

Expedient Incendiaries

CIA Field Manual

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INTRODUCTION

This manual describes useful incendiaries, igniters, and delays which can be prepared easily by an operator who has a minimum amount of skill and education.

An incendiary may be a material or mixture of materials which when used against wood, rags, paper, straw or other combustible materials will burn with enough heat and flame to be sure of starting a fire. Or an incendiary, usually a different type from the first one, may be used for melting, cutting, or welding metals. Examples of the first type are gasoline, fuel oil, napalm, and fire bottles. An example of an incendiary to use against metals is thermite.

An igniter is a material or mixture of materials which will start an incendiary burning. The best example of an igniter is a match. Because a match is usually not the best thing to use to start an incendiary burning, other kinds of igniters are needed, such as sugar-chlorate and fire fudge.

A delay is a device which an operator uses to make it possible for him to be away from the scene of the fire when the fire starts. At the place where the fire is to be started, the operator will usually arrange the delay, the igniter, and the incendiary in such a manner that he will set the delay, and go away. At the proper time the delay will ignite the igniter, which will then set fire to the incendiary.

The charts, which separately list incendiaries, igniters, and delays, are so arranged that the operator can easily find the incendiary system to use on the objective to be destroyed. By first looking at the incendiary chart, he can find which incendiary will give him the desired destructive effect; from the igniter chart he can determine which igniter to use with this incendiary; and from the delay chart he can determine which delay to use with the previously selected igniter.

For each chart, the items are listed in order of reliability and effectiveness. This is, the best item is first and the relatively poorest is listed last. If an operator needs an incendiary to use against a specific objective, he should use the first incendiary listed on the chart which will work against the objective. If he cannot obtain the chemicals for that incendiary he should go

down the chart until he finds an incendiary which will do the job. The same procedure applies when picking the proper igniter and delay to use.

Of all the formulas described in this manual, only two of low reliability have been included. They are the last two igniters described, fuming nitric acid plus turpentine and calcium carbide-calcium hypochlorite mixture. Both of these igniters are erratic in cold or windy weather. They should be used only when no other igniters are available.

In the description of the method of manufacture of these items, volume measurements as well as weight measurements are given, using ordinary household utensils as volume measuring devices. This eliminates the need for a scale or balance in all but a few formulas where more accuracy is required than is obtainable from volume measurements where granulation or particle size is mentioned, it has been compared to ordinary household items like rice, ground coffee, granulated sugar, and flour. Where alternate materials may be substituted, these are mentioned. Where alternate methods of preparation may be used, they are described. In many instances the appearance of the finished product is also described.

The procedure for using these items is described, especially where placing or positioning is important. Special precautions to be taken are also described.

A list of the materials mentioned in this manual, together with suggested sources, alternate names and other information may be found at the end of this section. As a further aid to the operator who may not be familiar with the metric systems, charts are included for converting distance, weight or temperature from the metric system to English. These charts follow the list of materials.

In a manual of incendiaries it is essential that the operator know the basic rules which make a fire easy to start and increase the destructive effect of the fire after it has been started.

In starting a fire, it is necessary to provide as much exposed surface area as possible of the objective, especially that part of the objective which will be ignited first. Some ways to do this are to use wood with jagged edges, wood shavings

or sawdust, thin pieces of wood rather than thick pieces of wood, crumpled paper rather than flat sheets, and loose paper and rags rather than the tightly baled kind.

The reason for using loose materials with plenty of exposed surface area is to allow more air to come in contact with these materials. The oxygen which is present in air is needed to burn anything. One effective way to supply more air to keep a fire burning is to provide draft. Drafts may be provided by opening doors and windows in a room. If the wind is blowing very strongly the windows should be opened only 5 to 10 cm, or the windows in adjoining rooms should be opened.

The oxygen in the air is used up when anything is burned in the room, which makes it necessary to supply more air to keep the fire burning.

Proper placing of a fire to avoid detection is of the utmost importance. If there is a choice, the fire should be started in a place where it will be concealed well enough to be burning strongly before it is detected. A fire which is detected within the first few minutes after it starts may be extinguished before it has done much damage. The same fire if not detected for five minutes longer may get such a good start that it will be impossible to extinguish it. To hide a fire and still make it strong by getting enough air to it, may be a difficult job.

A good place to start a fire where it will be concealed until it has a good start is in the basement of a building. In addition, the hot gases given off from the fire always go up and will often ignite the area above the fire, increasing the size of the fire and spreading it more swiftly. A closet may be used to conceal a fire, but the door should be partly open to allow more air to get into the closet, or the fire may go out.

Another favorable arrangement for starting fires quickly makes use of surfaces which reflect heat and improve draft. A simple way to do this is to start the fire between two packing cases, with the vertical sides spaced about 10 cm. apart. This arrangement will start the packing cases burning quickly. An alternate arrangement can be made by tipping a table on edge about 10 cm. from a wall and starting a fire between the wall and the table. Or another alternate arrangement that will work well is to swing a door back on its hinges and start a fire in the angular space between the door and the wall.

A general rule to remember is to start a fire at the lowest place possible in the building because the heat and flame travel upward to spread

the fire quickly. That is one of the reasons why a fire started in the basement is effective, aside from the fact that a basement fire will not usually be detected until it has gotten a good start. The same reason makes starting a fire in an attic less desirable even though the sloping roof makes a good reflector when a fire is started in the attic at the place where the floor and the roof meet. A fire will travel slowly down a building, but it will travel upward rapidly.

A number of small fires started at the same time instead of one large fire, especially on readily combustible materials, may often spread more quickly and be more difficult to control.

There are some things to avoid in making fires. Wood which has been charred in a previous attempt to start it burning should not be used to try to start a fire because it is difficult to ignite. Painted wooden surfaces are very difficult to ignite and should not be used to start fires. If a baffle or reflector is made from furniture, one should always try to have an unpainted surface toward the fire. Surfaces covered with wall paper burn poorly because the dried paste underneath is hard to burn.

Wet wood or other wet combustible materials are difficult to ignite and should not be used whenever possible.

In general, the slow persistent and relatively cool fires from napalm, wax, and flammable liquids are best where the objects are hard to ignite and where the starting fire can be well hidden. The very hot fires such as from thermite and related white-hot burning incendiaries are best for easier ignitable articles, especially those in containers which need a hole burned through to get at the burnable material. Large amounts of very hot incendiaries are not only excellent, nearly instantaneous fire-producers but are likely to cause a panic because of the element of surprise and the strong action.

By following the rules just given, the operator should be able to start a fire successfully under almost any kind of conditions.

All the formulas described in this manual should first be tested at home or at any other place where the operator will not be detected, to be certain that they will perform properly.



DESCRIPTION OF MATERIALS REQUIRED

MATERIAL	ALTERNATE NAME OR NAMES	WHEN ORDINARILY USED	WHERE IT MAY BE OBTAINED	COMMENTS
Flake aluminum Powder	Silver Bronzing Powder	In making aluminum paints, silver inks, dry silver bronzing	Paint supply stores, art supply stores	Any grade of flake aluminum powder will work
Red Iron Oxide	Jeweler's rouge crocus, polishing crocus	Paint pigment, polishing compounds	Paint supply stores, hardware stores, art supply stores	
Black Iron Oxide	Black rouge	Paint pigment, polishing compounds	Paint supply stores, hardware stores, art supply stores	The coarse flakes "hammerschlag" are found where iron is heated very high, smithies, foundries, steel mills
Potassium Chlorate	Potassium oxymuriate	Medicinal purposes, disinfectant	Drug store	
Potassium Permanganate		Medicine, disinfectant, deodorant, wood preservative, photography	Drug stores, photographic supply stores	
Potassium Nitrate	Saltpeter, niter, nitre	Pickling meat, fertilizer	Grocery stores, garden supplies, drug stores	
Paraffin Wax	Ceresin	Making candles, waterproofing	Grocery stores, hardware stores	May be bought as paraffin candles. Most any wax (beeswax may be substituted).

DESCRIPTION OF MATERIALS REQUIRED (continued)

MATERIAL	ALTERNATE NAME OR NAMES	WHERE ORDINARILY USED	WHERE IT MAY BE OBTAINED	COMMENTS
Sodium Chlorate		Weed killer, medicine	Garden supply, drug store	
Sodium Nitrate	Chile Saltpeter, soda niter, nitratine	Fertilizer, medicine	Garden supply, drug store	
Potassium Dichromate	Potassium Bichromate, red potassium chromate	Electroplating, etching, brass pickling, leather tanning, poison fly paper, photography	Hardware store, photographic supplies, electroplating shops	
White Phosphorus	Yellow Phosphorus	Rat poison, medicine	Probably only at chemical supply houses	Do not use red phosphorus
Carbon Disulfide	Carbon Bisulfide	Solvent, insecticide	Probably only at chemical supply houses	
Sodium Peroxide	Sodium dioxide, sodium binoxide	Germicide, disinfectant, bleaching agent, water purification	Drug stores, chemical supply houses	
Magnesium Powder	Photoflash powder		As filings or drillings from a machine shop	Commercial photoflash powder may contain various oxidizers
Sulfur	Brimstone, sulfur flour, flowers of sulfur	Insecticide, fungicide, medicine, fumigant	Garden supply, drug stores	Any grade of finely ground sulfur may be used

DESCRIPTION OF MATERIALS REQUIRED (continued)

MATERIAL	ALTERNATE NAME OR NAMES	WHERE ORDINARILY USED	WHERE IT MAY BE OBTAINED	COMMENTS
Benzene	Benzol, coal naphtha	Dry cleaning, cleaning metal parts	Machine shops, dry cleaning shops	
Toluene	Toluol, methylbenzene, methylbenzol	Ink solvent, paint solvent for fats and oils, leather dressings	Paint shop, printing shop, shoe factory	
Silver Nitrate	Lapis castic, lunar caustic, nitrate of silver	Silvering glass photography, medicine	Photographic supply shop, drug store	
Ammonium Nitrate	Nitrate of Ammonia	Fertilizer	Garden supply store	
or Calcium Carbide		Illuminating and heating purposes	Hardware stores	
Calcium Hypochlorite	Bleaching Powder, chlorinated lime, chloride of lime	Bleaching agent for clothes, deodorant, disinfectant	Grocery store, hardware store, drug store	Use only the dry powder, not the solution of calcium hypochlorite
Zinc Dust	Spelter	Anticorrosive paint	Paint stores	
Barium Nitrate	Nitrate of Baryta	Manufacturers of fireworks, colored flares	Chemical suppliers	
Fuming Nitric Acid	Aqua fortis, azotic acid	Etching or cleaning metals	Electroplating shops	The fuming grade of acid is very concentrated and may be available only at chemical supply houses

DESCRIPTION OF MATERIALS REQUIRED (continued)

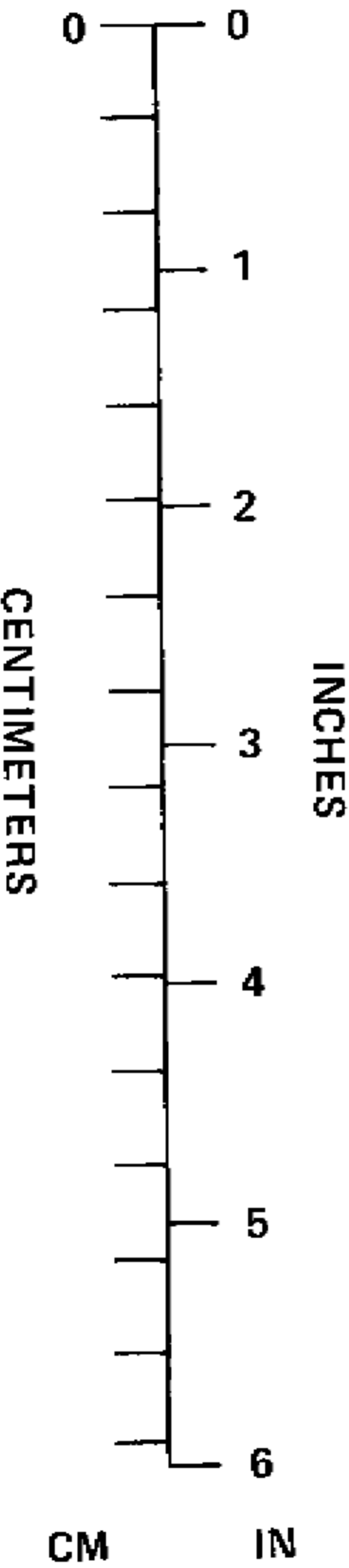
MATERIAL	ALTERNATE NAME OR NAMES	WHERE ORDINARILY USED	WHERE IT MAY BE OBTAINED	COMMENTS
Sulfuric Acid	Oil of Vitriol, battery acid	Storage batteries, cleaning metal	Storage batteries, metal-working shops	Battery acid will usually have to be concentrated by boiling before it can be used
Turpentine	Oil of turpentine, spirits of turpentine	Paint, Germicide, ink, solvent, polish	Paint stores	
Glycerin	Glycerol	Food, cosmetics, sweetening agent	Drug stores	
Gelatin Capsules		Drugs, animal medication	Drug stores, animal stores	The large capsules used for giving drugs to animals are required
Carbon Tetrachloride	Perchloromethane, tetrachloromethane	Dry cleaning, metal degreasing	Dry cleaners, metal working shops	
Calcium Chloride		Killing weeds, cement mortars, thawing ice	Garden supply stores, building	Lately sold for drying out basements in humid climates
Sodium Hydroxide	Caustic soda, soda lye, sodium hydrate	Making soap, cattle or sheep dip cleaning compounds	Grocery stores, drug stores, metal working shops	
Cupric Chloride	Copper bichloride, copper dichloride	Etching agent for galvanizing iron, photography	Paint stores, photographic supply stores	

DESCRIPTION OF MATERIALS REQUIRED (continued)

MATERIAL	ALTERNATE NAME OR NAMES	WHERE ORDINARILY USED	WHERE IT MAY BE OBTAINED	COMMENTS
Cupric Sulfate	Blue stone, blue vitriol, Roman vitriol	Fungicide, insecticide, copper plating, photo- engraving	Garden supply stores, plating shops, printing shops	



CONVERSION TABLES



DEGREES CENTIGRADE	DEGREES FAHRENHEIT
100	212
95	203
90	194
85	185
80	176
75	167
70	158
65	149
60	140
55	131
50	122
45	113
40	104
35	95
30	86
25	77
20	68
15	59
10	50
5	41
0	32

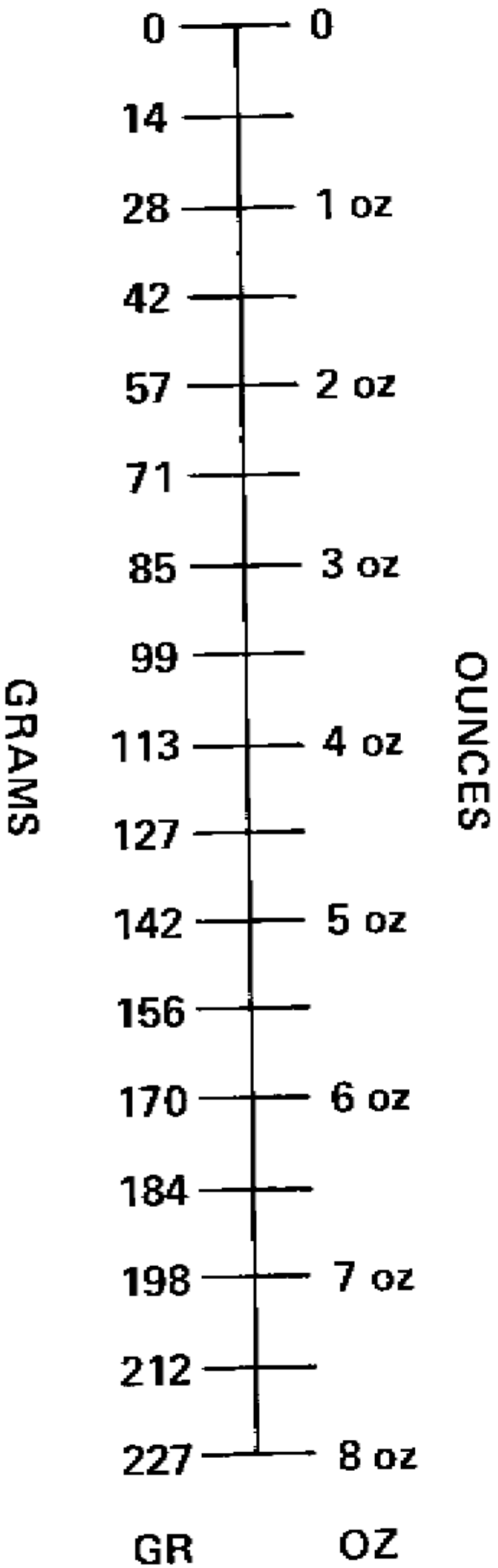


TABLE OF INCENDIARIES

INCENDIARY	TO BE USED AGAINST	IGNITED BY	COMMENTS
1. Napalm	Paper, straw, inflammable solvents, wooden structures. Is the best incendiary against wet wood.	All igniters except white phosphorus solution and time fuse.	Excellent incendiary, very destructive, easily ignited, long burning. Adding a few pieces of charcoal increases the effectiveness
2. Paraffin-sawdust	Paper, straw, rags, all kinds of wooden structures	All igniters except: turpentine-fuming nitric acid, calcium hypochlorite, and time fuse	Very destructive, starts slowly, easily prepared
6 3. Fire Bottles	Paper, straw, rags	Breaking of the bottle by throwing it against something	Starts a number of small fires simultaneously
4. Thermate	Burning through, melting, welding metals	All igniters, time fuse	Hot and very fast. Hazardous because of extreme sensitivity to flame or sparks.
5. Thermite (flake aluminum)	Burning through, melting, welding metals	All igniters except: turpentine-fuming nitric acid, calcium carbide-calcium Hypochlorite. May ignite from time fuse	Made from flake aluminum and powdered iron oxide. Very hot flame, hot molten slag; very fast burning

TABLE OF INCENDIARIES (continued)

INCENDIARY	TO BE USED AGAINST	IGNITED BY	COMMENTS
6. Commercial thermite	Burning through, melting, welding metals	Flake aluminum thermite, potassium dichromate-aluminum powder, flake aluminum-sulfur pellets, thermate	Very difficult to ignite. Very fast acting.
7. Flammable liquids (gasoline, kerosene, benzene, mineral oils)	Paper, straw, rags, wooden structures	All igniters except white phosphorus solution and time fuse	Very effective for starting a large area burning all at once when the solvent is poured out
8. Paint, lacquer, aluminum paint	Paper, straw, rags, thin wooden structures	All igniters except phosphorus solution and time fuse	Cool burning when left in a can, much hotter when in a non-metallic container or when spilled out
9. White phosphorus solution	Paper, straw, oily rags, loose tinder materials	Self-igniting when solvent evaporates	Relatively cool flame, very persistent. Dangerous to handle. Spilled solution on the skin can cause painful burns

NAPALM INCENDIARY

To Be Used Against:

Crumpled or loosely piled paper, straw, piles of rags, loose tinder materials, and all types of wooden structures. Also, inflammable fuel oils, such as kerosene, gasoline, and turpentine when they are exposed in open tanks or barrels. Napalm incendiary may be used to ignite piles of coal and coke, and baled flammable materials such as cotton, wool, and paperboard. It will not ignite sacks of staple foodstuffs such as sugar, flour, rice, nuts, and beans. Napalm incendiary is unfit for igniting combustibles in closed metal containers, because it burns at too low a temperature.

Can Be Ignited By:

All igniters except white phosphorus solutions. Napalm incendiary will not be directly ignited by the various kinds of fuze-trains such as a Bickford fuze, fire-cracker fuze, and the homemade string fuze.

Advantages.

1. Made from readily available materials.
2. Very easy to prepare with minimum hazard.
3. Can be used to destroy many objectives.
4. Readily ignited.
5. Sticks to objects, even on vertical surfaces.
6. Long burning.

Disadvantages:

1. Gasoline odor may identify it as an incendiary.
2. Cannot be ignited directly by a fuze.

Materials Needed:

Soap powder or soap chips (bar soap can easily be chipped), and any of the following: gasoline, fuel oil, diesel oil, kerosene, turpentine, benzol, toluol. Charcoal may be added to the napalm before use and is recommended for using against objects that are more difficult to ignite. So-called detergents ("soapless soap") cannot be used in place of real soap in this item.

Equipment Needed:

A double boiler made from any material, with the upper pot having a capacity of at least 500 cc; a cup or can for measuring; a spoon or stick for stirring; a source of heat such as a stove or hot plate; a knife or grater if only bar soap is available.

Preparation:

Fill the bottom of the double boiler with water and heat until the water boils. Put the upper pot on top of the bottom pot, then remove both containers to a point at least 5 feet (2 meters) from the vicinity of any flame or hot plate. Into the upper pot of the double boiler pour one cup or can filled with any kind of soap chips or powder. Using the same sized container, add to the contents of the upper pot, one full cup of any one of the liquids listed under "MATERIALS NEEDED". Stir the mixture with a stick or spoon until it thickens to a paste, having about the same consistency as jelly or marmalade. Do this in a well ventilated room where the vapors can escape, because they may burn or explode from a flame or spark. If the mixture has not thickened enough after about 15 minutes of stirring, boil the water in the lower pot again, first setting the upper pot at least 5 feet (2 meters) to one side. Again set the upper pot in the boiling water and repeat the stirring process until the soap mixture reaches the proper jelly-like consistency. When the proper consistency is obtained store the finished napalm in a tightly sealed jar or can until it is required for use. Napalm mixtures will keep for some months if stored in a container with a tight-fitting lid where the mixtures' solvent cannot evaporate.

Alternate Procedure:

Where the source of heat is not available, a napalm mixture can be prepared by a cold method. This mixture will perform almost as well as that made by the hot method just described.

To prepare the cold stirred napalm, add one cup or can full of soap chips or soap powder to a pot, then add part of a cup of gasoline or one of the other solvents and stir the mixture with a stick or spoon until smooth. Then add more of the solvent slowly while stirring until the mixture becomes pasty, or has the same consistency of jelly. This mixture will also keep well if stored in a tightly sealed can or jar.

Application:

To use napalm most effectively on easily ignitable materials (i.e., loosely piled paper, rags, or hay), it should be spread out so that when it is ignited it will start a large area burning at once. Tightly baled paper and rags should be loosened first, because they do not burn well. For igniting wooden structures it is necessary to burn at least a kilogram of napalm massed in one corner to get the strong updraft which is needed to burn heavier wood structures. The same concentration of fire should be the rule for all large articles which are difficult to ignite. If over a half dozen pieces of charcoal, about the size of small apples, are put into and around the napalm, the destructive effect is considerably increased. The charcoal will ignite readily and the persistent glow from the charcoal fire will outlast the burning of the napalm. Some of the materials that the napalm and charcoal combination will burn are, baled woolen rags, fats, and nuts in their shells. Napalm incendiary alone is ineffective against these items. Whenever the charcoal is available it should always be used, provided that it can be done without arousing suspicion. In these cases, it may be more desirable to confine the napalm in a cardboard container, paper cup, or open wooden box.

Quantities Required: (Minimum)

For readily ignitable loose materials	1/4 liter
For light wooden structures	1/2 liter
For heavy wooden structures, bulk items, nuts, and tightly baled materials	1 liter

Napalm should not ordinarily be used with a delay of over an hour because the gasoline will evaporate and make the napalm ineffective. In very hot weather, or if the napalm is exposed to the direct rays of the sun in warm weather, a delay time of not more than 15 minutes should be used. In any application where the napalm is to be used in hot rooms or in hot weather it is suggested that the napalm be made with fuel oil instead of gasoline.

In extremely cold weather napalm ignites readily, and it is recommended that the napalm used here, be made with gasoline.

When it is desired to use a piece of fuze as a time delay for igniting napalm an additional igniter must be used because fuze will not ignite napalm directly. Pile a spoonful of sugar-chlorate mixture on the napalm and insert the end of a piece of fuze into the sugar-chlorate. When the other end of the fuze is lit it will give a delay system that will ignite the napalm incendiary.

