a small amount of calcium carbonate to any mixture containing chlorates.

The higher the speed number, the faster the fuel-oxidizer mixture burns after ignition. Also, as a rule, the finer the powder, the faster the burn rate.

Extremely fine aluminum powder is detrimental because the layer of aluminum oxide becomes a significant fraction of the weight when particle size is very small.

As one can easily see, there is a wide variety of fuel-oxidizer mixtures that can be made at home. By altering the amounts of fuel and oxidizer(s), different burn rates can be achieved, but this also can change the sensitivity of the mixture.

:USEFUL PYROCHEMISTRY

In theory, it is possible to make many chemicals from just a few basic ones. A list of useful chemical reactions is presented. It assumes knowledge of general chemistry; any individual who does not understand the following reactions would merely have to read the first few chapters of a high school chemistry book.

potassium perchlorate from perchloric acid and potassium hydroxide
 $K(OH) + HClO_4 \rightarrow KClO_4 + H_2O$

potassium nitrate from nitric acid and potassium hydroxide
 $K(OH) + HNO_3 \rightarrow KNO_3 + H_2O$

ammonium perchlorate from perchloric acid and ammonium hydroxide
 $NH_3OH + HClO_4 \rightarrow NH_3ClO_4 + H_2O$

ammonium nitrate from nitric acid and ammonium hydroxide
 $NH_3OH + HNO_3 \rightarrow NH_3NO_3 + H_2O$

powdered aluminum from acids, aluminum foil, and magnesium

aluminum foil + $6HCl_3 \rightarrow 2AlCl_3 + 3H_2$;
 $2AlCl_3(aq) + 3Mg \rightarrow 3MgCl_2(aq) + 2Al$

The Al will be a very fine silvery powder at the bottom of the container which must be filtered and dried. This same method works with nitric and sulfuric acids, but these acids are too valuable in the production of high explosives to use for such a purpose, unless they are available in great excess.

Reactions of assorted fuel-oxidizer mixtures

Balanced equations of some oxidizer/metal reactions. Only major products are considered. Excess metal powders are generally used. This excess burns with atmospheric oxygen.

$2KNO_3 + 5Mg \rightarrow K_2O + N_2 + 5MgO + \text{energy}$

$KClO_3 + 2Al \rightarrow KCl + Al_2O_3 + \text{energy}$

$3KClO_4 + 8Al \rightarrow 3KCl + 4Al_2O_3 + \text{energy}$

$6KMnO_4 + 14Al \rightarrow 3K_2O + 7Al_2O_3 + 6Mn + \text{energy}$

- END OF THE BOOK. THIS IS APPROXIMATELY LINE NUMBER 3,670 OF THE TOTAL -