PARAFFIN - SAWDUST INCENDIARY

To Be Used Against:

All kinds of wooden structures including heavy beams and timbers. Paraffin-sawdust works very well on paper, rags, straw, excelsior, and other tinder type materials. It will work well for starting fires in open containers of flammable liquids, piles of coal, coke, or lumber and on baled rags and paper. Do not use it against metallic objects.

Can Be Ignited By:

The flame of a match. It ignites slowly enough to be safe when ignited this way. When a delay is required, use any igniter or delay device which produces a flame except for white phosphorus solutions, turpentine-fuming nitric acid mixture, calcium carbide-calcium hypochlorite mixture, and all kinds of time fuze.

Advantages:

1. Materials are readily available.
2. Easily prepared.
3. Ignites readily.
4. Very destructive to many materials.
5. May be stored indefinitely.
6. Safe to carry.
7. All or part of the paraffin wax may be replaced by beeswax, but not by vegetable or animal fats and greases.

Disadvantages:

1. Starts slowly, and takes a relatively long time to ignite large, bulky materials.

Materials Needed:

Sawdust, paraffin wax, beeswax, or wax obtained by melting candles.

Equipment Needed:

A pot, a source of heat such as a stove or hot plate, a spoon or stick for stirring.

Preparation:

The pot used can be made of any material and should hold at least 2000 ml. Put enough paraffin or other wax in the pot so that it is about half full. Heat the pot on a stove or hot plate until the wax melts. Wax candles will work very well as a source of wax. Take the heated pot off the stove or hot plate. Add sawdust to the melted wax until the pot is nearly full, and stir the mixture with a spoon or stick for a few minutes. Be sure that there is no layer of wax at the bottom of the pot which has not been mixed with the sawdust. Continue to stir the mixture until the wax has cooled enough to become solid again. Transfer the sawdust-wax mixture to a can or jar, or store it in a paper bag or box. The mixture may be stored for months without losing its effectiveness, unless it gets wet. When it dries, it will again be effective.



PARAFFIN – SAWDUST INCENDIARY

Application:

An easy, effective way to use this mixture is to place a quantity of about a liter of mixture into a paper bag and put the paper bag down on the objective to be burned. A match may be used to ignite the edge of the bag which will then ignite the paraffin-sawdust mixture. The fire starts very slowly so there is no hazard involved, and it usually takes two or three minutes before the paraffin-sawdust mixture is burning strongly. This, of course, is a disadvantage where a hot fire is required quickly. Once started, however, this mixture burns vigorously because the paraffin itself gives a fairly hot flame and the sawdust acts like charcoal to increase the destructive effect.

Where a longer delay time is required, use a delay or igniter mentioned under "CAN BE IGNITED BY." Note that a fuze will not ignite this mixture. Where very large wooden beams or structures are to be burned, use more of the mixture. A bag containing two or three liters will be enough to destroy any objective on which paraffin-sawdust mixture can be used effectively.

To be most effective on wooden structures, this mixture should be in a pile, never spread it out in a thin layer. Place it under the object to be burned if possible, so that the flames will contact the object. In a packing box or in a room, place the mixture at the bottom in a corner.

Cold and windy weather have little effect on the way paraffin-sawdust mixture burns except that in windy weather it may burn more vigorously. As stated before this mixture can be stored for months without losing any of its effectiveness.

A similar incendiary may be made by melting some paraffin or beeswax, then dipping sheets of paper in the molten wax for a few seconds. Remove the paper and let the wax harden. This waxed paper lights readily from a match and burns hotly. Although not quite as hot or persistent as the paraffin-sawdust mixture, the waxed paper is an excellent incendiary and may be substituted in many instances. The paper may be wadded up, folded, or torn into strips. Ordinary household wax paper is not as good because it has a much thinner coating of wax, but it is a fairly good incendiary for readily ignited materials. Use enough waxed paper to equal in volume the amounts required for the paraffin-sawdust mixture.

FIRE BOTTLE INCENDIARIES

To Be Used Against:

Paper, rags, excelsior, straw and other tinder type materials. These fire bottles are very good for igniting tanks of flammable liquids in open top containers.

Can Be Ignited By:

Breaking the bottle by throwing it against a hard surface.

Advantages:

1. A fire bottle can start a large number of small fires at once on readily ignited materials.
2. The bottle is previously prepared and requires no setting-up at the place where it is to be used.
3. It does not look like an incendiary device.
4. It requires no skill to use it.

Disadvantages:

Limited in the number of materials which it will destroy.

Materials Needed:

Potassium chlorate or sodium chlorate, gasoline, kerosene, or fuel oil, absorbent paper, concentrated sulfuric acid, sugar, string or rubber bands.

Equipment Needed:

A bottle of at least 500 cc capacity, a copper enamel or heat-resistant glass pot, a source of heat such as a stove or hot plate.

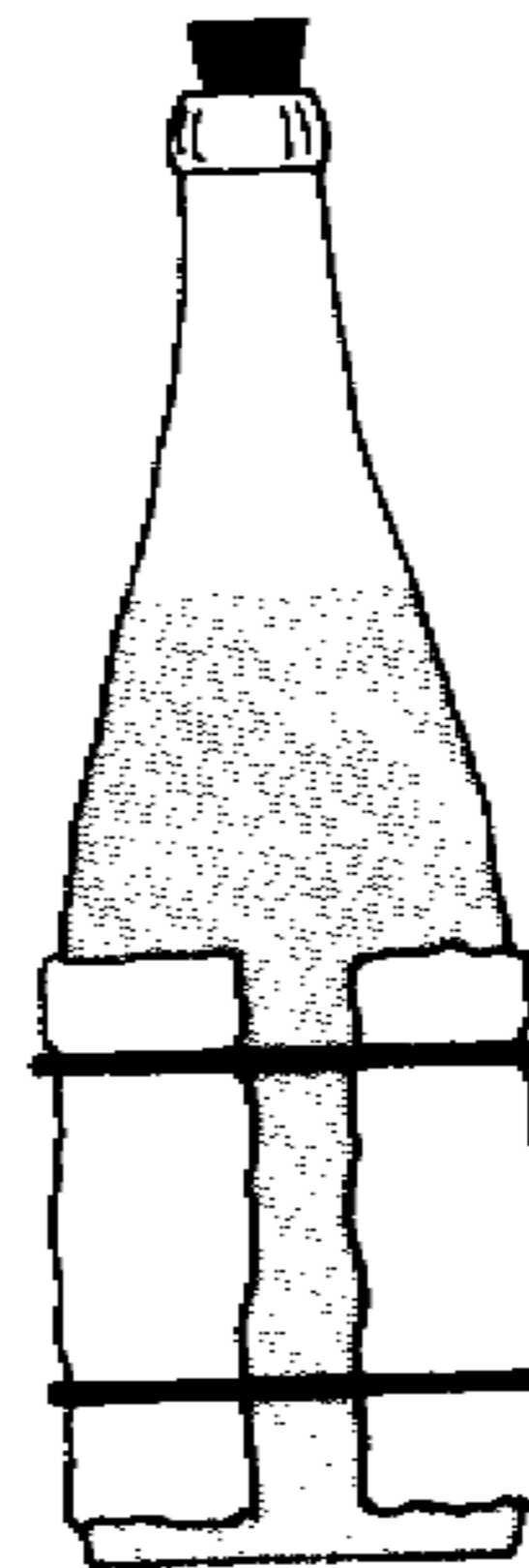
Preparation and Application:

Many variations of fire bottles may be prepared, but the ones described here are the easiest to prepare and work very well. All fire bottles work in the following manner: a mixture of gasoline or fuel oil and concentrated sulfuric acid in a glass bottle is thrown against a solid object to break the bottle. When the sulfuric acid comes

in contact with a mixture of sugar and potassium chlorate or sodium chlorate, attached to the outside of the bottle, a fire results, and this in turn ignites the gasoline or fuel oil. The advantage of a fire bottle is that it is a self-contained incendiary and requires no additional ignition system.

To prepare a simple fire bottle, put enough concentrated sulfuric acid into a bottle so it is about one-third full. The bottle should have at least 500 cc capacity but should not be so big that it cannot be thrown easily. Add gasoline, kerosene, or fuel oil until the bottle is almost full. Securely stopper the bottle with a cork, a rubber stopper, or a metal cap or lid. Rinse off the outside of the bottle to be sure there is no acid remains, then dry the bottle.

Now boil about 250 cc of water in a pot, any kind will do, then add a full cup of sugar and a full cup of sodium chlorate or potassium chlorate. Stir for a few minutes with a spoon. Allow this solution to cool to where it is just warm to the touch. Either dip the lower two-thirds of the bottle in this solution or swab or brush some of the solution on the lower two-thirds of the bottle. Set the bottle aside to dry for twenty-four hours or longer. The bottle is now ready for use and may be stored for several weeks without losing its effectiveness. To use, throw it against an object with enough force to break the bottle. It will catch fire immediately and burn the gasoline or fuel oil which has been scattered by the breaking bottle.



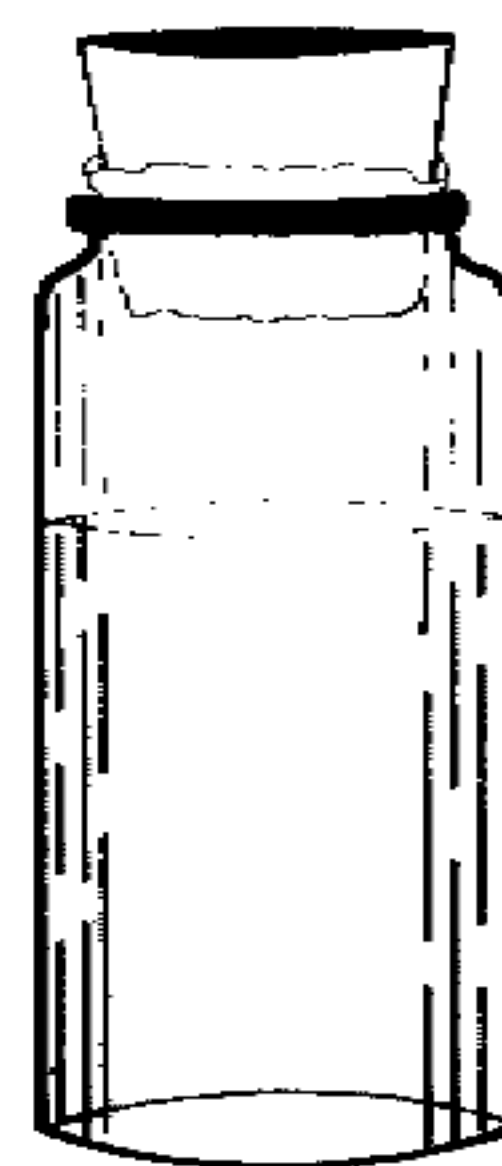
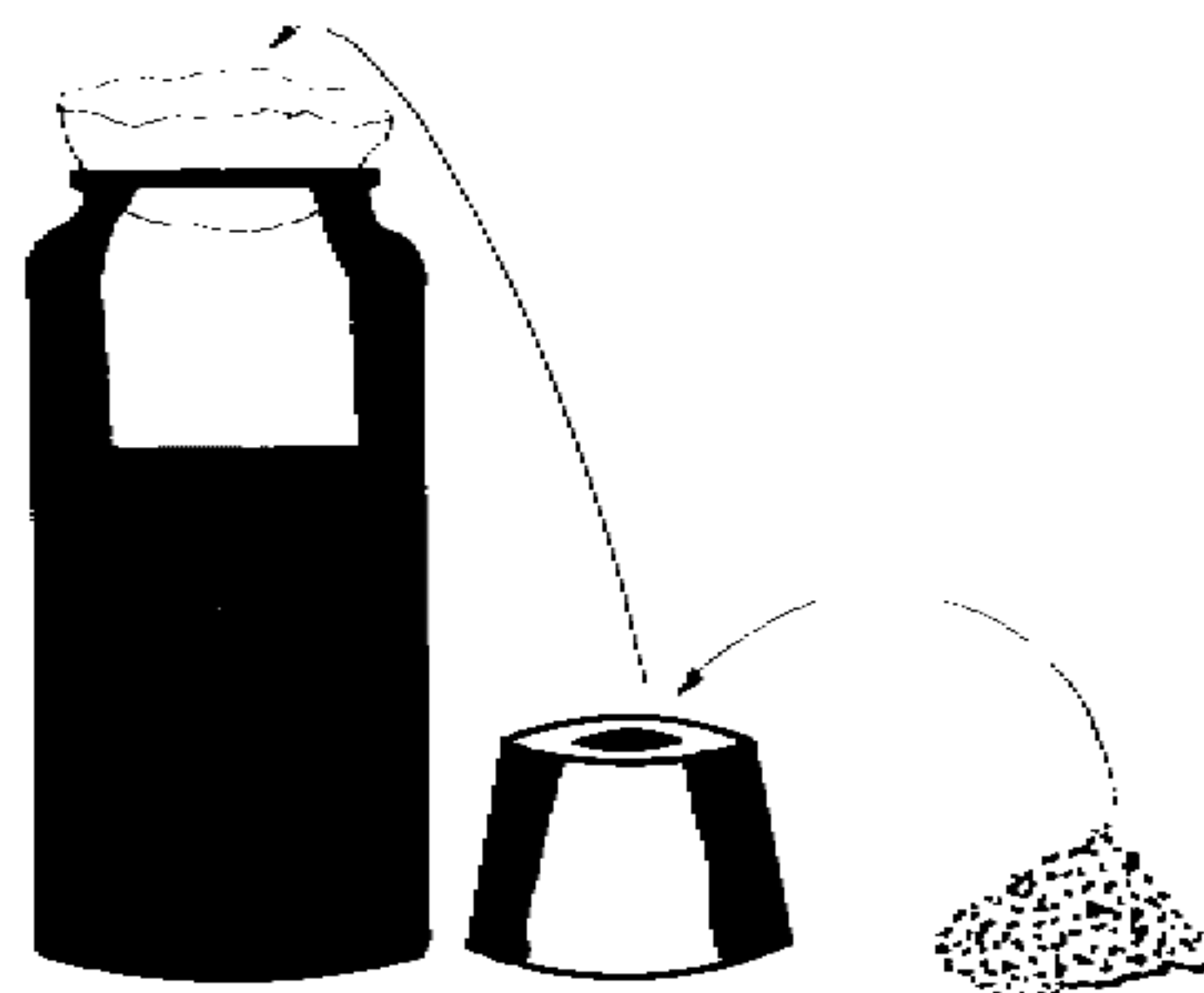
FIRE BOTTLE INCENDIARY

A variation of this, and one which also works well, is to dip pieces of absorbent paper such as newspaper, toilet paper, or paper towels into the hot solution of sugar and sodium chlorate or potassium chlorate. This paper is allowed to dry at least twenty-four hours and then wrapped around the bottle of gasoline and sulfuric acid. Hold the paper in place with a piece of string or a rubber band. This treated paper can be stored separately then wrapped on the bottle just before it is to be used. This practice eliminates the need to store bottles which have a white film or coating on them. White coated bottles stored on a shelf may look suspicious.

One other kind of fire bottle can be made. This does not need to be thrown to ignite it. When properly placed it does have a delay time before it ignites. To make this type of fire bottle, put one-half sulfuric acid and one-half of either fuel oil or gasoline in a bottle and fill it to within two or three centimeters of the top. It is best to use a bottle with a wide mouth, and the stopper used must be either rubber or cork. Before putting the stopper in the bottle, drill a hole in the bottom of this stopper, large enough to hold at least two spoonfuls of material. But do not drill the hole all the way through the stopper. Fill this hole with a dry mixture of ordinary granulated sugar blended with either sodium chlorate or potassium chlorate, use one spoonful each. Wrap a piece of thin rubber sheet from a balloon or a condom around the stopper so that this mixture in the hole cannot fall out. Force the stopper down hard on the bottle so that it seals tightly. The drilled end of the cork containing the mixture must be on the inside of the bottle but be sure the rubber membrane is not touching the gasoline or fuel oil. This bottle may be stored this way for weeks. When it is desired to use this fire bottle, tip it upside down so that the stopper is on the bottom, and leave it that way. The sulfuric acid in the bottle will sink to the bottom, eat through the rubber membrane, and react with the mixture of sugar and chlorate. This reaction will either blow out the stopper or break the bottle and ignite the gasoline or fuel oil in a ring around the bottle.

Fire bottles do not give a very hot flame, nor do they usually burn very long. They are useful on very readily ignited materials where the scattering of the burning oil or gasoline will start a number of fires at once. Do not attempt to use a fire bottle on wooden structures.

In throwing a fire bottle to break it, the bottle should be thrown downward so that the sulfuric



FIRE BOTTLE INCENDIARY AND PARTS

acid is sure to come in contact with the sugar-chlorate, otherwise ignition will not occur.

Fire bottles work well in cold and windy weather, except that in extremely cold weather the fire bottle which is used with a rubber membrane delay may take a longer time. In some cases it may not work at all if it is cold enough to freeze the sulfuric acid. It is best not to use any delay which uses sulfuric acid in temperatures below 5°C. Always check this delay time by running a test on another bottle first.

Concentrated sulfuric acid must be used in all fire bottles. Dilute sulfuric acid from a storage battery does not work and must be concentrated. To concentrate storage battery acid, heat it in a container made of copper, enamelware, or glass until dense, white fumes are given off, then stop heating.

THERMATE INCENDIARY

To Be Used Against:

Metal objects or structures to melt, weld or cut holes in them. Thermate will also directly ignite paper, rags, excelsior, straw, and other tinder type materials. It is not recommended for burning wooden structures or other materials where persistent heat is required.

Can Be Ignited By:

Sugar chlorate, sugar sodium peroxide, aluminum sodium peroxide; if the metal in it is flake aluminum or fine magnesium powder, it may ignite from Bickford fuze, fire-cracker fuze or homemade fuze.

Advantages:

1. Somewhat easier to ignite than thermite.
2. Burns very hot, ignites thermite.
3. Easily prepared.

Disadvantages:

Thermate burns out too quickly to be an effective incendiary for most combustible materials.

Materials Needed:

Aluminum filings or powder, or magnesium filings or powder. Either metal may be used. In addition, any of the following chemicals are required: potassium nitrate, sodium nitrate, barium nitrate, potassium dichromate, sodium dichromate, and potassium permanganate.

Equipment Needed:

A spoon or a cup for measuring, a can or jar with a tight fitting lid. This container should have a capacity of at least 1000 ml.

Preparation:

To make thermate, aluminum powder or magnesium powder are required. Either may be used, although thermate made from magnesium is generally easier to ignite. Filings or the dust resulting from sawing aluminum or magnesium

may be used. Chips from a lathe or drill or other machining operations are too large and cannot be used. Any of the magnesium powders used must be at least as fine as coarse ground coffee. Aluminum powders should be at least as fine as ordinary granulated sugar. Flake aluminum is excellent for this purpose.

Any of the non-metal chemicals mentioned under "materials needed" may be mixed with either aluminum powder or magnesium powder. These chemicals called oxidizing agents, should be no coarser than granulated sugar.

To prepare thermate first fill the jar or can about one-third full of the metal powder, then add about the same volume of oxidizing agent, so that the container is about two-thirds full. Put the lid on the container, then roll and tumble it in the hands for at least two minutes to completely mix the chemicals. The proportions of chemicals used as just described will be suitable for all mixtures except where flake aluminum is the metal. When flake aluminum is the metal powder used, first fill the container about half full of the flake aluminum then add oxidizing agent until the container is three-fourths full. Mix this the same way as the other mixtures. Thermate in a sealed container may be stored for months and will remain effective.

Application:

Thermate incendiary should be mainly used for destroying metal objectives because it gives an intensely hot flame for a very short time. To use it most effectively, pile at least a pound (500 g) on top of any small object to be destroyed or damaged. On larger objects more thermate will be needed. When the thermate is made from magnesium powder or flake aluminum it is easily ignited by Bickford fuze, fire-cracker fuze, homemade string fuze, and by any kind of delay device which produces a flame. When the thermate is made from aluminum powder rather than flake aluminum, it is much more difficult to ignite and requires a much hotter igniter. The ones recommended for this purpose are sugar-chlorate, sugar-sodium peroxide, and aluminum powder-sodium peroxide.

Thermate works well in cold or windy weather. Although it will ignite readily combustible materials like paper, rags or straw, its use is not recommended because it burns out too quickly.

Never attempt to ignite thermate without a delay time of at least ten seconds because it burns very hot and very rapidly. Anyone nearby could be badly burned when it ignited.

If possible, the amount of thermate used to achieve the desired destructive effect, should be tested first by using it on a similar objective, before using it against the real objective.

FLAKE ALUMINUM THERMITE INCENDIARY

To Be Used Against:

The most important use for flake aluminum thermite is to melt, weld, or cut holes in metal. It may also be used to start fires in paper, rags, excelsior, straw and other readily combustible materials. But on most other materials it is not effective because it burns out too quickly to ignite them even though it burns hotly. Flake aluminum thermite should not be used against wooden structures.

Can Be Ignited By:

Fire-cracker fuze, Bickford fuze, and sometimes by homemade string fuze. It ignites from all igniters and delays which produce a flame except for white phosphorus solutions, fuming nitric acid - turpentine igniter, and calcium carbide-calcium hypochlorite igniter. Because it is easy to ignite, this distinguishes it from ordinary thermite which is very difficult to ignite.

Advantages:

1. Easily prepared.
2. Easily ignited.
3. Materials readily available.

Disadvantages:

Burns out very quickly, cannot be used against wooden structures.

Materials Needed:

Flake aluminum powder, and finely powdered red iron oxide or black iron oxide. If iron oxide is not available, the following materials can be used, all in finely powdered form: barium peroxide, red lead, manganese dioxide, lead dioxide, ferric sulfate, plaster of Paris, aluminum sulfate, anhydrous copper sulfate, and anhydrous sodium sulfate.

Equipment Needed:

A spoon or a small container for measuring, a can or jar with a tight fitting lid. The can or jar should be at least one liter capacity and must be clean and dry.

Preparation:

Put enough flake aluminum into the jar or can so that it is about one-third full. Add enough of the powdered iron oxide so that the jar or can is about two-thirds full. Put the lid on tight, shake and tumble the container vigorously for at least three or four minutes to thoroughly mix the two ingredients. This flake aluminum thermite is now ready to use. It can be stored in a sealed container for months without losing its effectiveness.

Application:

To use flake aluminum thermite most effectively, a volume of at least a liter should be used on small metal objects or thin metal plates. Place it in a pile on top of the object to be destroyed. Leave the thermite in the metal can or pour it out in a pile and place it so that it directly touches the objective. The one liter amount will usually burn a hole through a thin steel plate no more than 1mm thick. Much of the destructive action of this flake aluminum thermite is due to the hot molten slag produced, which is why the thermite should always be put directly on top of the objective.

Sometimes homemade string fuze will ignite flake aluminum thermite, but to be sure of igniting it, use a hotter igniter. Some igniters that work well are sugar-chlorate, sugar-sodium peroxide, match heads, and aluminum powder-potassium dichromate.

Cold or windy weather does not have any effect on the way flake aluminum thermite burns or on its ease of ignition.

When iron oxide is not available, any of the other chemicals listed as substitutes can be used. The mixing procedure is exactly the same. The resulting mixtures will behave very much like thermite made with iron oxide except that the slag or residue is not as hot and therefore will not do as much damage. Because of this, it is recommended to use twice as much of these latter formulations compared with the regular flake aluminum, iron oxide mixture.

COMMERCIAL THERMITE INCENDIARY

To Be Used Against:

Metal objects or structures where it is desired to melt, weld, or cut holes in them. Thermite will directly ignite paper, rags, excelsior, straw, and other tinder type materials. It is not recommended for moderate or heavy wooden structures or other applications where a persistent heat or flame is necessary.

Can Be Ignited By:

Only by flake aluminum thermite, potassium dichromate-aluminum powder igniter, flake aluminum-sulfur pellets, and thermate. No other igniters can be depended upon for igniting commercial thermite. Commercial thermite is very difficult to ignite, because a very high temperature is required.

Advantages:

1. Sometimes it may be obtained already mixed, or it may easily be mixed from readily available materials.
2. It is very safe to transport because it is so difficult to ignite.
3. It will penetrate a sealed metal container and ignite its flammable contents.

Disadvantages:

Aluminum powder or filings, iron oxide flakes or powder.

Equipment Needed:

A spoon or cup for measuring, a large jar or can of at least 1000 cc capacity with a tight fitting lid.

Preparation:

Sometimes thermite may be available already mixed. It is used in shipyards and on railroads for welding and repairing. Usually the particle sizes in commercial thermite are about the same as coarse ground coffee. When none of

the ready mixed thermite is available, it can be prepared by mixing aluminum filings or powder with iron oxide. The aluminum may be small particles obtained from the filings or sawing of aluminum. Larger chips from a lathe or drill are too large and cannot be used. The particles must be as small as coarse ground coffee or smaller. The iron oxide may be either red iron oxide commonly called jeweler's rouge or black iron oxide commonly called hammerscale or magnetic iron oxide. The black iron oxide is commonly found around forges and steel mills or foundries. Whichever iron oxide is used it should be no coarser than coarsely ground coffee.

To prepare thermite, fill the large can or jar about one-third full of aluminum powder or filings, add an equal volume of iron oxide, and put the lid on the can or jar. Shake and tumble it vigorously for at least two minutes to blend the mixture. It is now ready for use and can be stored for months in the closed container.

Application:

Thermite is used mainly for destroying metal objects. To use it most effectively place it in a pile on top of the object to be destroyed, or burn it directly in a can placed on top of the objective. Although exact quantities to use cannot be given for each object, never use less than 500 cc of the thermite. On larger objectives more thermite will naturally be required to melt or deform them. One full 500 cc measure will burn a hole through a 1/4 inch (0.7 cm) steel plate. Most of the destructive action of thermite is due to the hot, molten slag left when it burns, therefore thermite should always be placed on top of the objective.

Most igniters will not ignite thermite. Use only those igniters mentioned under "CAN BE IGNITED BY". These are the only ones which will dependably ignite thermite. Always insert the igniter so that it is in the thermite; never place the igniter on top of the thermite.

Thermite burns well in cold or windy weather. Although thermite can be used to ignite most other incendiaries and readily combustible materials, its use is not recommended because the igniter required to ignite thermite will usually ignite incendiaries and readily combustible materials directly.

Never attempt to ignite thermite without at least a few seconds delay time. It burns quickly and so hot that the operator could be seriously burned if he were too close to it when it ignited.

FLAMMABLE LIQUIDS INCENDIARY

To Be Used Against:

Paper, rags, excelsior, straw, and all kinds of other readily combustible materials. Flammable liquids may also be used against most wooden structures except heavy beams. In combination with charcoal, heavy wooden structures can be destroyed by these liquids.

Can Be Ignited By:

Any igniter or delay device which produces a flame, with the exception of white phosphorus solutions and time fuze. Although time fuze may sometimes ignite volatile flammable liquids, it cannot be depended upon to do so.

Advantages:

1. Readily available.
2. Requires no mixing or preparation.
3. Easily ignited.
4. Persistent flame.

Disadvantages:

1. Since these incendiary materials are liquids, they have a tendency to run off the objective to be destroyed.
2. Their characteristic odor and appearance may cast suspicion on anyone carrying them.

Material Needed:

Any of the following are good, hot flammable liquids; gasoline, fuel oil, kerosene, cleaner's naphthas, turpentine, benzene, toluene, xylene, and lighter fluid. Ordinary alcohol will burn but it gives a cool flame which will burn only easily ignited materials.

Equipment Needed:

A can or a bottle with a tight fitting lid is all that is required, to carry the liquid to the place where it is to be used. This container should have a capacity of at least 500 cc.

Preparation and Application:

No preparation is required. For burning paper, rags, and other easily ignited materials, pour the flammable liquid on top of as great an area of the material as possible. When ignited, this will start a large area burning at once and will make the fire spread more quickly. It is usually too dangerous to ignite a large quantity of these liquids with a match, so use one of the delays or igniters listed under "CAN BE IGNITED BY".

To burn medium sized wooden structures or small pieces of furniture such as chairs, packing cases, or wooden drawers, place a can of flammable liquid of at least 500 cc capacity so that when the liquid is ignited the flame coming from the top of the can will touch the wood and start it burning. By first spilling some of the liquid on a half dozen pieces of charcoal about the size of small apples, these are then arranged around the can, thereby greatly increasing the destructive effect. The charcoal will ignite and give a hot, persistent glow that will last for a long time after the liquid has burned out.

Another way to use flammable liquids effectively is to place five or six folded rags, measuring at least 30 cm by 30 cm, or about a liter of saw dust, in the corner of the packing case or other wooden structure to be burned. Pour at least 500 cc of flammable liquid on the rags or sawdust, and ignite the mixture. This procedure keeps the liquid concentrated in a small area, which is a necessity when it is required to burn heavy wooden structures.

Flammable solvents are good incendiaries in cold and windy weather. In fact, strong winds will increase the speed with which fires will spread. When using flammable solvents to start fires on wooden structures, remember that it usually takes at least ten minutes or more for the wood to start burning well. This is one of the main disadvantages of using flammable liquids on wooden structures. The fire may be discovered and put out before it has a chance to get a good start. For this reason it is helpful to start the fire in a basement or closet, whenever possible, to allow the fire to get a good start before it is discovered. When starting a fire in a closet remember to leave the door open slightly or the fire may go out in a few minutes because of a lack of air.

PAINT INCENDIARY

To Be Used Against:

Paper, rags, excelsior, straw, and other tinder type materials. Paint can also be used very destructively against light wooden objects such as packing cases and small pieces of furniture. Paint can be used to start charcoal burning which produces a persistent glow which is very destructive to wooden structures.

Can Be Ignited By:

Any igniter or delay device which produces a flame except for white phosphorus solutions, turpentine-fuming nitric acid mixture, calcium carbide-calcium hypochlorite mixture, and all kinds of time fuze.

Advantages:

1. Readily available.
2. Possession of paint is not suspicious.
3. Requires no mixing or preparation.

Disadvantages:

Generally more paint is required to give the same destructive effect obtained from the same amount of other incendiaries. This is because a large portion of the paint will not burn, but remains as a residue after the flammable portion has burned off.

Material Needed:

Any kind of paint, lacquer, enamel, or varnish except for the following: water-thinned paints, water emulsion paints, and prepared liquid shellac. Water-thinned and water emulsion paints will not burn at all. The shellac will burn with a very cool flame because it is dissolved in alcohol and alcohol gives a relatively cool flame. The shellac may be used as an incendiary only against easily ignited materials.

Equipment Needed:

A metal can or glass jar to hold the paint. This container should have a capacity of at least one liter. A paint can preferably should be used as this would be least likely to arouse suspicion.

Preparation:

The paint to be used should not be mixed or stirred. The flammable part is that liquid which floats to the top of paint which has been allowed to settle for a while. Pour off this liquid and use it for the incendiary material, discarding the thick material at the bottom of the can. Paint which has been stirred is often difficult to ignite and may burn erratically.

Application:

To use the paint on paper, rags excelsior, straw, and other readily combustible materials pour the thin liquid from the top of a can of paint on the material, spilling the liquid in a thin layer to cover as much area as possible. Now ignite the paint with a match or any of the delays or igniters listed under "CAN BE IGNITED BY". Spreading the paint out will start a large area burning quickly and make it more difficult to put out the fire.

To burn wooden structures such as packing cases or small pieces of wooden furniture, a whole can of paint which has not been stirred or a can full of the thin liquid from the top of the paint should be used. Use at least one liter of paint or thin liquid. Place the can in the corner of the wooden case or under the furniture so that the hot flame and gases given off by the burning will come in direct contact with the wood. By first spilling a little of the liquid on a half dozen pieces of charcoal, about the size of small apples, and placing them around the can, the destructive effect will be greatly increased because the charcoal will ignite and give a hot, persistent glow. Or, the charcoal can be piled in the corner of the packing case or on top of the furniture and the entire contents of the can poured on the charcoal. When the paint is ignited, the combination of paint and charcoal will give a very hot fire.

One other way to use paint for burning wooden structures is to wad up five or six rags, measuring about 30 cm by 30 cm, in the corner of the structure, pour the paint on the rags, then ignite the paint. The rags soak up the paint and concentrate the flame in a small area.

Paint can be used effectively as an incendiary in cold or windy weather. It is a very reliable incendiary for easily ignited materials and works well against medium sized wooden structures. When charcoal is added to the paint, it makes a very destructive combination, which may be used against heavy wooden structures as well as against more readily ignited materials.

WHITE PHOSPHORUS INCENDIARY

To Be Used Against:

Paper, straw, oily rags, loose tinder materials.

To Be Ignited By:

Self-igniting in air when solven evaporates.

Advantages:

Does not require an igniter as it is self-igniting.

Disadvantages:

1. Materials required may not be readily available.
2. Very hazardous for an inexperienced operator to handle. It can produce painful burns that heal very slowly.

Material Needed:

White phosphorus and carbon disulfide. In addition, some copper sulfate solution should be available.

Equipment Needed:

Bottle and stopper, tweezers.

Procedure:

This is such a hazardous incendiary that it should be attempted only by some one familiar with the handling of white phosphorus. The cupric sulfate solution is a precautionary measure to be used if any of the phosphorus solution is spilled on the skin.

First pour enough carbon disulfide into a small bottle so that the bottle is about one-fourth full. A bottle that holds between 100 cc and 200 cc is excellent for this purpose. Now with a pair of tweezers remove sufficient sticks of white phosphorus from the container in which it is stored and drop them into the small bottle containing the carbon disulfide, to bring the level up to one-half full. Securely stopper the bottle and shake for a minute or two to dissolve the phosphorus completely. Do not use a rubber stopper because the carbon disulfide will attack it. The incendiary

solution is now ready to use and will keep indefinitely if the bottle is kept tightly sealed.

Application:

If a spoonful of this solution is poured onto some paper, rags, or straw it will ignite in less than a minute. The time will depend on the temperature, air currents, and the concentration of the solution. The things which will speed up the ignition time are higher temperatures, stronger air currents, and more concentrated solutions.

To get best results with this incendiary, it is advisable to apply at least a spoonful of the solution at a number of different places on the objective to be destroyed, so that a number of fires are started at the same time. Phosphorus fires are not extremely hot but are very persistent and burn with a dense, white, irritating smoke which makes them difficult to put out. They may often flare up again when the water used to put them out evaporates.

A good way to use this solution as an incendiary is to drop some strips of an absorbent paper (toilet paper, paper towels, newspaper) into the jar containing the solution. Although the size is not too important, a good size for these papers is about 5 cm by 5 cm. However, they should be no smaller than the size mentioned. A number of fires can be started at almost the same time by scattering these soaked strips over the area to be burned. Be careful to handle them only with a pair of tweezers. Remember, never handle phosphorus or its solutions so that they come in contact with the skin. When phosphorus comes in contact with the skin it causes extremely painful burns which take a long time to heal. Remember to wash off the tweezers with the copper sulfate solution after the tweezers have been used to handle these soaked strips of paper. Otherwise the residue on the tweezers will start to burn when the solven evaporates.

This incendiary can be used against the materials listed only if they are reasonably dry. When they are wet, incendiaries such as napalm and flammable solvents should be used.

Another precaution to take when using this incendiary is to be sure that the solution is put where the solvent can evaporate. It will not work if material is piled on top of the solution so that the carbon disulfide cannot evaporate. Always pour the solution on top of the material to be burned. When using the soaked strips of paper, the same

thing applies. Always put these strips of paper on top of the materials to be burned.

Although red phosphorus is readily available at match factories or other manufacturing installations it is completely different in its chemical behavior from white phosphorus and cannot be used as a substitute for the white phosphorus. White phosphorus may also be called yellow phosphorus. They are merely different names for the same thing.

When carbon disulfide is not available, benzene may be used to dissolve the phosphorus. It requires considerable shaking and soaking overnight to get an appreciable amount of phosphorus dissolved in benzene.

The copper sulfate solution is made up by dissolving two spoonfuls of the crystals in a cup of water. Stirring and shaking will be required to dissolve the crystals. Should any of the phosphorus or any of the phosphorus solution come in contact with the skin, immediately wash it off with plenty of copper sulfate solution. If any of the phosphorus starts burning on the skin, quickly pour on a large amount of water to put out the fire, then wash two or three times with the copper sulfate solution. If the clothing becomes contaminated with phosphorus solution or is burning because phosphorus solution has been spilled on it, remove the clothing as quickly as possible. Then apply the copper sulfate solution to the affected skin area.



TABLE OF IGNITERS

IGNITER	IGNITED BY	TO BE USED ON	COMMENTS
1. Sugar-chlorate	Fuse, flame, sulfuric acid, conc. nitric acid, friction, impact	Any incendiary except commercial thermitc	Best and most versatile of all igniters tested
2. Fire fudge	Same as sugar-chlorate	Same as sugar-chlorate	Good igniter. Requires some skill to prepare
3. Sugar + sodium peroxide	Fuse, flame, water, acids	Same as sugar-chlorate	May absorb moisture from atmosphere and be self-igniting
4. Aluminum powder + sodium peroxide	Water, dilute acid	All incendiaries except commercial thermitc	Violent, almost explosive when flake aluminum is used. Coarser particles of aluminum should be used. May be self-igniting from moisture picked up from the air
5. Broken up match heads	Fuse, flame, sulfuric acid	All incendiaries except commercial thermitc	Readily available. Requires no mixing, no chemicals
6. Flake aluminum thermitc	Flame: does not always ignite from homemade time fuse	All incendiaries including commercial thermitc	Much safer to handle and prepare than the aluminum-dichromate mixture
7. Potassium dichromate + aluminum powder	Flame (when finely powdered dichromate and flake aluminum are used it will ignite from time fuse)	All incendiaries including commercial thermitc	Very hot. Will ignite all incendiaries

TABLE OF IGNITERS (continued)

IGNITER	IGNITED BY	TO BE USED ON	COMMENTS
8. Glycerin	Potassium permanganate	All incendiaries except commercial thermite	Fairly hot. Does not work dependably below 10° C
9. Gun powder	Fuse, flame	Napalm, volatile flammable solvents	Burns too quickly to ignite most incendiaries
10. Flake aluminum sulfur pellets	Broken up match heads	Excellent for igniting commercial thermite	Pellets are convenient to carry and store
11. Zinc dust plus ammonium nitrate	Fuse, flame, water, acid	All incendiaries except commercial thermite	Hazardous, may be self-igniting from moisture in air. Requires fairly critical ratio of chemicals
12. Silver nitrate plus magnesium powder	Fuse, flame, water, acid	Same as sugar-chlorate	Hazardous, may be self-igniting if chemicals are not dry. Burns violently.
13. White phosphorus in carbon disulfide	Evaporation of solvent, flame	Paper, straw, rags	Solution causes painful burns if spilled on the skin and solvent evaporates. Dangerous to handle.
14. Turpentine	Fuming nitric acid	Only on napalm, paper, flammable solvents	Very cool flame, fuming nitric acid not commonly available.
15. Calcium carbide plus calcium hypochlorite	Dilute sulfuric acid	Napalm, flammable volatile solvents	Very cool flame. Does not always ignite. Do not use when other igniter materials are available

SUGAR-CHLORATE IGNITER

To Be Used For Igniting:

All the incendiaries listed in this manual except commercial thermite. Its most important use as an igniter is that it can be ignited by the addition of acid, which can be taken advantage of in acid actuated delays. This is described under "DELAYS". It can be used as an incendiary directly against easily ignited materials like crumpled paper, excelsior, rags and hay.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade time fuse, flame, concentrated sulfuric acid, concentrated nitric acid.

Advantages:

1. Materials readily available.
2. Very easily prepared.
3. Harmless appearance, looks just like sugar.
4. Can be ignited in many ways and will ignite many materials.

Disadvantages:

Somewhat hazardous in handling.

Materials Needed:

Granulated sugar, potassium chlorate or sodium chlorate.

Equipment needed:

A spoon, preferably made of wood, for measuring, a jar or can with a tight-fitting lid.

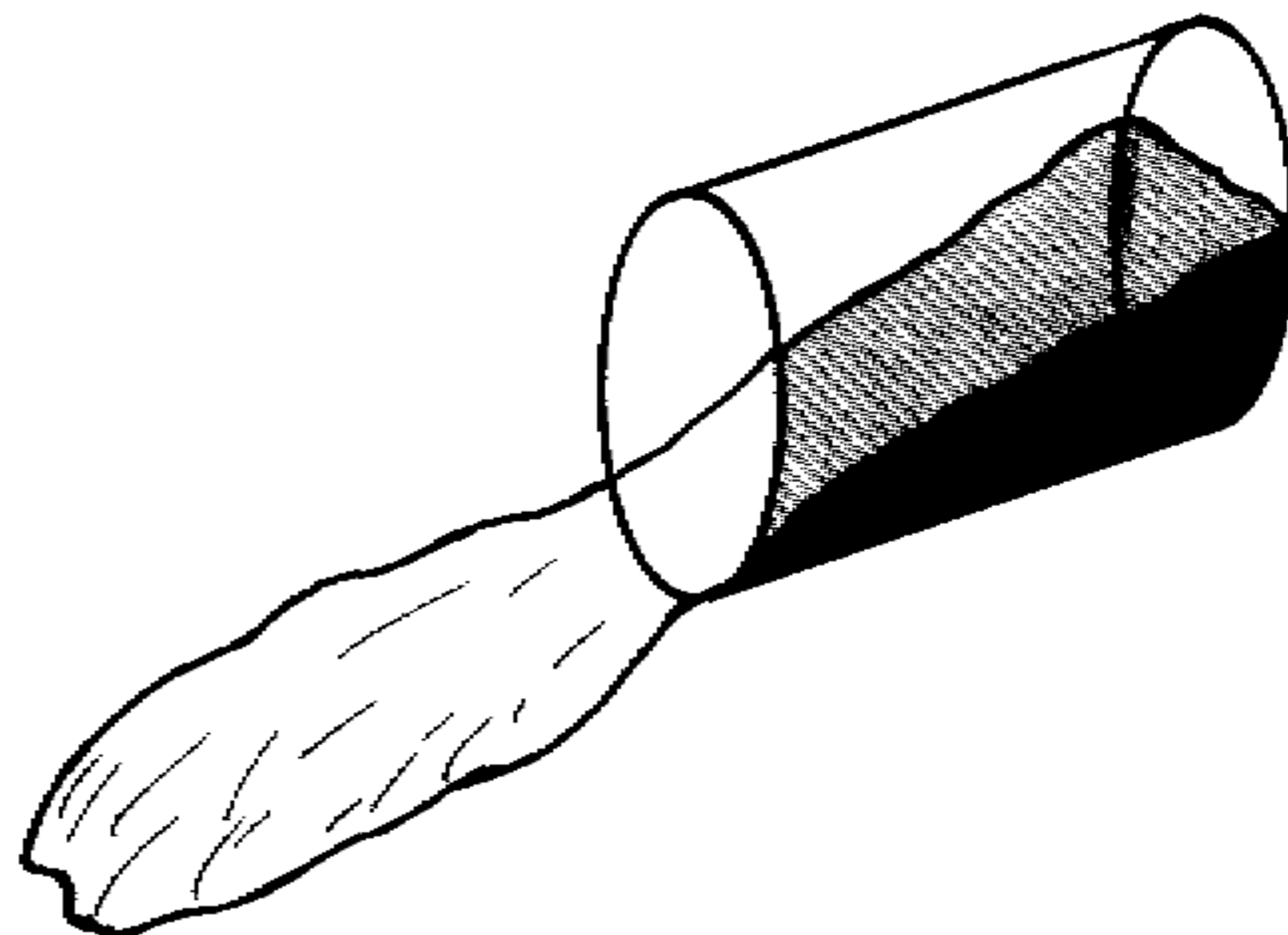
Preparation:

This is a hazardous, sensitive mixture which may ignite or even explode when subjected to friction or impact.

Although in the description given here only potassium chlorate is mentioned, the same amount by volume of sodium chlorate can be substituted with the same results.

The easiest way to prepare this mixture is to count out enough spoonfuls of sugar into the jar

or can to fill it about one-quarter full. Be sure to use only granulated sugar, never finely powdered or confectioner's sugar. Wipe the spoon with a clean cloth and use it to add the same number of spoonfuls of potassium chlorate to the jar containing the sugar. The potassium chlorate should not be lumpy. If it is, it should be crushed BY ITSELF with a rolling pin. Be sure that none of the powder is on the lip or edge of the jar, then put the lid on tight. Roll the jar slowly along the table and tumble it in the hands for a few minutes to mix the two powders completely. The mixture is now ready for use and can be stored for months in the tightly sealed container.



SUGAR - CHLORATE

Application:

To use the mixture, place several spoonfuls directly on the material to be ignited, if it is solid material. Do not scatter the mixture, leave it in a little pile. If the material to be ignited is a liquid, put the sugar-chlorate mixture adjacent to and just touching it. It may not work if the sugar chlorate is soaked with the flammable liquid. Any of the delays listed in this manual except those actuated by water will ignite sugar-chlorate mixture. It will ignite readily from a match, homemade string fuse, Bickford fuse, fire-cracker fuse, a few drops of concentrated sulfuric or concentrated nitric acid. Because of its friction and impact sensitivity, the mixture must be handled carefully. Sugar-chlorate mixture is the best general purpose igniter, because of the number of ways it can be used. It looks so much like granulated sugar that it is almost impossible to detect. It works well in cold and windy weather.

FIRE FUDGE IGNITER

To Be Used For Igniting:

All the incendiaries listed in this manual except commercial thermite. It will directly ignite readily combustible materials such as crumpled paper, rags, excelsior, and hay.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade time fuse, flame, concentrated sulfuric acid, concentrated nitric acid.

Advantages:

1. Looks like fudge, not like an igniter.
2. Ignites readily by a number of methods.
3. Will ignite most incendiaries.

Disadvantages:

1. Requires some skill to prepare.
2. Exact proportions are required.

Materials Needed:

Granulated sugar, potassium chlorate.

Equipment Required:

A small heat resistant glass dish or an enameled pan with a cover, a measuring cylinder which will measure 25 cc, a spoon, a balanced or scale, a source of heat on which water can be boiled, a thermometer for measuring temperatures of liquids up to at least 110°C.

Preparation:

Boil some clean water in a clean heat resistant glass or enamel pan for five minutes. Throw the water away. Pour 25 cc of clean water into the pan, warm it, then add 25 grams of sugar and stir with the spoon until dissolved. Cover the pan.

Bring this solution to a boil for a few minutes, then remove the cover, insert a clean thermometer, and continue to boil the solution with the cover off until the thermometer reads 110° C. The solution will be a fairly thick syrup.

Remove the pan from the source of heat and rapidly add 50 grams of potassium chlorate. Stir gently with a spoon for a minute to mix the syrup and powder, then pour or spoon the putty-like mixture either into small paper molds or onto a sheet of paper. If poured into molds, the paper can be peeled off when the fudge cools and hardens. If poured onto a piece of paper, the large piece which is formed can be cut up or broken up into smaller pieces when it cools and hardens.

The resulting fudge is a white, smooth material which very much resembles domestic fudge fondant. Immediately after cooling it is moderately hard, but it will become harder after 24 hours. Keep it in a tightly sealed container and it will retain its effectiveness for months.

Application

To use fire fudge, take one piece, or enough pieces to give the same volume as half a hen's egg. Place the fire fudge on top of the incendiary to be ignited. Ignite the fire fudge by one of the methods listed under "CAN BE IGNITED BY." When igniting fire fudge by using acid, only concentrated acid must be used. If battery grade sulfuric acid is available, it cannot be used until it is concentrated. To concentrate sulfuric acid, heat it in a copper, enameled, heat resistant glass, or porcelain pot until dense, white fumes start to come off. If only dilute nitric acid is available, there is no simple way to concentrate it, and, therefore, it cannot be used to ignite fire fudge. Always use a delay when using fire fudge because it ignites almost instantly from a drop of concentrated sulfuric or nitric acid.

Fire fudge works well in cold weather. Because it looks exactly like hard candy or fudge it can be carried around without arousing suspicion. It cannot be eaten because it is poisonous. It is a very good general purpose igniter with the disadvantage that it requires some skill to prepare properly. If the instructions given for its preparation are not followed exactly, the result will usually be a crumbly, grainy product rather than a smooth fudge type material. This crumbly material will work as well as the fudge, although it does not have the advantage of ease of handling and looking like fudge. In all applications, a simple sugar-chlorate mixture will work just as well as fire fudge. This simple mixture closely resembles sugar and therefore will not arouse suspicion.

SUGAR-SODIUM PEROXIDE IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, flake aluminum thermite, thermate, paints and lacquers, flammable solvents in open containers, and paraffin-sawdust mixtures. In addition, it will ignite loose crumpled paper, loose rags, excelsior, straw, and other tinder type materials.

Can Be Ignited By:

A drop of water. It can also be ignited by Bickford fuse, fire-cracker fuse, homemade string fuse, flame, and dilute acids.

Advantages:

1. Easily prepared.
2. Ignites most incendiaries.
3. Can be ignited by many delay systems.

Disadvantages:

1. Sodium peroxide is not always readily available.
2. The sugar-sodium peroxide mixture must be stored where no moisture can get to it, or it will not keep well. DO NOT USE A MIXTURE THAT IS OVER A WEEK OLD.
3. In humid weather it may self-ignite before the desired delay time, or it may become "dead" and not work at all.

Materials Needed:

Granulated sugar, fresh sodium peroxide. If the sodium peroxide is hard and caked in the container it indicates that it has picked up moisture and it cannot be used in this mixture.

Equipment Needed:

A spoon, a jar or can with a tight fitting lid. Always protect your eyes when working with sodium peroxide. Ordinary spectacles will do.

Preparation:

Using a clean, dry spoon, measure out about ten spoonfuls of ordinary granulated sugar into

the jar or can. Never use finely powdered or confectioner's sugar. Wipe the spoon with a clean, dry cloth, and add the same number of spoonfuls of sodium peroxide to the can. Replace the lid on the can of sodium peroxide and remove it at least two meters from the table. Firmly place the lid on the container which has the sugar and sodium peroxide and gently roll and tumble it in the hands for at least two minutes to completely mix the two powders. The mixture is now ready to use. It may not keep well and should be used within a week. It must be stored in a tightly sealed container. It is best to test it just before it is to be used.

Application:

Sugar-sodium peroxide mixture can be used in a number of ways. Any of the water-actuated delays will ignite it, or a piece of time fuse or dilute acid will ignite it. The mixture should always be placed in a pile on top of any solid incendiary material to be ignited. For igniting liquid fuels it must be placed near to and just touching the liquid. One spoonful will ignite most incendiaries but it is best to use two or three spoonfuls to make sure the incendiary material is ignited.

This mixture is one of the best igniters because of the many ways it can be ignited and because of the many incendiaries which it will ignite. It works well even in extremely cold weather or in very windy weather.

This mixture may self-ignite while being mixed in damp weather. The chemicals used, and the equipment used for mixing must be completely dry or self-ignition will occur.

ALUMINUM POWDER-SODIUM PEROXIDE IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, flake aluminum thermite, thermate, paints, lacquers, and flammable solvents in open containers, and paraffin-sawdust mixtures.

Can Be Ignited By:

Water, Bickford fuse, fire-cracker fuse, string fuse, dilute acids, flame. Its most important feature is that it can be ignited by water.

Advantages:

1. Readily ignited by a number of methods.
2. Ignites most incendiaries.
3. Easily prepared.

Disadvantages:

1. Sodium peroxide is not a common material; may be difficult to obtain.
2. Hazardous to handle; may ignite spontaneously from moisture picked up from the air.

Materials Needed:

Fresh sodium peroxide, aluminum powder or filings.

Equipment Needed:

A small can or jar with a tight-fitting lid, a spoon.

Preparation:

Put enough spoonfuls of the aluminum powder into a small jar or can to fill it approximately one-fourth full.

The aluminum powder should be at least as fine as the filing obtained with a file of medium coarseness. Flake aluminum powder may also be used. Do not use lathe chips or particles from other machining operations unless these particles are as small as those obtained by a file. Wipe off the spoon used for measuring the aluminum powder and add enough sodium peroxide to the jar or can containing the aluminum powder to fill the container about half full. Put on the lid and shake and tumble the container for at least two minutes to completely mix the two ingredients. The igniter mixture is now ready to use and may be kept for several weeks in the tightly closed container. It is well to shake it for a minute just before use to mix the contents thoroughly which may have separated while being stored.

Application:

Place several spoonfuls of the mixture on a solid incendiary to be ignited, or if it is to be used on a liquid incendiary, wrap several spoonfuls in a piece of absorbent paper. Either tape this package to the inside of the liquid container just above

the liquid level or suspend it inside just above the liquid level. It may be ignited by means of a piece of time fuse, or by one of the water actuated or dilute acid actuated delays described in the manual.

Aluminum powder-sodium peroxide igniter works well in cold weather. When flake aluminum powder is used in the mixture, it is very violent, almost explosive, but it will ignite. This mixture is very hazardous and should not be allowed to get wet accidentally. The sodium peroxide used should be as fine as granulated sugar and must be fresh. If it is caked and full of hard lumps it cannot be used for making this igniter because it has already picked up moisture and will not react when water is added.

MATCH HEAD IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, thermate, paints and lacquers in open containers, flammable solvents in open containers, and paraffin-sawdust mixtures. This igniter will also directly ignite such readily combustible materials as paper, rags, excelsior, straw and other tinder type materials.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade string fuse, flame, concentrated sulfuric acid and concentrated nitric acid.

Advantages:

1. Requires no mixing or formulating.
2. Readily available.
3. Can be ignited by many different methods.

Disadvantages:

None.

Materials Required:

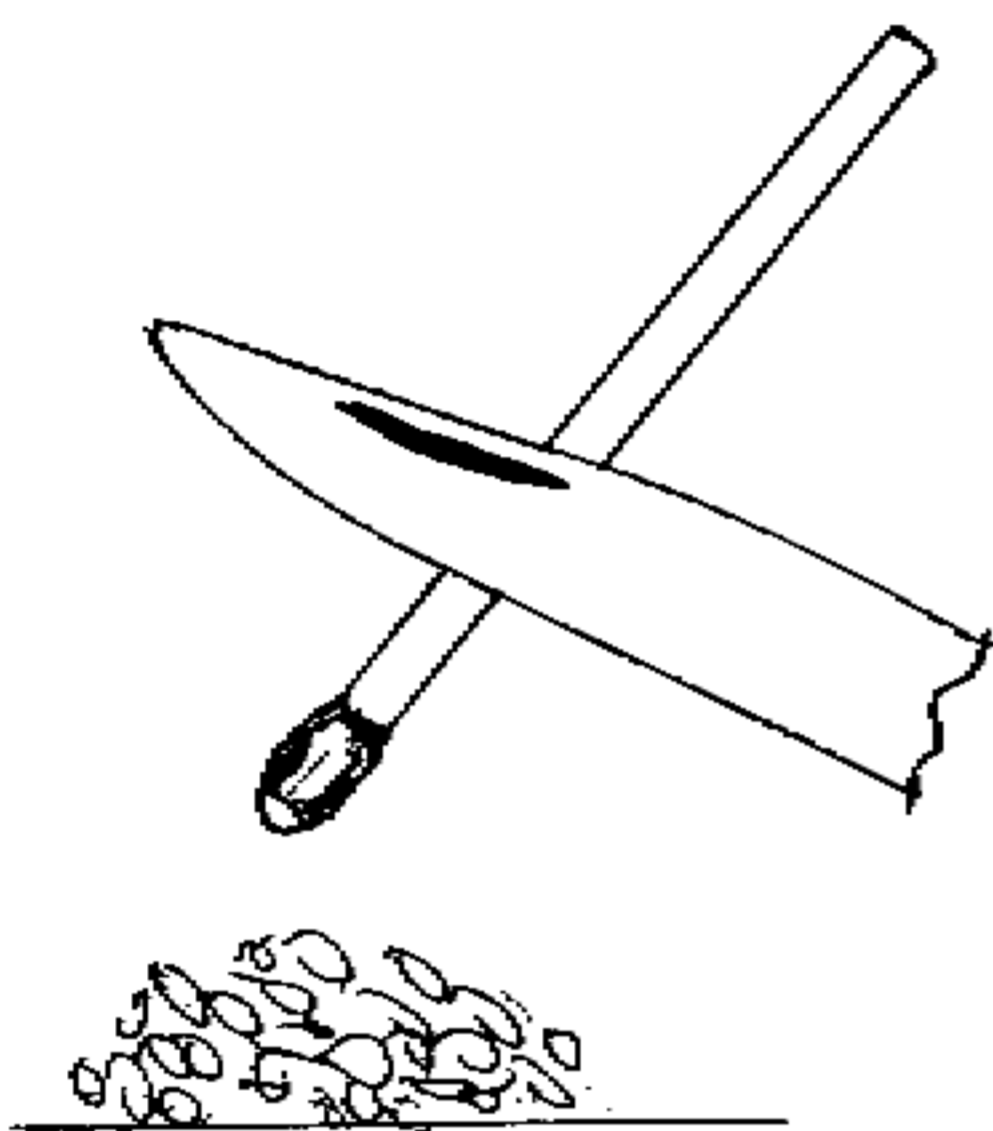
Matches -- wooden or paper, safety type or the type of match which can be ignited by striking on any surface, sometimes called "lucifers".

Equipment Needed:

A knife or a pair of pliers, a small jar or can with a tight-fitting lid.

Preparation:

This igniter is merely the composition obtained by breaking or shaving off the heads of matches. Any kind of friction matches will do because of the potassium chlorate they contain. With a sharp knife shave off the composition from the match sticks or use a pair of pliers to squeeze the match heads and the composition will chip off. Prepare at least two spoonfuls of the composition and store it in a jar or can with a tight-fitting lid. This match head composition can be stored for months and will remain effective.



MATCH - HEADS

Application:

To use this composition put two spoonfuls in a little pile on top of any solid incendiary to be ignited. A suitable delay to use can be either a piece of Bickford fuse, fire-cracker fuse, homemade string fuse, or an overflow or diaphragm type of delay. The latter two delays allow concentrated sulfuric acid or concentrated nitric acid to drip onto the match heads for ignition.

To use this match head igniter for igniting flammable solvents or paints, wrap several spoonfuls of the match heads in a piece of absorbent paper. Tape or suspend this little package inside of the container of solvent or paint, just above the liquid level. The package can be ignited by a piece of fuse or by acid as mentioned above. This burning packet will then start the paint or solvent burning.

This match head igniter is one of the best igniters because it is easy to prepare, does not require any chemicals, ignites most incendiaries, keeps well in storage, and can be ignited by many delay devices. It performs well in cold and windy weather. Best of all, matches are always available in most any home, and no suspicious or unusual chemicals need be purchased to prepare this igniter.

FLAKE ALUMINUM-THERMITE IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, thermate, paints and lacquers in open containers, paraffin-sawdust mixtures, commercial thermite. It is its ability to ignite commercial thermite that makes flake aluminum thermite such an unusually good igniter. It will also directly ignite such readily combustible materials as paper, rags, excelsior, straw and other tinder type materials.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, and flame. It is not always ignited by the flame from calcium carbide-calcium hypochlorite or by the flame from turpentine-fuming nitric acid mixtures. Flake aluminum thermite may sometimes be ignited by homemade string fuse, but it is not a sure way of ignition.

Advantages:

1. Materials readily available.
2. Easily prepared.
3. Gives a very hot flame.

Disadvantages:

In most applications it requires another igniter to ignite this mixture. It cannot be ignited directly by most delays.

Materials Needed:

Flake aluminum powder, finely powdered iron oxide such as jeweler's rouge or hammer scale (or magnetic iron oxide).

Equipment Needed:

A spoon, a jar or can with a tight-fitting lid.

Preparation:

The flake aluminum is the kind commonly used for making aluminum paint. It must be a very fine powder like dust. The iron oxide may be either red or black and must be as fine as dust. The red powder is commonly called jeweler's rouge, the black powder is commonly called hammer scale or magnetic iron oxide. To prepare the mixture, place ten spoonfuls of the aluminum powder in the jar or can, wipe off the spoon, then add five spoonfuls of the iron oxide on top of the aluminum. Put the lid on the jar or can and shake it vigorously for at least two minutes. The mixture is now ready to use and will remain effective for months if kept in the sealed container.

Application:

To use flake aluminum thermite on a solid incendiary, place five spoonfuls on top of the incendiary and ignite the thermite with a piece of time fuse, or another igniter or delay which produces a flame. This thermite will ignite commercial thermite.

To ignite liquid incendiaries place five spoonfuls of the flake aluminum thermite next to and just touching the surface of the liquid and ignite the thermite in the same way as described for igniting solid incendiaries. This can best be done by wrapping the flake aluminum thermite in paper, then taping the package to the inside of the can or suspending it inside the can just above the top of the liquid.

Although flake aluminum thermite will ignite all incendiaries, its ability to ignite commercial thermite is its most important feature. Flake aluminum thermite can be stored for a long time before use, and will work well even in extremely cold or windy weather. Its main disadvantage is that except for time fuses, most of the delays described in this manual will not directly ignite flake aluminum thermite. In most applications of this igniter it will have to be ignited from another kind of igniter, one which is more easily ignited by delay devices.

POTASSIUM DICHROMATE-ALUMINUM IGNITER

To Be Used For Igniting:

Those materials which are more difficult to ignite such as commercial thermite. It will, however, ignite all other incendiaries and directly ignite readily combustible materials such as paper, rags, excelsior, straw and other tinder type materials.

Can Be Ignited By:

A flame, or when flake aluminum powder and finely powdered potassium dichromate are used in its preparation, this mixture can be ignited by Bickford fuse or fire-cracker fuse, but not with homemade string fuse.

Advantages:

1. Ignites commercial thermite.
2. Has a very hot flame.
3. Easily prepared.

Disadvantages:

Limited number of delay devices can ignite this mixture.

Materials Needed:

Aluminum powder, potassium dichromate or sodium dichromate.

Equipment Needed:

A spoon, a can or jar with a tight-fitting lid.

Preparation:

Although potassium dichromate is called for in the preparation, sodium dichromate can be used instead when potassium dichromate is not available. Potassium dichromate is usually available as crystals, which must be ground to a fine powder, about as fine as dust. Put three spoonfuls of the finely ground potassium dichromate into a clean, dry jar or can. Wash the spoon and dry it carefully. Now add nine spoonfuls of flake aluminum powder on top of the powdered potassium dichromate. Seal the jar or can and shake it vigorously

for at least two minutes to mix the powder. It is now ready for use and may be kept for several weeks in the closed container before using it.

Application:

To use this mixture on solid incendiaries place five teaspoons of the mixture in a little pile on top of the incendiary and ignite it with a piece of Bickford fuse or fire-cracker fuse. If no fuse is available, ignite it with another igniter or delay which produces a flame. Potassium dichromate-aluminum mixture is one of the few igniters hot enough to ignite commercial thermite, and is especially recommended for this application.

To ignite liquid incendiaries place five spoonfuls of the igniter mixture wrapped in paper next to and just touching the surface of the liquid. Tape the package to the side of the container or suspend it just above the liquid level. Ignite the mixture in the same way as described for igniting solid incendiaries. This igniter works well in cold and windy weather. Its main disadvantage is that it usually requires some other igniter to ignite it, as only a few delay devices will ignite it directly.

POTASSIUM PERMANGANATE-GLYCERIN IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, flake aluminum thermite, thermate, paint and lacquer in open containers, flammable solvents in open containers, and paraffin-sawdust mixtures. It will directly ignite readily combustible materials like paper, rags, excelsior, straw, and other tinder type materials.

Ignited By:

The addition of glycerin to potassium permanganate.

Advantages:

1. Very easily prepared.
2. Ignites most incendiaries.
3. Safe to carry.
4. Does not lose its effectiveness when stored.

Disadvantages:

1. Limited number of ways to use this igniter.
2. Will not work below 10° C.

Materials Needed:

Potassium permanganate crystals, glycerin, water.

Equipment Needed:

A small bottle, can, or vial of approximately 100 cc capacity with a tight-fitting lid, a small can or jar with lid.

Preparation and Application:

This igniter works simply. When a few drops of glycerin are spilled on a pile of potassium permanganate crystals, the mixture will start to burn in about 10 seconds or less with a hot flame that will ignite the materials listed above. The glycerin is carried separately in a small container with a tight lid, and the potassium permanganate crystals should be in a separate container (can or jar with lid). The potassium permanganate crystals may, however, be merely wrapped in paper while being carried.

At the place where this igniter is to be used, make a small pile of about two spoonfuls of the potassium permanganate on top of the solid incendiary to be ignited or next to and just touching a liquid incendiary. Tape or suspend a package of potassium permanganate crystals inside the container of liquid just above the liquid level. By means of a suitable overflow or tipping delay, glycerin can be spilled on these crystals, causing the mixture to ignite.

The glycerin solution used is ordinary commercial glycerin to which a little water has been added. To prepare the glycerin solution, fill a small bottle or vial about nine-tenths full of glycerin, fill the rest of the bottle with water, and shake for a minute to mix the water and glycerin.

The potassium permanganate used is in the form of crystals, usually about the size of ground coffee.

The glycerin solution can be stored for months if placed in a bottle with a tight-fitting cap. The potassium permanganate crystals when stored in another bottle or can, with a tight-fitting lid, may be stored for several months.

This igniter works well except when the temperature falls below 10°C. When the temperature is lower than 10°C some other kind of igniter must be used.

GUNPOWDER IGNITER

To Be Used For Igniting:

Napalm, flammable solvents in open containers, flake aluminum thermite, thermate, and such readily ignited materials as crumpled paper, loose rags, straw, excelsior and other tinder type materials.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade string fuse, flame, and sparks.

Advantages:

1. Readily available.
2. Easily ignited.

Disadvantages:

1. Burns too quickly to ignite many incendiaries.
2. Limited number of delay systems with which it can be used.

Materials Required:

Gunpowder is usually available as a product already mixed. If it is necessary to prepare it, potassium nitrate, ground sulfur, and powdered charcoal are needed. Sodium nitrate can be used instead of potassium nitrate, but if sodium nitrate is used, more precaution should be taken to keep the powder from absorbing moisture from the air.

Equipment Needed:

A spoon, a jar or can with a tight-fitting lid.

Preparation:

All the ingredients used should be at least as fine as granulated sugar. Grind each chemical separately. NEVER ATTEMPT TO GRIND THE FINISHED GUN POWDER. It may ignite or even explode.

Into a jar or can put seven spoonfuls of potassium nitrate or sodium nitrate, two spoonfuls of powdered charcoal, and one spoonful of powdered sulfur. Put the lid of the can or jar on tight and shake and tumble it in the hands for at least two minutes to completely mix all the ingredients. The mixture will be effective for months if kept in this tightly sealed container. It is especially important to keep the powder in a tightly sealed container if the powder has been made with sodium nitrate. Sodium nitrate has a tendency to absorb moisture from the air, especially in damp weather. If enough moisture is absorbed, the powder will not ignite.

Application:

To use gun powder, pile two or three spoonfuls on top of any solid incendiary which is to be ignited. For igniting liquids in open containers, wrap two or three spoonfuls in a piece of paper and either tape this package to the inside of the container just above the liquid level or suspend it on the inside of the container just above the liquid level. Gun powder is best ignited by time fuse. Gun powder ignites with a great deal of heat, so allow enough length of time fuse to be sure of getting away before the gun powder ignites.

Gun powder is not affected by cold weather. It burns out so quickly that it will only ignite readily ignited materials. It is useful as an igniter because it is often available ready-mixed or may be prepared easily from commonly available chemicals.

FLAKE ALUMINUM-SULFUR PELLETS IGNITER

To Be Used For Igniting:

Commercial thermite, which is exceedingly difficult to ignite. These pellets will ignite all the other incendiaries mentioned in this manual but is especially suited for igniting commercial thermite.

Can Be Ignited By:

Sugar-chlorate, sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and broken-up match heads.

Advantages:

One of the few igniters which will ignite commercial thermite.

Disadvantages:

1. Requires some skill to prepare.
2. Requires weight measurements. Volume measurements are not usually accurate enough.

Materials Needed:

Flake aluminum powder, finely powdered sulfur, starch.

Equipment Needed:

A scale which will weigh in grams and has a capacity of at least 100 grams, a bowl or can for mixing, a spoon, a piece of pipe or metal tubing about 10 cm. long and approximately 2 cm. inside diameter, a wooden or metal rod which fits inside the tube with only a few mm. clearance, a source of heat such as a stove or hot plate, a graduated measuring cylinder.

Preparation:

These pellets are made by dry mixing flake aluminum powder and finely powdered sulfur, then adding starch solution to form a heavy putty-like material which can be extruded. This extruded material may then be cut up and dried.

The pellets are prepared in the following way. Into a mixing bowl or can place 40 grams of flake aluminum powder, then add 80 grams of finely powdered sulfur which has been ground to a fine dust. Mix the two powders gently with the spoon for a few minutes until no unmixed particles of sulfur are visible. Now in a separate pot add 10 grams of starch to 200 cc of water and boil gently for a few minutes with stirring until the starch is completely dissolved. Allow the starch solution to cool to room temperature.

Weigh out 120 grams of this starch solution and add it to the mixture of flake aluminum and powdered sulfur. Mix with the spoon until the whole mass is a smooth, evenly-mixed, putty-like paste. Now fill the piece of pipe or tubing with this paste, ramming and tamping it with the close fitting rod to squeeze out the air and consolidate it. Push the material out of the tube with the rod

so that it forms a roll, then cut the damp roll into 3 to 4 cm lengths. Dry them in a warm place for at least 24 hours before using. They may be stored for months and will remain effective.



FLAKE ALUMINUM – SULFUR PELLETS

Application:

To use these pellets on commercial thermite, drill a hole about 0.7 cm in diameter halfway into one end of the pellets. Partly fill the hole with broken match heads or one of the other igniters mentioned under "CAN BE IGNITED BY". Insert a piece of time fuse in the hole so that it touches the igniter mixture in the hole. Add more of the same igniter material to fill the hole, and tape the piece of time fuse in place, so that it cannot fall out, or become loose.

Tape two or three more of the pellets to the one with the fuse to insure ignition of the thermite. Insert this taped assembly into a pile of thermite, so that it is completely buried, leaving the end of the fuse exposed so that it can be lit.

These pellets are one of the few dependable igniters for commercial thermite. They are convenient to carry and easy to use. They work well in cold weather. Their only disadvantage is that they are difficult to prepare. It is recommended that flake aluminum thermite be used as an igniter for commercial thermite when the operator does not have the equipment or skill to prepare these flake aluminum-sulfur pellets.

ZINC DUST - AMMONIUM NITRATE IGNITER

To Be Used For Igniting:

Napalm, white phosphorous solutions, flake aluminum thermite, thermate, paint and lacquer in open containers, flammable solvents in open containers, and paraffin-sawdust mixtures. In addition, this igniter mixture will directly ignite such readily combustible materials as paper, rags, excelsior, straw, and other tinder type materials.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade string fuse, flame, water, and dilute acids.

Advantages:

1. Easily prepared.
2. Ignites most incendiaries.
3. Can be ignited by many types of delays.

Disadvantages:

1. Very sensitive to moisture. Even a trace of moisture in either of the chemicals may ignite the mixture while it is being blended or carried. Only completely dry chemicals can be used. Mixing equipment must be dry.
2. Must be prepared just before using, does not keep well in storage. Cannot be used in humid weather.

Materials Needed:

Finely powdered zinc, ammonium nitrate crystals or powder.

Equipment Needed:

A spoon, a small jar or can with a tight-fitting lid.

Preparation:

With a clean, dry spoon, measure out 5 spoonfuls of powdered zinc into the dry can or jar. The zinc should be a very fine powder, about as fine as dust. Wipe off the spoon with a clean, dry cloth, then add 15 spoonfuls of ammonium nitrate powder

to the 5 spoonfuls of zinc. The ammonium nitrate should be about as fine as granulated sugar, although a finer grade will work. Seal the container and gently roll and tumble it in the hands for at least two minutes to completely blend the mixture. The mixture is now ready for use. It should not be prepared more than a few days before it is to be used because it may deteriorate during storage.

Application:

To use this mixture, place several spoonfuls in a pile on top of a solid incendiary or next to and just touching the edge of any liquid incendiary to be burned. It can be wrapped in absorbent paper and taped or suspended in the tank just above the level of the liquid. Although it may be ignited in a number of ways, it is especially well suited to a water-actuated delay. Within a few seconds after several drops of water hit the mixture, it will ignite with a hot flame. Do not use a type of delay which will spill a large volume of water on the mixture all at once because this will cool the mixture so much that it will not ignite. An overflow or leaking type of delay is recommended. A tipping delay should not be used.

An impure form of ammonium nitrate, known as fertilizer grade, works as well as the chemically pure grade. The zinc powder must be very finely ground or this igniter will not work.

Temperature has no effect on this igniter. It works as well in cold weather as it does in hot weather.

Although this igniter is especially suitable for a water-actuated delay it works well when ignited by the materials listed under "CAN BE IGNITED BY".

This is a very useful igniter because of the many ways it can be ignited and the many things it will ignite.

SILVER NITRATE - MAGNESIUM IGNITER

To Be Used For Igniting:

Napalm, white phosphorus solutions, flake aluminum thermite, thermate, paints and lacquers in open containers, flammable solvents in open containers, and paraffin-sawdust mixtures. In addition, this igniter will directly ignite such readily combustible materials as paper, rags, excelsior, straw, and other tinder type materials.

Can Be Ignited By:

Bickford fuse, fire-cracker fuse, homemade string fuse, flame, water, and dilute acids.

Advantages:

1. Easily prepared.
2. Ignites most incendiaries.
3. Can be ignited by many delay devices.

Disadvantages:

1. May self-ignite if even a trace of moisture is present in the chemicals used.
2. Fine magnesium powder may not be readily available, or it may be difficult to prepare.

Materials Needed:

Silver nitrate crystals (not powdered), magnesium powder or filings.

Equipment Required:

A spoon, a container (jar or can) with a tight-fitting lid. The jar should be dried by heating in a kitchen stove after wiping it dry first.

Preparation:

Using a clean, dry spoon, measure out 5 spoonfuls of silver nitrate crystals into the dry container. The silver nitrate crystal size should be that of coarse sand or small gravel. Powdered silver nitrate should never be used. Carefully wipe the spoon with a clean, dry rag. Now add 5 spoonfuls of magnesium powder or filings to the silver nitrate crystals. The magnesium powder or filings should be free of grease and have a texture similar to or finer than granulated sugar. Filings will do, but lathe chips or scrap from other similar machining operations will not ignite. Put the lid on the container firmly. Now roll and tumble it in the hands for at least two minutes to mix the two ingredients. It is now ready for use. Store the contents in a tightly sealed container. This type of igniter material should not be stored for more than a few weeks before using, because it may not be effective after that time. Always test this igniter mixture just before using.

Application:

To use this mixture, shake it gently in its container just before using. This will assure thorough mixing. Pile several spoonfuls of the igniter mixture on top of a solid incendiary material or place it adjacent to and almost touching liquid incendiaries. When liquid incendiaries in containers are to be ignited, wrap several spoonfuls of the igniter mixture in a paper package and place it inside the container just above the liquid surface by: (a) taping the package to the containers side or (b) by suspending it above the surface.

This igniter is especially well suited to a dripping or overflow type of delay because it will ignite when it comes in contact with a few drops of water. A tipping delay should not be used. A large quantity of water poured over this igniter all at once will prevent it from igniting. A dilute acid or water delay breaking through a membrane will also work very well. This igniter mixture may also be ignited by a Bickford fuse, fire-cracker fuse, homemade string fuse, or a flame. Silver nitrate-magnesium powder gives a very hot flame that lasts for only a few seconds.

This igniter works well in both very cold weather and in warm weather. It is a very dependable igniter and is very useful because it can be ignited by many types of delays, and will itself ignite many incendiary materials. It is quite important to keep this igniter material dry, since only a trace of moisture in the chemicals or mixing equipment will cause self-ignition of this igniter.

WHITE PHOSPHORUS IGNITER

To Be Used For Igniting:

Crumpled paper, rags, excelsior and hay. In addition, white phosphorus works as an igniter or igniter booster on flake aluminum thermite and thermite incendiaries.

Ignited By:

Evaporation of a volatile solvent.

Advantages:

1. May be used as a delay, an igniter, an incendiary, or any combination of these.
2. Easily prepared.

Disadvantages:

1. Very hazardous for an inexperienced operator to handle. It can produce painful burns that heal very slowly.
2. Ignites only a few types of incendiaries.
3. Materials are not readily available.

Materials Needed:

White phosphorus, carbon disulfide. In addition, some copper sulfate solution should be available.

Equipment Needed:

Two bottles with stoppers, a pair of tweezers or tongs.

Preparation:

Never directly touch white phosphorus or allow any of its solutions to get on the skin. First pour enough carbon disulfide into a small bottle so that the bottle is about one-fourth full. A bottle that hold between 100 cc and 200 cc is excellent for this purpose. Now with a pair of tweezers remove sufficient sticks of white phosphorus from its container in which it is stored and drop them quickly into the small bottle containing the carbon disulfide to bring the level up to one-half full. Be sure that all the phosphorus left in the original container is completely covered by water before putting the container away.

Securely stopper the bottle containing the phosphorus and carbon disulfide and shake for a few minutes until the phosphorus is completely dissolved. The solution is now ready to use and will keep for months in the bottle. Do not store it in direct sunlight or it will not keep well. The lid for the bottle should not be made of rubber because the carbon disulfide will dissolve rubber.

Application:

To use the solution, pour it from the bottle onto the object to be burned. The bottle should be discarded because if any of the solution has dripped down the outside of the bottle, it will burst into flame and cause a painful burn to the person holding it. If the solution is poured directly onto crumpled paper, rags, excelsior, or straw it will ignite and start to burn in less than a minute. Do not cover the soaked material with

anything because the carbon disulfide must be allowed to evaporate or ignition will not occur.

To ignite thermate or flake aluminum thermite a different technique is required. Instead of pouring the white phosphorus solution directly on these incendiaries, the solution must be poured out so that it just touches the outer edge of the pile of flake aluminum thermite or the thermate. If the solution is poured directly on the thermate or flake aluminum thermite, it may not ignite. Here again, a delay time of less than a minute is usual.

The delay time of this igniter may be varied and made longer by adding another solvent such as gasoline, benzene, or toluene to the phosphorus carbon disulfide solution. Always add just a little of the solvent to the phosphorus solution and test the delay time. Continue to add small portions of solvent, and test the solution until the proper delay time is reached. Delay times of twenty to thirty minutes may be obtained by this method.

The copper sulfate solution is required in case any of the phosphorus solution is accidentally spilled on the skin or for washing off the tweezers immediately following the preparation of the phosphorus-carbon disulfide solution. To make the solution, add several spoonfuls of the copper sulfate crystals to a small bottle full of water and shake until the crystals dissolve. Have this solution available whenever you work with white phosphorus. If any phosphorus solution spills on the skin, immediately wash it off with plenty of soap and water, then apply copper sulfate solution on a rag or piece of cotton. If phosphorus begins to burn on the skin, drown the flame with water, then apply some of the copper sulfate solution.

Do not attempt to use red phosphorus for an igniter because it does not behave at all like white phosphorus and cannot be substituted for it. White phosphorus may sometimes be called yellow phosphorus, but they are both the same thing.

When carbon disulfide is not available, an equal volume of benzene may be used to dissolve the phosphorus. This will require much shaking of the bottle and the phosphorus may take as long as twelve hours of soaking in the bottle before all the phosphorus dissolves. This solution can be expected to give a longer delay time than the delay time obtained when carbon disulfide is the solvent, usually ten minutes or longer.

The delay time of all these solutions should always be checked shortly before they are to be used so that the operator can get an idea of what kind of delay time to expect.

In very cold weather this igniter will take longer to ignite, but it will work. However, it is recommended that one of the other igniters be used if they are available, except those igniters which are also not recommended for use in cold weather.

TURPENTINE - FUMING NITRIC ACID IGNITER

To Be Used For Igniting:

Loosely piled or crumpled paper, napalm, and flammable solvents in open containers or spilled on the ground.

Ignited By:

Adding turpentine to fuming nitric acid or by adding fuming nitric acid to turpentine.

Advantages:

1. Easily prepared, requires no mixing or blending.
2. Can be used as combination delay and igniter.

Disadvantages:

1. Gives a cool flame, does not ignite many of the commonly used incendiary materials.
2. Fuming nitric acid is not commonly available.
3. It is adversely affected by cold weather or strong winds.
4. May not ignite under certain circumstances.

Materials Needed:

Fuming nitric acid, turpentine.

Equipment Required:

A spoon, a glass vial or jar, and a jar or can.

Preparation and Application:

This igniter is easily prepared. When either one of the liquids is poured into the other, it pro-

duces a flame almost instantly.

Because this igniter flames instantly when the two solutions are mixed, it is best used with a tipping delay. Pour enough turpentine into a 200 to 400 cc capacity jar or can to fill it about three-fourths full. By means of a tipping delay (described under "delay") pour a glass vial or jar full of fuming nitric acid into the turpentine. The acid container used should be approximately half the size of the turpentine container. The acid should be poured all at once, not drop by drop, or no flame will be generated. For this reason a tipping delay is needed rather than an overflow delay.

The container for the acid should always be made of glass. The container for the turpentine can be a cardboard cup, a wooden bowl, a jar, or a can.

The container of turpentine should be placed where the flame coming from the top of the container will touch the material to be burned.

In handling fuming nitric acid as with any other kind of acid, great care should be used not to get any on the skin. If some is accidentally spilled on the skin, it should be washed off with plenty of water immediately. Do not breathe the fumes coming off the fuming nitric acid.

This igniter is uncertain in its action and is limited in the ways it can be used. It and the calcium carbide-calcium hypochlorite are the two poorest igniters described in this manual.

Whenever material for any other kind of igniter is available, always use one of the other igniters. This igniter should not be used at all in very cold or very windy weather, if it is to be used outdoors. Strong winds or cold weather may cool the mixture enough to prevent a flame.

CALCIUM CARBIDE -- CALCIUM HYPOCHLORITE IGNITER

To Be Used For Igniting:

Napalm or flammable solvents in open containers or spilled on the ground.

Ignited By:

Dilute sulfuric acid.

Advantages:

Easily prepared.

Disadvantages:

1. Very cool burning; sometimes does not ignite.
2. Deteriorates and loses its effectiveness in storage. It must be used soon after being prepared.
3. There is only one way to ignite it.
4. It is the poorest igniter of those listed.

Materials Needed:

Calcium carbide, calcium hypochlorite (called bleaching powder), and sulfuric acid. Only bleaching powders which have the chlorine smell can be used.

Equipment Needed:

A spoon, a jar or can with a tight-fitting lid.

Preparation:

Put two spoonfuls of calcium carbide on a piece of paper. The calcium carbide should be in pieces no larger than coarse ground coffee. Wipe the spoon, then add one spoonful of calcium hypochlorite. Mix for a minute with the spoon and transfer to a jar or can with a tight-fitting lid. This mixture loses its effectiveness when stored and should be used within a few days after it is mixed. To make larger quantities, always use twice as much of the calcium carbide as the calcium hypochlorite. Never make up more than you expect to use in the next few days, because the mixture does not work well when stored longer than stated.

If the calcium carbide you have is in the form of lumps, these lumps can be broken up with a hammer or a rock. If the calcium carbide is already powdery it indicates that it is not fresh and it will not work. The calcium hypochlorite is commonly called bleaching powder and is the chemical which smells like chlorine. This is often used to disinfect sanitary facilities such as toilets, wash rooms, and swimming pools.

No special hazards are involved in the preparation of this mixture. All the equipment used for mixing must be dry or the mixture will deteriorate rapidly.

Application:

To use this mixture, a delay device is required which will bring it in contact with dilute sulfuric acid. For this purpose, select one of the gelatin capsule or tipping delays described in this manual.

This igniter is uncertain in its action, especially in cold, windy weather. When it does ignite it gives a very cool flame which ignites only a few incendiaries. For these reasons, do not use this igniter when materials for any other igniter are available.

Battery acid will actuate this igniter. If concentrated acid is available, it must be diluted before it can be used. To prepare dilute acid from concentrated acid, first fill a bottle about three-fourths full of water, then add enough concentrated acid to fill the bottle. NEVER POUR THE WATER INTO THE ACID. It could splash out and burn the operator. If any sulfuric acid gets on the skin, wash it off immediately with plenty of water.

Always test this igniter just before using it on the objective, to be certain that it is working properly.



TABLE OF DELAYS

DELAY	ACTUATED BY	CAN BE USED WITH	APPROXIMATE TIME RANGE	COMMENTS
1. Cigarette	Flame, matches	Sugar-chlorate, fire fudge, sugar-sodium peroxide, silver nitrate-magnesium powder, gun powder, zinc dust-ammonium nitrate, potassium dichromate-aluminum powder, white phosphorus solution, match heads, napalm, thermate or directly on paper, straw, tinder type materials	15-20 minutes	Positioning of cigarette important
2. Gelatin Capsule	Sulfuric Acid	Sugar-chlorate, fire fudge, match heads, sugar-sodium peroxide, fire bottles	10 minutes to 2 or 3 days	Delay time will depend on thickness of gelatin, temperature, concentration of acid
	Water	Sugar-sodium peroxide, silver nitrate-magnesium, zinc dust-ammonium nitrate, aluminum powder-sodium peroxide	10 minutes to 2 or 3 days	Delay time will depend on thickness of gelatin capsule and temperature of the water
3. Rubber Diaphragm	Sulfuric Acid	Sugar-chlorate, fire fudge, sugar-sodium peroxide, silver nitrate-magnesium, zinc dust-ammonium nitrate, calcium carbide-calcium hypochlorite, match heads, aluminum powder-sodium peroxide, fire bottles	20 minutes to 3 or 4 days	Time will depend on thickness of rubber, temperature concentration of acid

TABLE OF DELAYS (continued)

DELAY	ACTUATED BY	CAN BE USED WITH	APPROXIMATE TIME RANGE	COMMENTS
4. Paper Diaphragm	a. Sulfuric Acid	Sugar-chlorate, fire fudge, match heads, sugar-sodium peroxide, fire bottles	10 minutes up to 3 or 4 hrs.	Delay time varies with kind of paper, temperature, concentration of acid. Using more layers of paper will increase the time.
	b. Glycerin	Potassium permanganate crystals wrapped in paper will ignite when the glycerin soaks through	1 minute up to an hour	Delay time easily varied by using more or less sheets of paper for the glycerin to penetrate
5. String fuse	Matches	All igniters except: turpentine-fuming nitric acid, calcium carbide-calcium hypochlorite, potassium permanganate-glycerin, aluminum-sulfur pellets	About 5 to 10 minutes per foot of length	Variations may occur due to difference in string samples and concentrations of sensitizing material
6. Candle	Matches	Flammable solvents	From a few minutes up to 5 or 6 hours	Determining factor is length of candle above the surface of the liquid to be ignited.
7. White Phosphorus solution	Evaporation of the solvent	Directly on paper, straw, and rags	30 seconds to an hour	Delay time will depend on solvent used and concentration of phosphorus in the solvent, as well as the temperature.

TABLE OF DELAYS (continued)

DELAY	ACTUATED BY	CAN BE USED WITH	APPROXIMATE TIME RANGE	COMMENTS
8. Overflow	Water	All water-actuated igniters	From a few minutes to hours	Gives reasonably reproducible results even for delays of several hours. Sulfuric acid could be used but is too corrosive for most types of containers needed for this delay
9. Tipping Delays	Filled with freshly moistened rice, peas or beans and spilling a vial of water or sulfuric acid when it tips	Use appropriate water or sulfuric acid actuated igniter, depending on whether contents of vial is water or sulfuric acid	10-15 minutes approximately when rice is used; 3-6 hrs when peas are used	Close duplication of results is not practical with this type of delay
a. Hollow Tube				
b. Corrosive action or dissolving delays	Cupric chloride on iron, water on sticks of hard candy, concentrated hydrochloric acid on iron, nails, concentrated nitric acid on copper wire	Vial filled with either water or concentrated sulfuric acid is tipped and spills its contents on the appropriate igniter mixture properly placed	From a few minutes to a week or more	The longer delays in this group will vary widely and cannot be depended upon for accurate timing

TABLE OF DELAYS (continued)

DELAY	ACTUATED BY	CAN BE USED WITH	APPROXIMATE TIME RANGE	COMMENTS
9. Tipping Delays (continued)				
c. Balancing stick delay	Either evaporation of solvent, melting of ice, or absorbing of moisture from the air	The appropriate water or acid actuated igniter	From a few minutes to a week or more	The evaporation of solvent and melting of ice give delay times of a few minutes and are fairly accurate; the absorption of water from the air gives a long delay of a number of days, usually not accurately determinable in advance.
d. Rubber band soaked in organic solvent	Evaporation of solvent causes rubber band to contract to its original size	The appropriate water or acid actuated igniter	1 minute to 10 minutes	Not an accurate delay. The time will depend on the volatility of the solvent used.
10. Alarm Clock	Alarm key will tip over a vial of water or sulfuric acid	The appropriate acid or water actuated delay	1-11 hours	Very accurate delay

CIGARETTE DELAY

To Be Used For Igniting:

Sugar-chlorate, fire fudge, sugar-sodium peroxide, silver nitrate- magnesium powder, gun-powder, zinc dust-ammonium nitrate, potassium dichromate-flake aluminum, white phosphorus solution, and match heads. A cigarette delay will directly ignite napalm and thermate incendiaries, and may be used directly against paper, straw, and other tinder type materials.

Method Of Operation:

By lighting one end of a cigarette and putting the other end into an igniter or incendiary material.

Advantages:

1. Easily made, requires little skill.
2. Cigarettes are readily available.
3. Gives fairly reproducible delay times.

Disadvantages:

1. Maximum delay time that can be obtained is usually only 15 to 20 minutes. Putting cigarettes in series to get longer delay times is not practical, because the fire may not transmit from one cigarette to the next one.
2. Glow from delay may reveal its presence unless shielded.

Materials Needed:

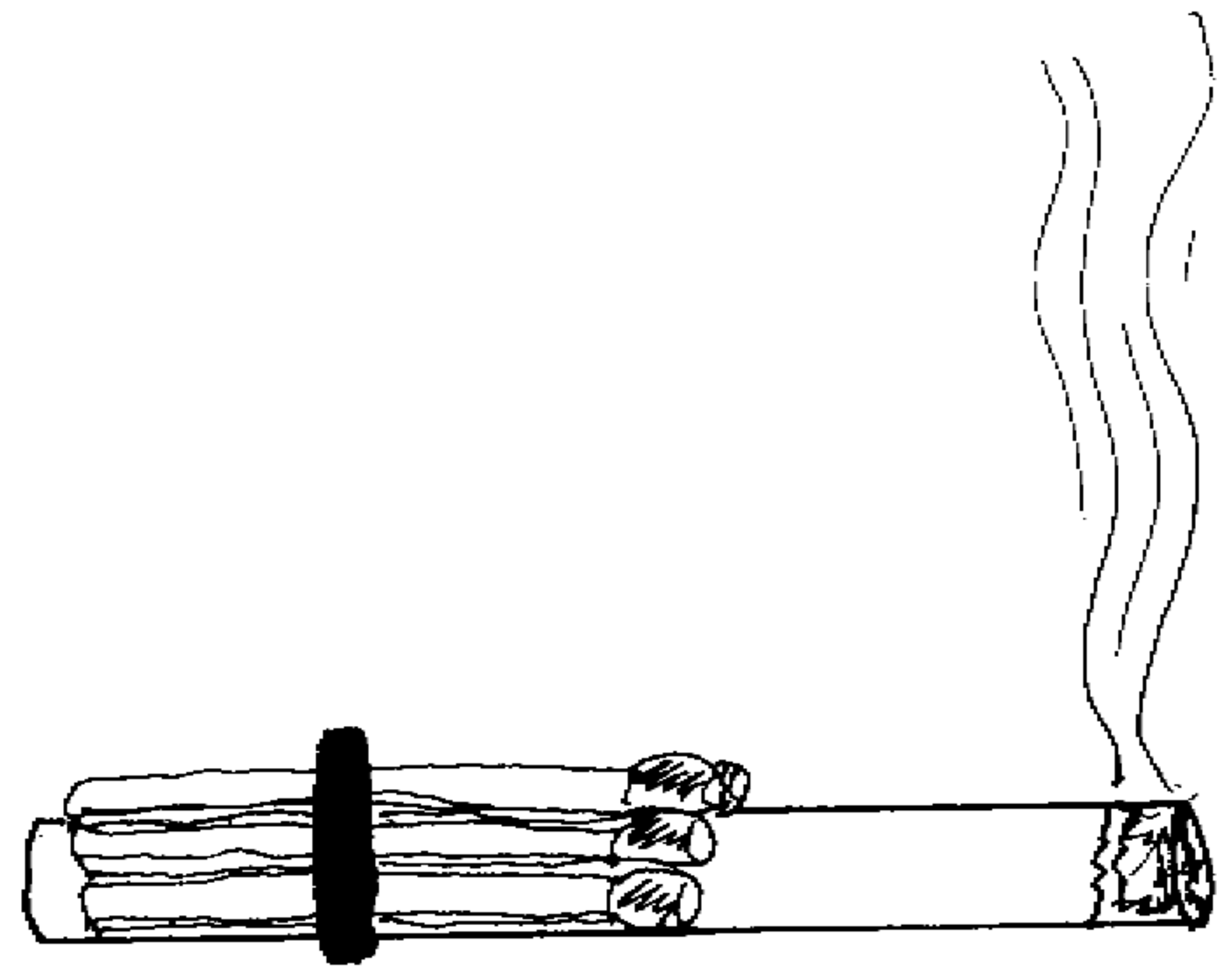
Cigarettes, matches, small box such as a match box, string or tape.

Preparation and Application:

A cigarette makes a good delay, which gives fairly accurate delay times. It can be made up in a number of ways, but there are two things to watch out for in any cigarette delay. First of all, the cigarette must always be positioned so that the flame will travel horizontally or upward. A cigarette that is placed in a vertical position and lit on top cannot be depended upon to burn all the way to the bottom. The second important thing to remember is that when a cigarette is held or

clamped it will usually not burn past the place where it is being held. The following are a few cigarette delays which work well.

A picket fence type of cigarette delay is easily made by placing four or five matches around a cigarette and tying or taping the matches in place. Place the matches parallel to the cigarette with the match heads pointing toward the end of the cigarette that is to be lit. The match heads should all be about the same distance back from the lit end of the cigarette, about one-half to three-fourths of the way back. To make the ignition of the matches more positive, push a match, head first, through the middle of the cigarette and parallel to the other matches on the outside of the cigarette. Make sure that it is pushed in to about the same depth as the matches on the outside. Lay the cigarette down so that it is horizontal, but be sure that the portion between the lit end of the cigarette and the match heads are not touching anything. Place some of the igniter material around the match heads, so that when the cigarette burns down to the match heads they will ignite and in turn ignite the igniter material.



CIGARETTE PICKET DELAY

GELATIN CAPSULE DELAYS

To Be Used For Igniting:

The water actuated igniters which are: sugar-sodium peroxide, silver nitrate-magnesium powder, zinc dust-ammonium nitrate, and aluminum powder-sodium peroxide; and the sulfuric acid actuated igniters which are: sugar-chlorate, fire fudge, and match heads.

Method Of Operation:

By the action of water or sulfuric acid on the appropriate igniter material after the water or acid has eaten a hole through a gelatin capsule.

Advantages:

1. Can be used with many igniters.
2. Easily prepared.
3. It is a small, compact delay which can be carried easily.

Disadvantages:

1. The delay time changes rapidly with changes in temperature.
2. At temperatures below 0°C, the delay will not work.

Materials Needed:

Sulfuric acid or water, depending on which igniter is used; gelatin capsules, the large kind that hold at least two spoonfuls, used for giving medicine to animals; one of the igniter mixtures listed under "TO BE USED FOR IGNITING".

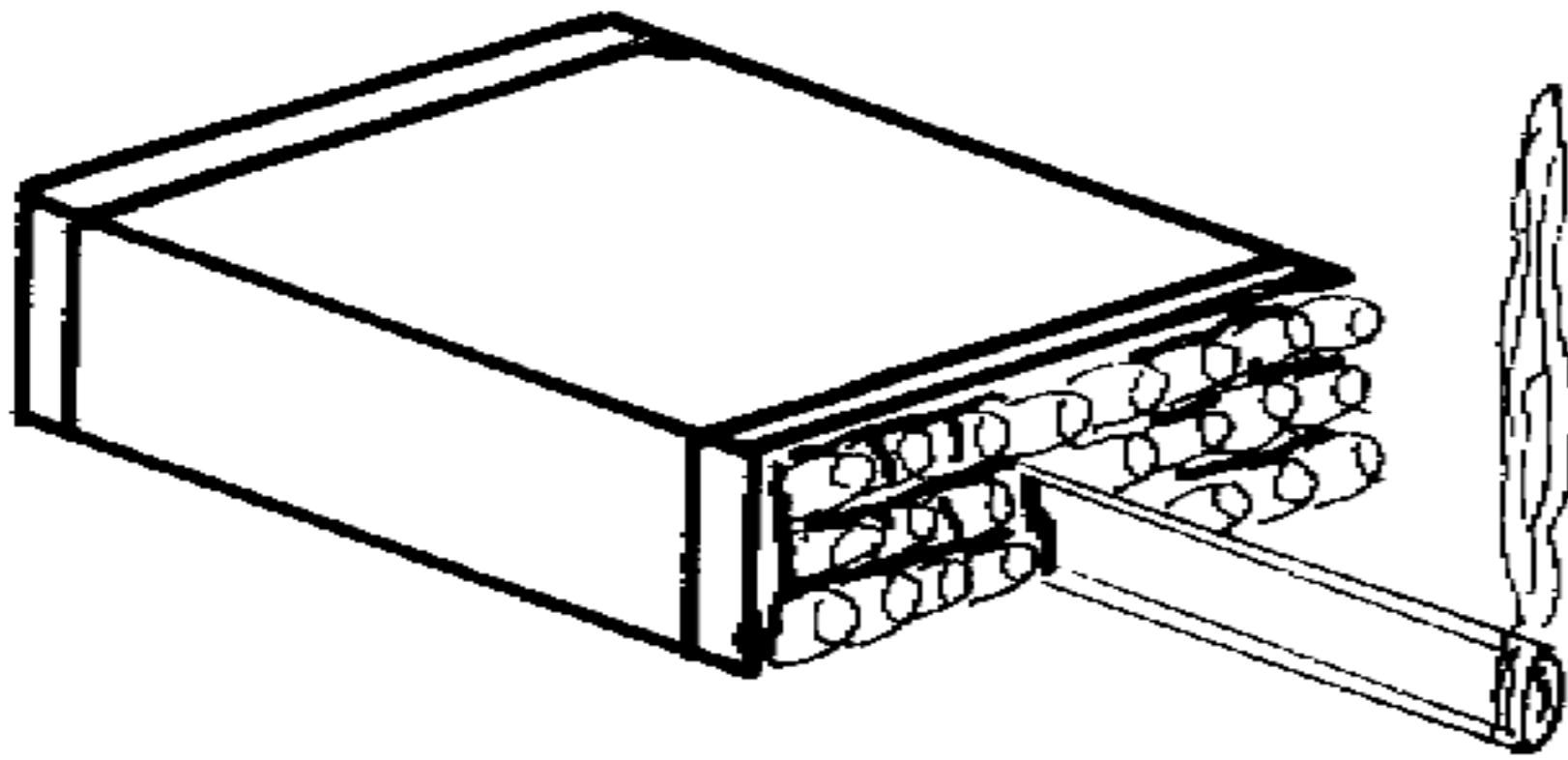
Equipment Needed:

A glass jar or bottle with a glass or plastic stopper for carrying acid. The capacity of the bottle may be only slightly larger than the capacity of the gelatin capsule. A shallow glass or porcelain dish may also be needed.

Preparation and Application:

Gelatin will slowly dissolve in either water or concentrated sulfuric acid, usually faster in the water than in the acid. The water or acid dripping through capsule will ignite when it comes in contact with the correct igniter mixture. When

Another easily prepared cigarette delay requires a cigarette and a box of matches. Tear out one end of the inner tray of a box of matches (the end next to the match heads). Insert a cigarette about half way into the matches and parallel to the matches. The cigarette should be centered in the rows of matches. Slide the tray back into the outer box, leaving all the match heads and about half of the cigarette exposed. Place the box so that the cigarette is horizontal, and on top of the material to be ignited. Light the cigarette. When it burns down to the match heads they will ignite and start the whole box of matches burning. This will ignite an igniter or it may even be used to directly start a fire on some readily ignitable materials such as paper, straw, flammable solvents, napalm, or thermite.



CIGARETTE – MATCH BOX DELAY

Cigarette delays are affected by windy weather, but not much by cold weather. In a strong wind a cigarette will burn faster and give a shorter delay time. The usual range of time for a cigarette delay is from 15 minutes up to about 20 minutes, depending on a number of factors. Such factors as the length of the cigarette, the kind of cigarette, winds and drafts, all affect the delay time. It is always a good idea to test a duplicate of the delay to be used under conditions which are close to the actual operating conditions. In this way a reasonably close estimate may be obtained of the delay time to be expected.

using water with a gelatin capsule the following igniters can be used:

Sugar-Sodium peroxide
Aluminum Powder-Sodium peroxide
Silver Nitrate-Magnesium powder
Zinc Dust-Ammonium nitrate

When using concentrated sulfuric acid with a gelatin capsule the following igniters can be used:

Sugar-Chlorate
Fire Fudge
Match Heads

Whether the delay is water actuated or acid actuated the method of preparing the delay is the same. Sulfuric acid must be handled carefully, and only in glass or unchipped enamel containers.

The simplest gelatin capsule delay is prepared by filling a gelatin capsule with one of the igniter mixtures listed above. Be sure that the two halves of the capsule fit tightly and wipe off any of the igniter material which may be sticking to the outside of the capsule. Put the capsule in a shallow glass or porcelain dish filled with water. Place the capsule close to the edge, but not in the middle of the dish. Quickly pile the incendiary material close to the capsule so that when the capsule ignites it will ignite the incendiary material. For the correct incendiary to use with the igniter mixture in the gelatin capsule, refer to the description of that igniter in the manual.

Another good way to prepare a gelatin capsule delay is to fill the capsule with water or sulfuric acid, wipe the outside off carefully, and set it down in a pile of about three spoonfuls of the igniter mixture which will work with the liquid which is in the capsule. Pile the incendiary material around the igniter so that it will ignite from the flame of the igniter. Once the liquid is added to the capsule, the other operations should be done quickly. This second method should not be used with water actuated igniters in damp weather, because ignition may occur before the required delay time has elapsed. This is due to the moisture which the incendiary material picks up from the air.

All these gelatin capsule delays work slowly in cold weather and will not work at all below 0° C. Besides temperature, other things which change the delay time are thickness of the capsule and concentration of the acid used. Always check the delay time of some of the same kind of capsules at home under conditions which are similar to those where the capsules will be used.

With water at 25° C. a gelatin capsule may give a delay time of about 20 minutes. The same kind of capsule in concentrated sulfuric acid at 25° C. may give a delay time of one hour. At 10° C. the same capsule may give a delay of 6 to 8 hours and sulfuric acid may give 24 hours. At the lower temperatures the delay time becomes less accurate.

The delay times just given are those which were obtained from one kind of gelatin capsule. Different kinds of capsules give different times, so it is very important to check the delay time of the kind you are going to use before using them on the objective.

RUBBER DIAPHRAGM DELAYS

To Be Used For Igniting:

Sugar-chlorate, fire fudge, sugar-sodium peroxide, silver nitrate-magnesium, zinc dust-ammonium nitrate, calcium carbide-calcium hypochlorite, match heads, aluminum powder-sodium peroxide, fire bottles.

Method Of Operation:

By the action of sulfuric acid on an igniter mixture after the acid has attacked a rubber membrane and drips through the membrane.

Advantages:

1. Can be used on a large number of igniters.
2. The delay does not burn or glow, a very desirable feature where it may be prematurely detected.

Disadvantages:

1. Carrying sulfuric acid around involves hazards to the operator, requires a container and stopper which will not be attacked by the acid.
2. The delay time fluctuates widely with changes in temperature.
3. The delay may not work at all in very cold weather, below 5° C.

Materials Needed:

Concentrated sulfuric acid, thin rubber membranes (such as condoms or balloons), string, tape, or rubber bands.

Equipment Needed:

A glass or plastic stoppered bottle or jar for carrying acid, a small jar or can of about 100 to 200 cc capacity.

Preparation:

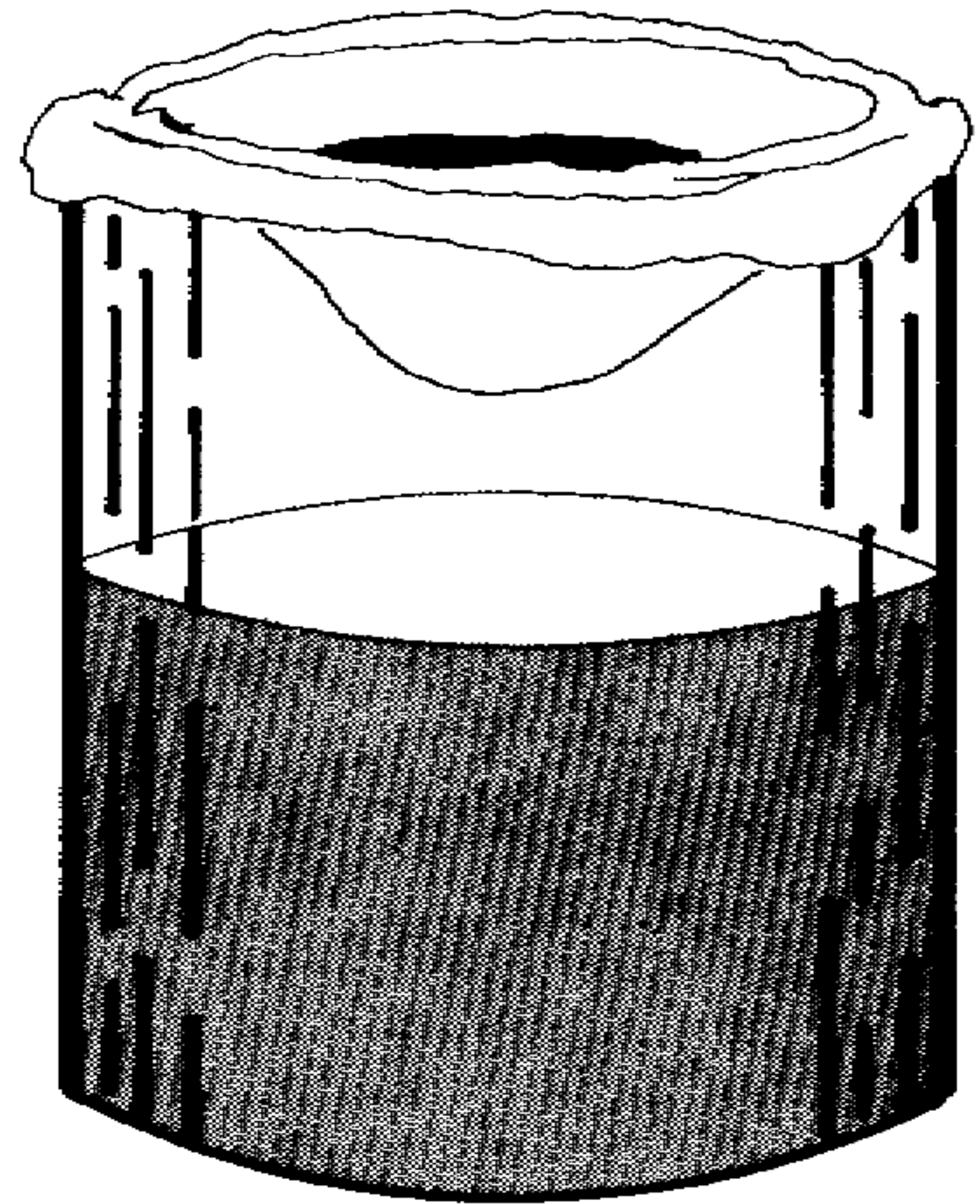
This delay works on the principle that sulfuric acid will attack and eat through a rubber membrane with a certain time. The sulfuric acid that drips through the membrane reacts with a material which ignites when it comes in contact with sulfuric acid. This igniter material may directly ignite readily combustible materials such as paper or straw, or it may ignite an incendiary which will destroy the objective.

This type of delay may be simply prepared. Into a small wide mouth jar or can put enough of the following igniter materials. Fill it about three-fourths full:

- Sugar-chlorate
- Fire Fudge
- Sugar-Sodium peroxide
- Zinc Dust-Ammonium Nitrate
- Calcium Carbide-Calcium Hypochlorite
- Match heads
- Aluminum Powder-Sodium Peroxide

Tie a piece of thin rubber sheet over the open end of the jar or can. Pile the material to be ignited around the jar or can so that when flame issues from the jar or can, it will come in contact with the incendiary material. Do not pile any of this igniter material on the rubber sheet which should be loose enough to sag slightly inward. Pour about 10 ml of concentrated sulfuric acid on the rubber sheet. When this acid eats through the rubber membrane it will react with the chemicals underneath and produce a flame.

The time delay produced by this delay varies considerably depending on a number of factors such as the kind of rubber, thickness of rubber, concentration of acid, and temperature. It is best to test a similar delay before putting it in operation at the objective, so as to get an idea of the delay time. Using a thin rubber membrane such as a condom and a temperature about



**RUBBER DIAPHRAGM DELAY
(Sugar-Chlorate In Container)**

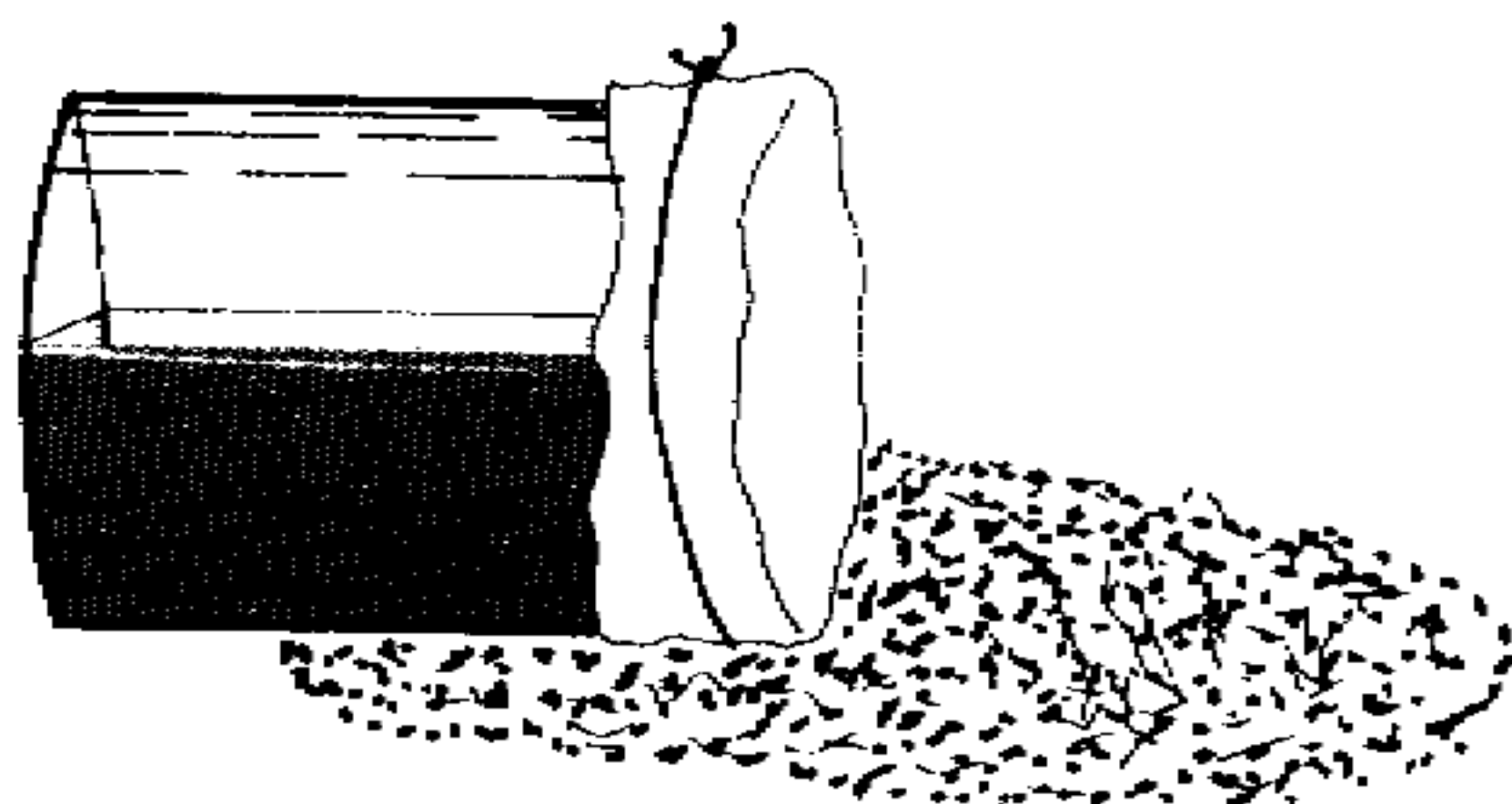
25°C., delay time is from 15 to 20 minutes. The same delay when used at a temperature of 5°C. do not use this type of delay because the acid may freeze, in which case it may not work until the temperature rises enough to thaw the acid.

Another simple way to make a rubber membrane delay is to fill a small glass bottle or vial with concentrated sulfuric acid, then tie or tape a thin rubber membrane over the end to seal it. Be sure no acid can leak out. If this bottle is placed on its side or with the rubber membrane down, on a small pile of igniter material which will ignite on contact with sulfuric acid, the acid will eat through the membrane and start a fire. Here again the delay time will be influenced by the kind of rubber, thickness of rubber, concentration of acid, and temperature.

A rubber glove may be used as a membrane for this type of delay. Pour some concentrated sulfuric acid into the glove and suspend the glove over some igniter material so that when the acid eats through the glove it will drip on the igniter material and start a fire. A rubber glove being thicker than a condom will usually give a longer delay time.

The rubber membranes used for these delays should be without pin holes or other imperfections, otherwise they cannot be used. The sulfuric acid required is the CONCENTRATED sulfuric acid. Acid taken directly from a storage battery cannot be used. To concentrate battery acid, boil it in an enameled, fire resistant glass, or copper pot until dense white fumes start to come off.

The use of rubber membranes in fire bottles is described in the manual in the instructions for preparing fire bottles.



RUBBER DIAPHRAGM DELAY
(Acid In Container)

PAPER DIAPHRAGM DELAYS
(Using Sulfuric Acid)

To Be Used For Igniting:

Sugar-chlorate, fire fudge, match heads, sugar-sodium peroxide, silver nitrate-magnesium powder, zinc dust-ammonium nitrate, aluminum powder-sodium peroxide, when sulfuric acid is used with a paper membrane delay.

Method Of Operation:

By the action of sulfuric acid on an appropriate igniter mixture, after the acid has soaked through or eaten through a paper membrane,

Advantages:

1. Easily prepared.
2. Material is readily available.

Disadvantages:

1. Works erratically or not at all in cold weather.

Materials Needed:

Writing paper such as bond paper, sulfuric acid, string, rubber bands, adhesive tape and a glass bottle with a glass or plastic stopper to carry the acid. The bottle should have a capacity of 25 to 50 cc.

Equipment Needed:

No special equipment is required because no mixing or preparation is necessary.

Preparation:

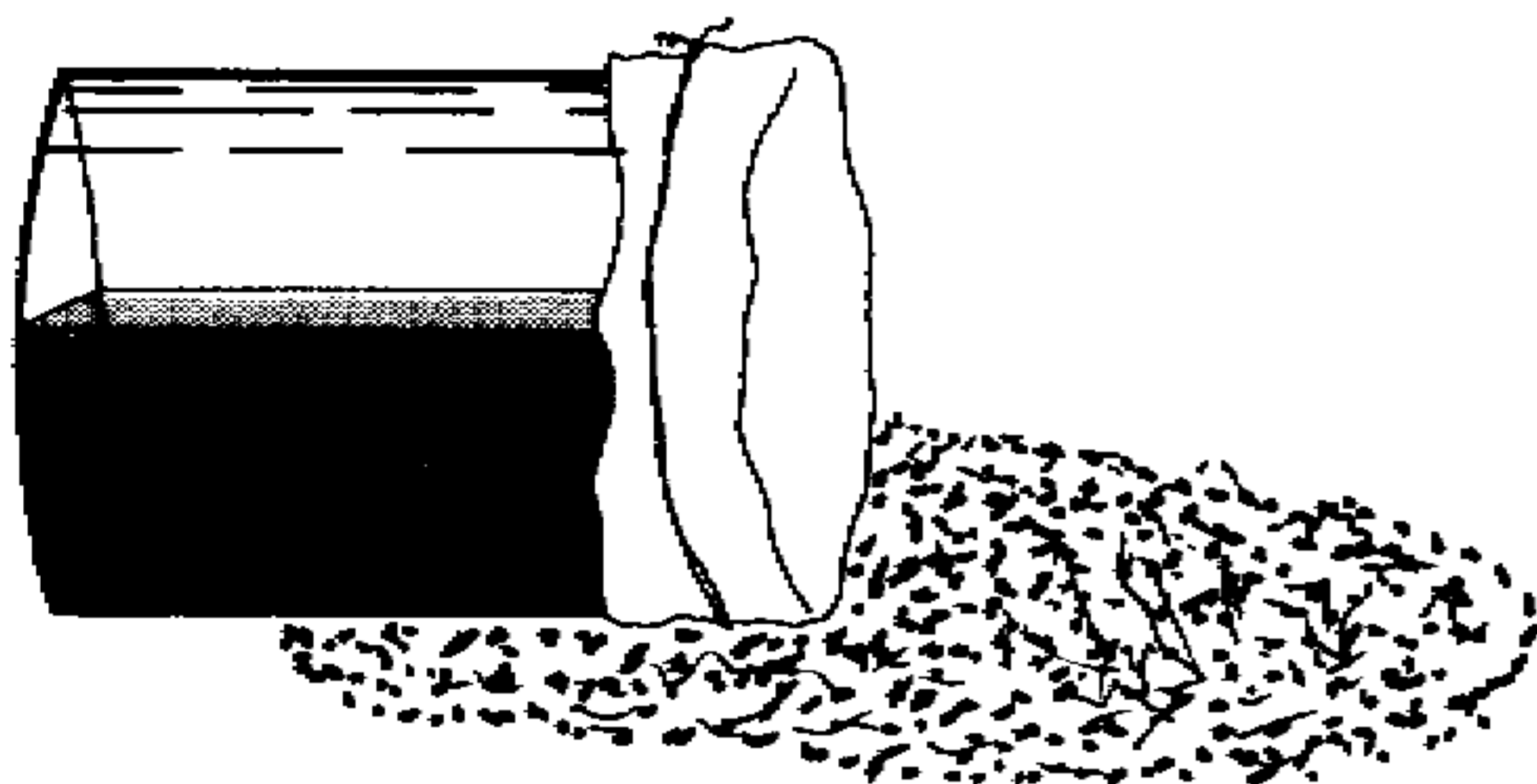
In this type of delay, paper is used as a membrane to separate sulfuric acid from an igniter material which will ignite when it comes in contact with the acid. The time required for the acid to leak through or eat through the paper is the delay time.

A very simple delay of this type is made by removing the cap from the small bottle which contains the sulfuric acid and tying or taping a piece of writing paper over the open end. Be sure that paper is on securely and that it does not leak around the edges. The bottle should be more than half full of acid. Lay the bottle on its side so that the paper rests on a few spoonfuls of the igniter material or it may be inverted so that the paper membrane is down and placed directly on top of the igniter material. Pile the incendiary material around the igniter material so that the flame from the igniter will start the incendiary material burning. The igniter mixtures which can be used with sulfuric acid and a paper membrane are:

- Sugar-Chlorate
- Fire Fudge
- Match Heads
- Sugar-sodium peroxide
- Silver Nitrate-Magnesium powder
- Zinc Dust-Ammonium Nitrate
- Aluminum Powder-Sodium Peroxide

To find out which incendiary to use, consult the manual for the description of the particular igniter which is being used.

At room temperature of about 20° C, a piece of writing paper will break in about 18 minutes. A piece of filter paper at the same temperature takes about 7 minutes. If adhesive tape is used instead of paper to seal the mouth of the bottle, the acid will break or start dripping through in about three hours. With higher temperatures the delay time is less, at lower temperatures the delay time is longer. Test it first under the same conditions as those existing where it will be used. Do not use this type of delay below 5° C, because it works very erratically or sometimes doesn't work at all.



**PAPER DIAPHRAGM
SULFURIC ACID DELAY**

**PAPER DIAPHRAGM DELAYS
(Using Glycerin)**

To Be Used For Igniting:

Sugar-chlorate, fire fudge, match heads, sugar-sodium peroxide, silver nitrate-magnesium powder, zinc dust-ammonium nitrate, and aluminum powder-sodium peroxide. It will directly ignite napalm, therinate, and other readily ignited materials such as paper, rags, straw, and excelsior.

Method of Operation:

When glycerin comes in contact with potassium permanganate, it self-ignites within a few seconds.

Advantages:

1. Easily prepared.
2. Materials are readily available.
3. Not hazardous to carry.

Disadvantages:

Will not work below 10° C.

Materials Needed:

Absorbent paper such as toilet paper, paper toweling, or newspaper, glycerin, potassium permanganate, rubber bands or string, a small bottle of about 50 cc capacity, a small, shallow dish.

Equipment Needed:

No special equipment is needed.

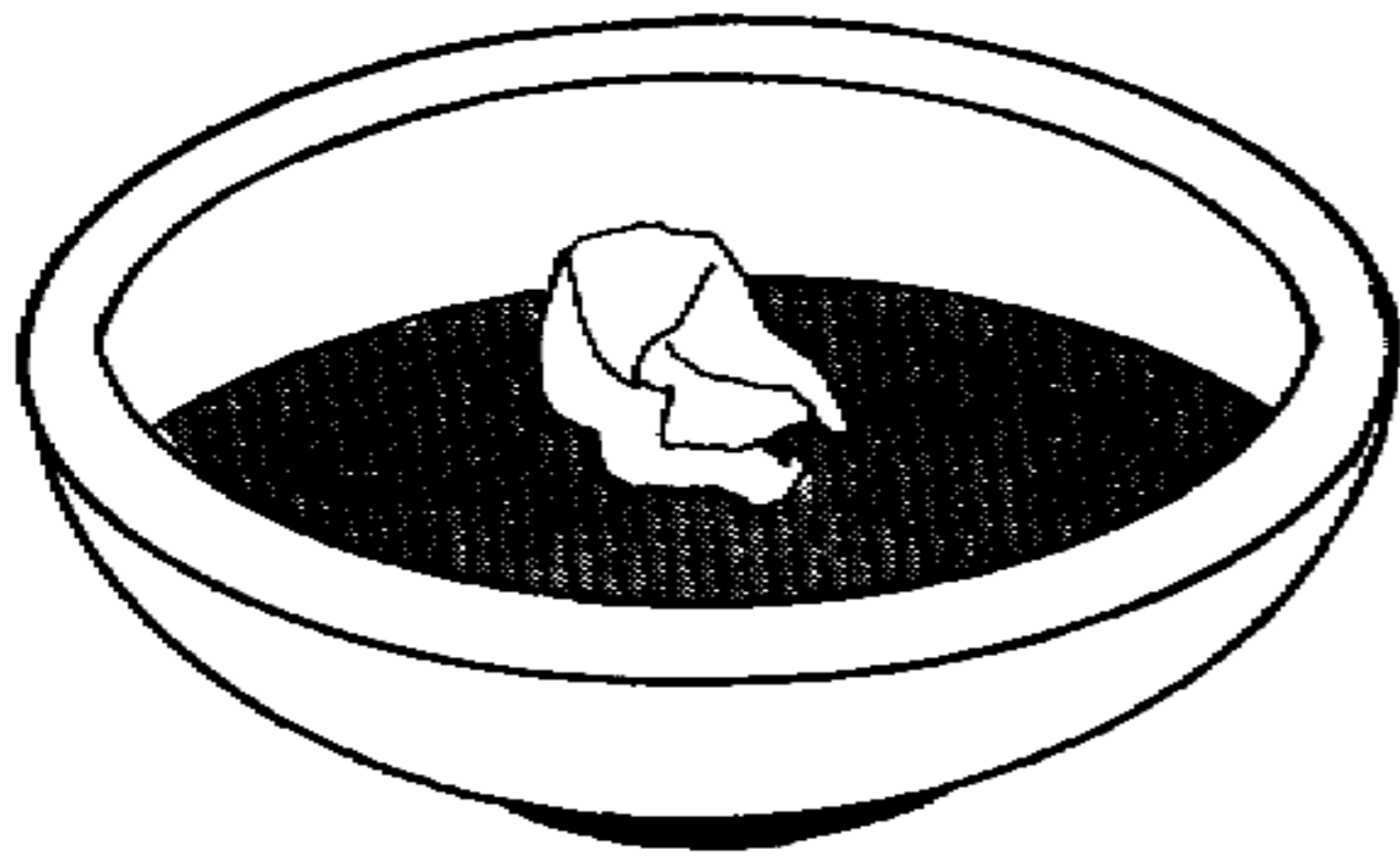
Preparation:

Fill the small bottle about nine-tenths full of glycerin, then add water to fill the bottle. Put on the cap and shake vigorously for several minutes to mix the water and glycerin completely. Now wrap five spoonfuls of potassium permanganate crystals in absorbent paper, being certain that none of the crystals can leak out. The bottle and the package may be carried by the operator without hazard to himself, and will be available for use when they are needed.

Application:

To use this delay, pour the glycerin solution into a small shallow dish or pan. Pile the incendiary material around the dish or pan in such a manner that when the glycerin burns it will ignite the incendiary material. Now drop the paper container of potassium permanganate crystals into the pan of glycerin. When the glycerin soaks through the paper and touches the potassium permanganate, a fire will start within a few seconds.

By using different kinds of paper different delay times can be gotten. Using more layers of paper for wrapping will increase the delay time. Using this delay at higher temperatures will decrease the delay time. Delay times from one minute up to about an hour are possible with this delay, depending on the condition stated above.



PAPER DIAPHRAGM GLYCERIN DELAY

The delay time should be checked under conditions which are similar to those which will exist when the delay is used against the objective.

Fairly accurate delay times are possible with this delay device. It works well at temperatures above 10°C . When the temperature is less than 10°C , a different delay system should be used, one that will work at the existing temperature.

The glycerin required for this delay is ordinary commercial, concentrated glycerin. The potassium permanganate used is the crystalline kind, about the same size as coarse ground coffee.

STRING FUSE DELAY

To Be Used For Igniting:

Sugar-chlorate, fire fudge, match heads, sugar-sodium peroxide, silver nitrate-magnesium powder, zinc dust-ammonium nitrate, and aluminum powder-sodium peroxide.

Method Of Operation:

The fuse is ignited by a match. The delay time is varied by varying the length of fuse used.

Advantages:

1. Easily prepared.
2. May be prepared at home and carried by the operator until it is needed.
3. Gives fairly accurate delay times.

Disadvantages:

Does not directly ignite incendiaries, will not ignite crumpled paper, rags, straw, or excelsior.

Materials Needed:

Sodium nitrate or potassium nitrate, some string or thin rope made from cotton, linen, jute, hemp, or other vegetable fiber, soap, and one of the igniter mixtures mentioned above.

Equipment Needed:

A small cooking pot, of either metal or fire-resistant glass, a spoon, a source of heat such as a stove or hot plate, a measuring cylinder for liquid measurement.

Preparation:

The first thing to do is to clean the string to be used. The string should be made from one of the vegetable fibers mentioned in "Materials Needed" and should be at least as thick as 2mm. Thin rope made from any of the same fibers and up to 4mm. in thickness may also be used. Cut six lengths each about one meter long. Clean the string by boiling it for 5 minutes in a small pot of soapy water. To make the soapy water, add 10 spoonfuls of soap to the water. Be certain that all of the string is covered by the soapy water while it is being boiled.

After 5 minutes of boiling, pour the soapy water out of the pot, add clean water to cover the string and boil for 2 minutes. Pour off the water, again add clean water, and boil again. Repeat the boiling with clean water three more times for a total of 5 times.

After pouring out the wash water for the fifth time, add about one-half a liter of clean water and 10 spoonfuls of sodium nitrate or potassium nitrate to the pot. Heat the pot with the string in it and stir with the spoon to dissolve the sodium nitrate or potassium nitrate, and stir till it all dissolves. Boil the solution for 5 minutes, using the spoon to keep the string down in the liquid, if necessary. When it is cool enough, take the string out one piece at a time and hang it up to dry, making certain that the bottom doesn't touch the floor, and that the string is not touching anything. A good way to do this is to tie one end to a piece of wire or string stretched across the



STRING FUSE DELAY

room, and high enough so that the string fuse will not touch the floor. Never dry the fuse by suspending it in the middle over the supporting wire or string. Space each piece of the fuse to be dried far enough apart to keep it from touching the piece on either side of it. In ordinary weather the fuse will dry enough to use in twenty-four hours, but in rainy weather it may not be dry enough, in which case two or three days may be required.

Test the fuse after twenty-four hours of drying by cutting off two equal lengths of about 20mm. each. Place one end of the fuse in a spoonful of one of the igniters mentioned in "TO BE USED FOR IGNITING" and light the other end with a match. Check the times with a watch. If both pieces of fuse ignite the igniter mixture, and the times are within 2 or 3 minutes of each other, the fuse is dry enough. If not, test them the same way the next day. If the desired results are not obtained on the second day, test again on the third day at which time the fuse is certain to be dry. Place the fuse in a tightly sealed container until it is to be used. It may be stored this way for months.

Application:

Under actual conditions of use, the fuse is used just the way it was tested. It is well to repeat the test at home a short time before it is to be used to find out if the burning time has changed. Using this latest burning time, cut the fuse long enough to give the required delay time. Twice the length gives twice the delay time. The delay time is directly proportional to the length of the fuse. Insert one end of the fuse in three spoonfuls of the proper igniter and place the igniter where it will ignite the incendiary.

If the small glow given off by the fuse is to be shielded to avoid detection, place the fuse inside a piece of pipe or bamboo. This may speed up the fuse and allowance should be made for it. Test it this way before using it to determine how fast it burns. This fuse works well in cold or windy weather. If a drop of water should fall on the fuse it could put it out. Do not use this fuse where there is a possibility that it might get wet.

This fuse will usually give a delay time of about five to ten minutes for a piece 30 cm. long. It may vary from these limits, depending on the kind of string used and the chemicals used in its preparation. Always test three pieces of this fuse at home first to get an idea of what the burning rate will be under actual operating conditions.

CANDLE DELAY

To Be Used For Igniting:

Flammable liquids of low volatility such as fuel oil, kerosene, and diesel fuel.

Method Of Operation:

A lighted candle inserted vertically into a container of flammable liquid of low volatility will ignite the liquid when the candle burns down to the liquid level.

Advantages:

1. Candles are readily available.
2. No special skill is required to use this delay.
3. Easily prepared.
4. It gives fairly accurate delay times.

Disadvantages:

1. Because of the light it gives, it may be detected easily unless special precautions to shield it are taken.
2. It may blow out in strong winds or drafts.

Materials Needed:

A candle, fuel oil or kerosene.

Equipment Needed:

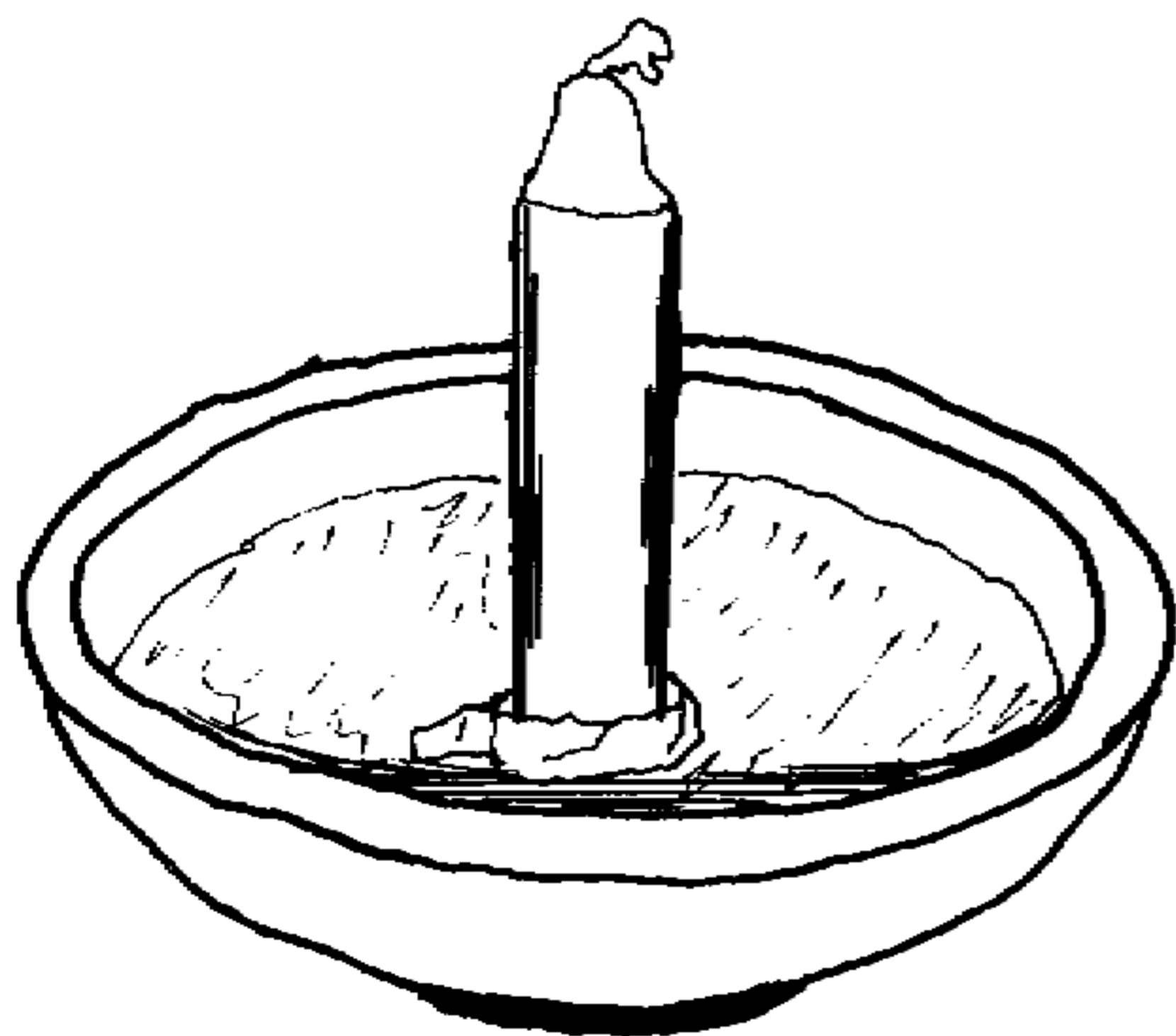
No special equipment is needed.

Preparation:

The rate at which a candle burns is the basis for this delay. Any kind of candle which gives a flame can be used. However, the candle must not be the kind that is enclosed in a container such as a glass jar or a can.

Application:

Place an unlighted candle upright in a shallow container of kerosene diesel fuel, or fuel oil. Do not use gasoline or other flammable liquid which evaporates fairly quickly. These liquids give off vapors which could ignite before the desired delay time was reached. Wrap a small piece of gauze or cloth around the base of the candle, making certain that the cloth project slightly above the level of the kerosene or fuel oil and acts as a wick. Pile the incendiary material to be ignited around the container of fuel oil or kerosene so that when the fuel oil or kerosene ignites, it will set fire to the incendiary material. Light the candle. The distance from the lighted end of the candle to the gauze or cloth will determine the delay time. Always test a similar candle beforehand under the same sort of conditions to determine how fast the candle burns. A candle delay is very useful where a delay of one to eight hours is required. For delays less than an hour it is better to use one of the other delay devices.



CANDLE DELAY

To shield the light of the candle where light is undesirable, place a loosely fitting tin can with its bottom cut out over the candle. The can must be taller than the candle. This can should have a small hole cut in its side, above the level of the fuel oil or kerosene, and several holes should be punched in the top. These holes are necessary to let in air. If a can without these holes is placed over the burning candle it would go out in a few minutes. By placing the can over the candle, this delay can be used even where strong winds or drafts would ordinarily blow out a candle.

This delay works well in cold weather and may be used at any temperature. Temperature has little effect on the delay time. This delay has the advantage that it will usually burn up completely in a fire so that it may be difficult to determine afterward how the fire was started.

The candle will not stand up in a bowl unless a weight is attached to the bottom of the candle. For this purpose a short piece of pipe about two or three cm long or a pipe coupling or cap is forced on over the bottom end of the candle. The bottom of the candle may have to be shaved down to fit inside the pipe, but it is essential that it fit tight. If it does not fit tight, it will float out of the pipe and give no delay time.

WHITE PHOSPHORUS SOLUTION DELAY

To Be Used For Igniting:

Crumpled paper, rags, excelsior, and hay. In addition white phosphorus solution will ignite flake aluminum thermite and thermite incendiaries.

Method Of Operation:

By the evaporation of volatile solvents, leaving a residue of white phosphorus which ignites by itself on contact with air.

Advantages:

1. This is a very versatile delay, because it may also be an igniter or an incendiary.
2. It is easily prepared.
3. It requires no skill to use this delay.

Disadvantages:

1. The materials required may not be readily available.
2. White phosphorus and its solutions are very hazardous to handle, especially for people who have had no experience handling it and are not familiar with its properties.

Materials Needed:

White phosphorus (sometimes called yellow phosphorus), carbon disulfide, copper sulfate, and another solvent such as gasoline, benzol or toluol.

Equipment Needed:

Two bottles with stoppers (not rubber stoppers), a pair of tweezers or tongs.

Preparation:

Never directly touch white phosphorus or allow any of its solutions to get on the skin. First pour enough carbon disulfide into a small bottle so that the bottle is about one-fourth full. A bottle that holds between 100 cc and 200 cc is excellent for this purpose. Now with a pair of tweezers or tongs, remove some sticks of white phosphorus from the container in which it is stored and drop them into the small bottle containing the carbon disulfide. Add enough sticks of phosphorus to bring the level of carbon disulfide up to half full. Be sure that all the phosphorus left in the original container is completely covered by water before putting the bottle away.

Securely stopper the bottle containing the phosphorus and carbon disulfide and shake for a few minutes until the phosphorus is completely dissolved. The solution is now ready to use and will keep for months in the stoppered bottle. Do not store it in direct sunlight or it will not keep well.

Application:

When white phosphorus is in solution, and it is poured out on a surface so that the solvent can evaporate, the white phosphorus will ignite by itself when all the solvent has evaporated. To use this solution, pour it directly onto the object to be ignited, pouring out the entire contents of the bottle. The bottle should be discarded because

if any of the solution drips on the outside of the bottle, it will catch fire and may cause a painful burn to the person holding it. If this solution is poured directly onto crumpled paper, rags, excelsior, or straw it will ignite and start to burn in less than a minute. Do not cover the soaked material with anything because the carbon disulfide must be allowed to evaporate or ignition will not occur.

For igniting thermate or flake aluminum thermite a different technique is required. Instead of pouring the white phosphorus solution directly on these materials, pour the solution so that most of it is near the thermite or thermate and only a little of the solution is directly on it. If all the solution is poured directly on the flake aluminum thermite or the thermate it may not ignite. Here again a delay time of less than a minute is usual.

The delay time of the solution can be varied by adding one of the other solvents mentioned under "MATERIALS NEEDED". To the original solution of phosphorus in carbon disulfide add a little gasoline, benzol, or toluol and test the delay time obtained by spilling a few cc of the new solution onto a piece of paper and noting when it starts to burn. Continue to add small portions of solvent, and test the solution each time until the proper delay time is reached. Delay times of twenty to thirty minutes may be obtained by this method.

Always attempt to check the delay time under conditions that simulate the conditions under which the delay will actually be used. At high temperatures the delay time will be less, and where wind or drafts are present they will hasten evaporation of the solvent and cut the delay time. This delay works well at temperatures below 0° C.

The copper sulfate solution is required if any of the phosphorus solution is accidentally spilled on the skin and for washing off the tweezers immediately following the preparation of the phosphorus-carbon disulfide solution. To make the solution, add several spoonfuls of the copper sulfate crystals to a small bottle full of water and shake until the crystals dissolve. Have this solution available whenever you work with white phosphorus. If any phosphorus solution spills on the skin, immediately wash it off with plenty of soap and water, then apply copper sulfate solution on a rag or piece of cotton. If phosphorus begins to burn on the skin, drown the flame with water, then apply some of the copper sulfate solution.

Do not attempt to substitute red phosphorus in this delay because it does not work like white phosphorus and cannot be used for this purpose.

OVERFLOW DELAYS

To Be Used For Igniting:

Water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and zinc dust-ammonium nitrate; and potassium permanganate-glycerine igniter.

Method Of Operation:

A liquid (water or glycerin, depending on which igniter is used), dripping through a hole in the bottom of a container, is caught in a second container under the first one. When the liquid overflows this second container, it comes in contact with an appropriate igniter mixture and starts a fire.

Advantages:

1. Easily prepared.
2. Gives fairly reproducible delay times.
3. A wide range of delay times may be obtained by this method.

Disadvantages:

1. Will not work in temperatures below 0°C ., or with glycerin-potassium permanganate, not below 10°C ..
2. Cannot be used with most igniter mixtures.

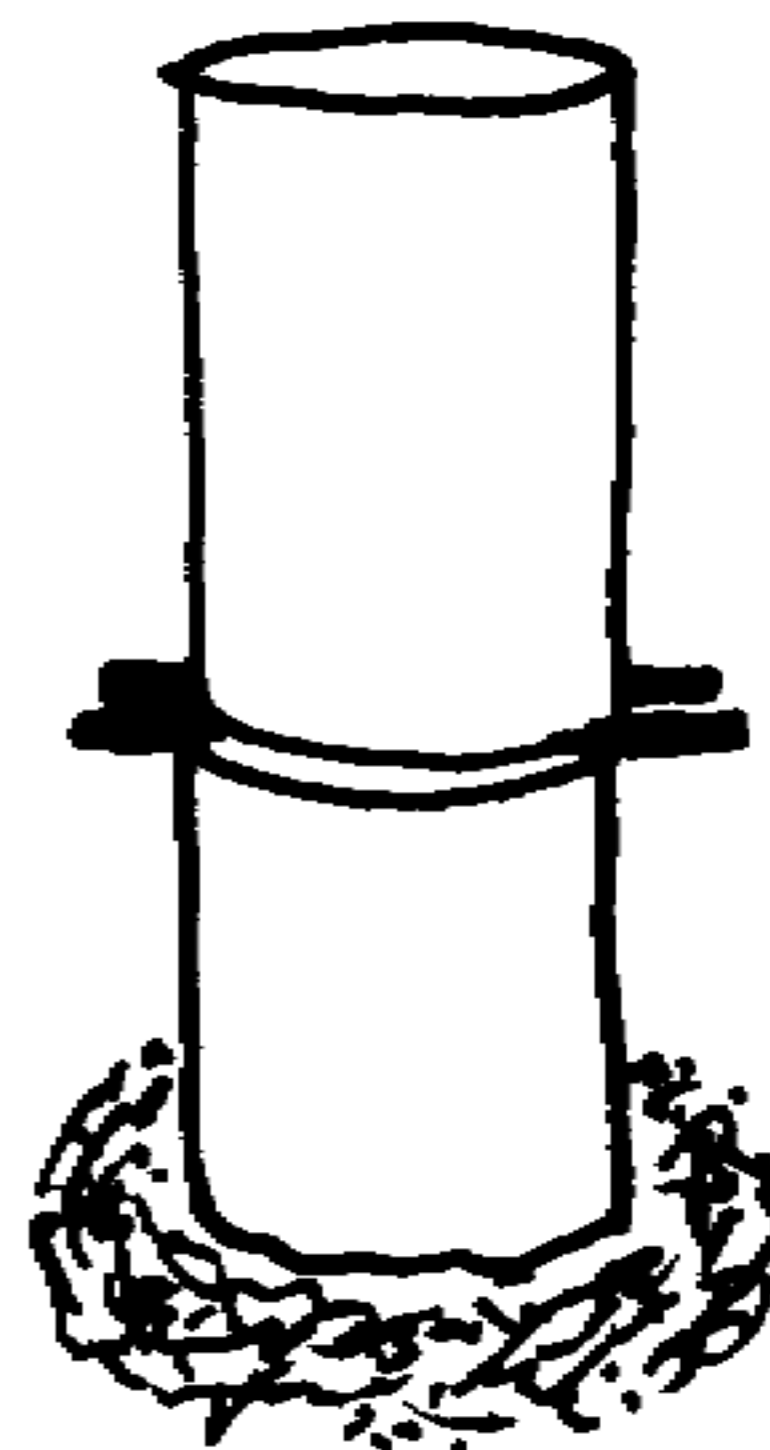
Material Needed:

Two cans of the same size, or approximately the same size. A good size to use is about 500 cc capacity, although smaller or larger cans can be used and will work as well. Large cans are not as easily concealed while being carried. Also needed are a water or acid actuated igniter or some glycerin and potassium permanganate.

Preparation And Application:

This delay is very simple to prepare and use. If two cans of the same size are used, either one may be used for the top can. If different size cans are used, place the larger can on top.

When two cans of the same size are used, punch or drill a small hole of 1 to 2 mm diameter in the bottom of one of them, fill it with water, and with a watch determine how long it takes for the can to empty. This will determine the maximum delay time that can be attained by this can. If this can filled with water is placed over the open end of the other can which already has water to a depth of 1 or 2 cm in it, the water from the top can will drip into the bottom can and finally overflow it. If a ring of 10 spoonfuls of a water actuated igniter mixture is scattered around this bottom can, this igniter will ignite when the water touches it. By putting more water in the bottom can before putting the filled can on top of it, the delay time can be decreased.



OVERFLOW DELAY

If cans of different sizes are used, always have the larger can on top. In this instance, the maximum delay time will be determined by how long it takes the larger can to overflow the smaller can under it. The delay time can be shortened by putting some water in the bottom can before setting the filled top can over the bottom can.

This delay can also be used with glycerin as the liquid instead of water. Here potassium permanganate should be sprinkled in a ring around the bottom can. Glycerin flows more slowly and gives a longer delay time than water at the same temperature.

Always test the glycerin delay at a temperature which is close to the temperature at which it is to be used because glycerin flows much more slowly when the temperature drops just a few degrees, especially in cold weather. Do not use glycerin in this delay when the temperature drops below 10°C .

This delay works well with water down to the freezing point of water at 0°C . The delay time will increase with lower temperatures. This delay cannot be used with water below 0°C , because the water will freeze.

When placing the top can over the bottom can always place it in such a position that the liquid can flow out of the bottom can when it fills up. That is, do not completely seal off the lower can so that no liquid can flow out the top.

One other way to vary the delay time which can be obtained by this type of delay is to change the diameter of the hole in the upper can. Enlarging the hole will give a shorter delay time; using a smaller hole will give a longer delay time.

HOLLOW TUBE TIPPING DELAYS

To Be Used For Igniting:

Water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powders, and zinc dust-ammonium nitrate, or the acid-actuated igniters, sugar-chlorate and fire fudge, or the glycerin-potassium permanganate igniter.

Method Of Operation:

A hollow tube filled with a freshly moistened cereal or grain will fall over and spill a vial of water or acid as the cereal or grain swells and expands. The water or acid is arranged to spill on and ignite the appropriate igniter mixture.

Advantages:

1. Easily prepared.
2. May be used with a large number of igniters.
3. It gives fairly reproducible delay times.

Disadvantages:

It will not work at all below 0°C , because the water will freeze, or the acid may freeze.

Materials Needed:

A piece of metal tube or pipe, or a piece of bamboo about 2 to 3 cm inside diameter and about 10 to 15 cm long, or a glass test tube of the same dimensions, a small glass vial or small bottle that holds about 25 cc., string or rubber bands, rice, peas, or beans, concentrated sulfuric acid, and one of the igniter mixtures mentioned above.

Equipment Needed:

A glass bottle with a glass or plastic cap to carry the acid or other liquids.

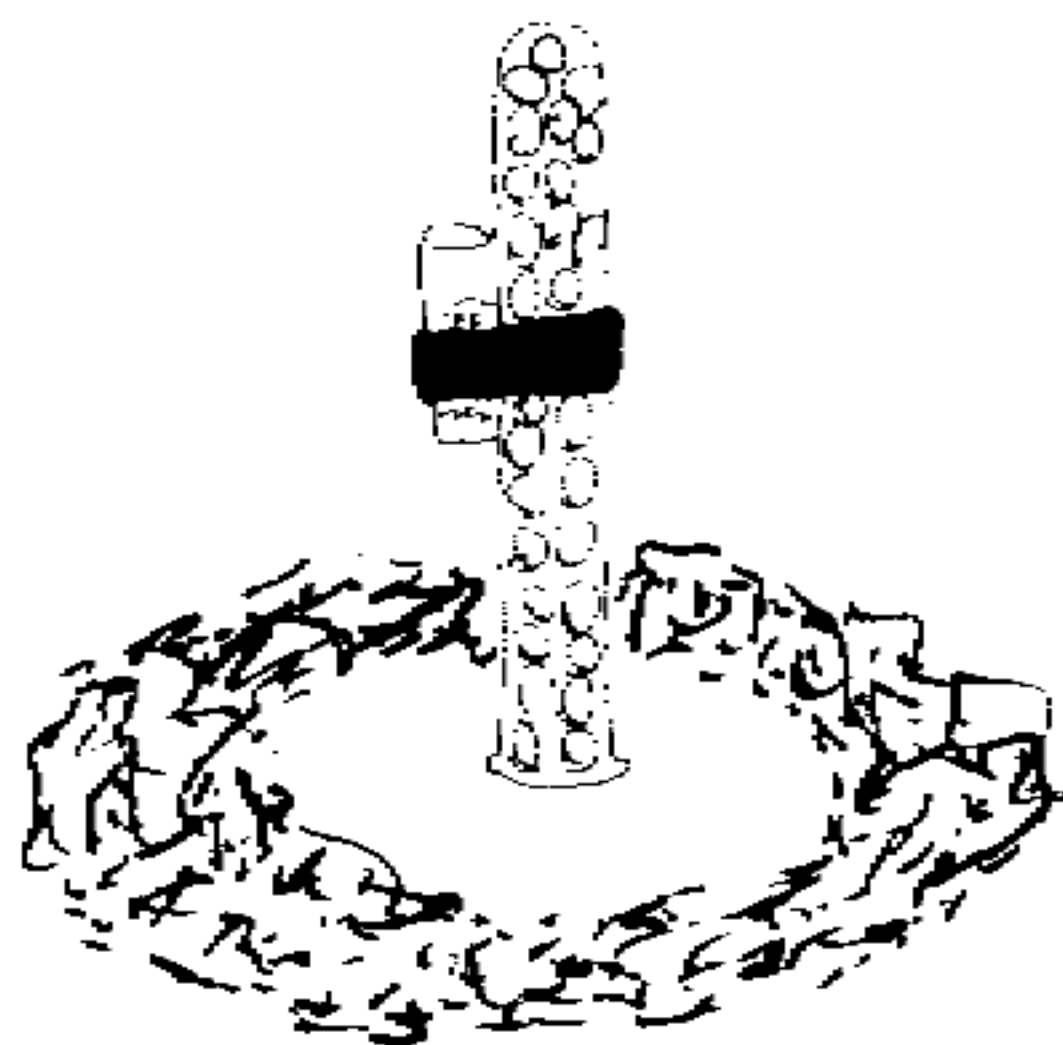
Preparation:

The metal tube or pipe or piece of bamboo must be sealed at the top and open at the bottom. The pipe or tube can be made of any metal or glass but must be flat across the bottom in order that it can stand up vertically without falling over. The piece of bamboo must also be able to stand vertically without falling over and must be sealed at the top. With some string or rubber bands attach the small glass vial or bottle to the piece of pipe or bamboo. The vial must be attached near the top of the pipe or bamboo, with the open end of the vial up, and the open end of the pipe down. This assembly should stand up without toppling over. If it seems unsteady, move the vial downward slightly. Nothing more should be done with this assembly until it is ready to be used at the place where the fire is to be started.

Application:

At the place where the delay is to be used, fill the piece of pipe or bamboo with rice, peas or beans depending on what time delay is required. Add enough water to completely moisten the rice,

peas, or beans and quickly pour off all the excess water. Put the delay down in a vertical position with the open end down and immediately fill the little vial or bottle with water or concentrated sulfuric acid. Now quickly put about ten spoonfuls of the igniter mixture in the form of a ring around the delay assembly, making the ring of such a diameter that when the delay mechanism falls over it will spill the acid or water from the vial or bottle onto the igniter mixture and start it burning. Place the incendiary material where the flame from the igniter will start the incendiary burning.



HOLLOW TUBE TIPPING DELAY

The reason why the delay assembly tips is because the rice, peas, or beans expand when they are wet with water and they expand enough to make the assembly unsteady enough to fall over. By putting the igniter material in a circle around the delay it doesn't matter in which direction the delay device falls. Rice will usually give a delay time of about 10 to 20 minutes. Peas and beans will usually give longer times, up to 4 or 5 hours. Whichever of these foods is used, always test it at home before using it on the job. In the test at home, where only the delay time is to be tested, do not use any of the igniter mixture.

Although this delay works well in fairly cold weather, it should not be used below 0° C. The water which is used to cause the swelling of the peas, beans, or rice may freeze, or the water or acid used for igniting the igniter may freeze.

Another way in which the hollow tube delay can be used is to fill the small vial or bottle with glycerin instead of water or sulfuric acid and to

put potassium permanganate crystals in a ring around the delay. When the glycerin is spilled on the potassium permanganate, a fire will start. This igniter will not work when the temperature is colder than 10° C.

All these delays will take longer to fall over in colder weather. When testing the delay time at home, try to test it at approximately the same temperature that you expect to find at the objective.

CORROSIVE OR DISSOLVING TIPPING DELAYS

To Be Used For Igniting:

Water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and zinc dust-ammonium nitrate; sulfuric acid actuated igniters which are: sugar-chlorate and fire-fudge; and potassium permanganate-glycerin igniter.

Method Of Operation:

A tripod is made to tip by a corrosive or dissolving action of a liquid against one of its legs, causing a vial of acid, water, or glycerin attached to the tripod to spill on the proper igniter mixture, which ignites the mixture.

Advantages:

1. Easily prepared
2. May be used with a large number of igniters.

Disadvantages:

1. Delay time may vary greatly with temperature changes.
2. Cannot be used in cold weather below 10° C.

Materials Needed:

Three wooden sticks about the size of pencils (about 15 cm. long and 0.5 cm in diameter), a small glass bottle or glass vial of about 25 cc. capacity, string, tape or rubber bands, concen-

trated sulfuric acid, and one of the igniter mixtures mentioned above. In addition, one of the following combinations of items are needed:

Long sticks of hard candy plus water.

Lengths of bare copper wire plus concentrated nitric acid

Iron nails or wire plus concentrated nitric acid

Iron nails or wire plus concentrated hydrochloric acid

Iron nails or wire plus cupric chloride solution

Equipment Needed:

Two glass bottles or glass jars with plastic or glass tops to carry acid or other liquids, a shallow glass or porcelain bowl such as a soup bowl.

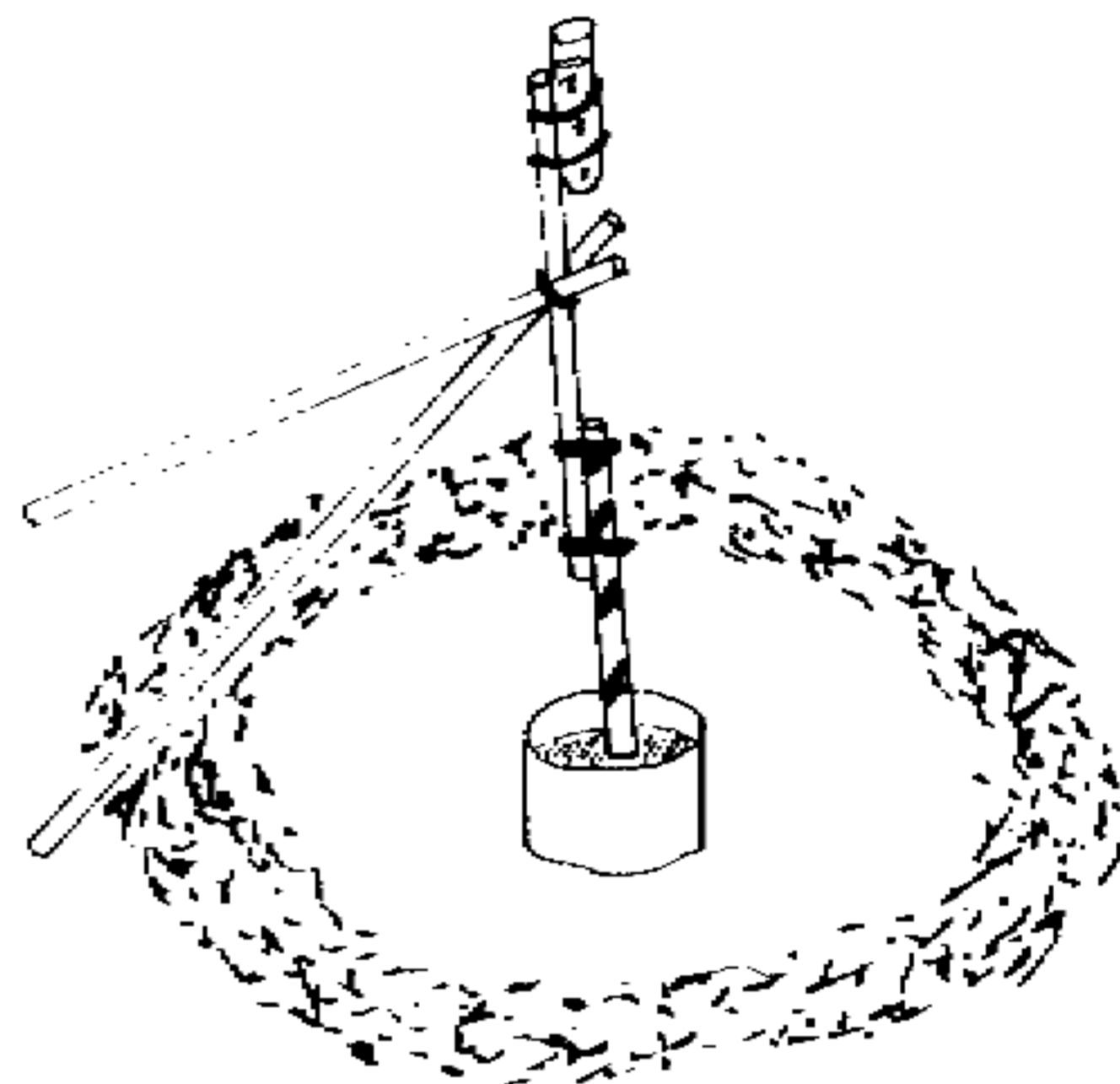
Preparation:

Make a tripod out of the three sticks, taping the sticks together at the top of the tripod. Two of the legs should be the same length, the third leg of this tripod should be about 5 or 6 cm shorter than the other two. Now attach by tape or a rubber band to the short leg either a stick of hard candy, a piece of heavy bare copper wire, or an iron nail or piece of heavy iron wire, adjusting this length to make it the same as the other two legs. The finished tripod should have a distance of about 10 to 12 cm. between any two legs and stand up straight without leaning. Now to the top of the tripod, firmly tape or tie a small glass vial, open end up, and make sure that the tripod will still stand without leaning or tipping. The distance between the legs at the bottom of the tripod may have to be adjusted to keep the tripod standing up straight.

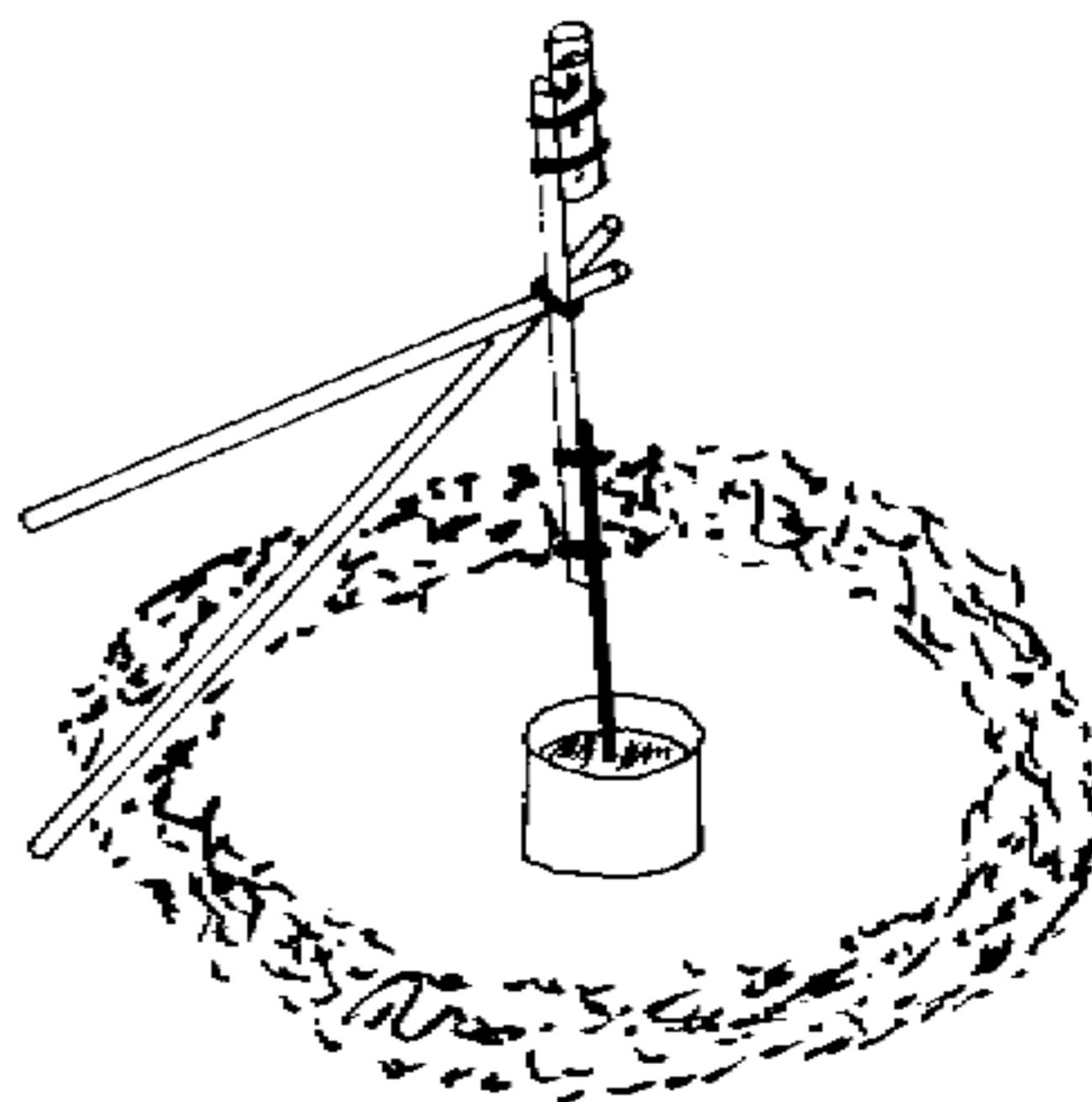
Application:

To use this delay device, insert the leg of the tripod which has the candy, wire, or nails into a glass or porcelain bowl, then fill the vial at the top of the tripod with either water, concentrated sulfuric acid, or glycerin, depending upon which igniter mixture is to be used. Put a ring of about ten spoonfuls of the proper igniter material

around this device, putting the igniter material where the spilled contents of the vial are sure to come in contact with it. Place the incendiary material where the flame of the igniter will ignite it. Now fill the glass bowl with the liquid which will dissolve or attack the leg of the tripod in the blow. For hard candy the liquid is water; for copper wire the liquid is concentrated nitric acid; for iron nails the liquid may be concentrated nitric acid, concentrated hydrochloric acid, or a solution of cupric chloride.



CANDY STICK TIPPING DELAY



CORROSIVE TIPPING DELAY

Because a number of factors such as temperature, concentration of solution, and imperfections in the leg of the tripod, may vary the delay time considerably, no definite delay times are given for the delays just described. In the table below are some of the times observed and they should serve as a guide to the range of times which may be expected. Always test at home the particular delay to be used under the same conditions as where it will be used.

	Time
Hard candy plus water	5 to 10 minutes
Copper wire plus concentrated nitric acid	5 min. to 2 hrs.
Iron wire or nails plus concentrated hydrochloric acid	24 hrs. to 3-4 days
Iron wire or nails plus concentrated nitric acid	5 to 10 minutes
Iron wire or nails plus cupric chloride solution	10 min. to 5-6 hrs.

This type of delay may vary greatly with only moderate changes in temperature. Never use it at very low temperatures below 10° C. because it may become very erratic or may not work at all.

Concentration of solutions, thickness of the leg to be attacked, differences in kinds of copper or iron, and, of course, temperature variations will all affect the delay time achieved by this type of delay. At lower temperatures the delay time will be longer, at higher temperatures the delay time will be shorter. Sometimes an impurity or imperfection in the metal may cause it to collapse much sooner than an identical previous test. Do not use this type of delay where a very accurate delay time is required.

BALANCING STICK DELAYS

To Be Used For Igniting:

The water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and

zinc dust-ammonium nitrate; acid actuated igniters which are: sugar-chlorate and fire fudge and potassium permanganate-glycerin igniter.

Method Of Operation:

A stick on a pivot is balanced by means of a weight on one end and a small glass vial full of liquid on the other end. By decreasing the weight on the weighted end, the vial is made to tip down and spill its liquid on an appropriate igniter material, starting a fire.

Advantages:

May be used with a large number of igniters.

Disadvantages:

1. Delay time is greatly affected by changes of temperature and air circulation.
2. Delay times are not easily reproduced because many conditions may change the delay time.
3. The delay is difficult to prepare and adjust properly.

Material Needed:

A stick about 2 cm. square and about 40 cm. long, a nail, string, concentrated sulfuric acid, a small glass vial of about 10 cc. capacity, volatile solvent such as alcohol, gasoline, ether, carbon tetrachloride, tape, rags. If no solvent is available and ice can be obtained, it may be used instead. Another kind of delay uses calcium chloride, zinc chloride, or soda lye. If ice or one of the chemicals is used, a small basket will have to be made from some wire screen, the kind used for insect screens. Also needed is one of the igniter mixtures mentioned above.

Equipment Needed:

Two small glass bottles with plastic or glass stoppers.

Preparation:

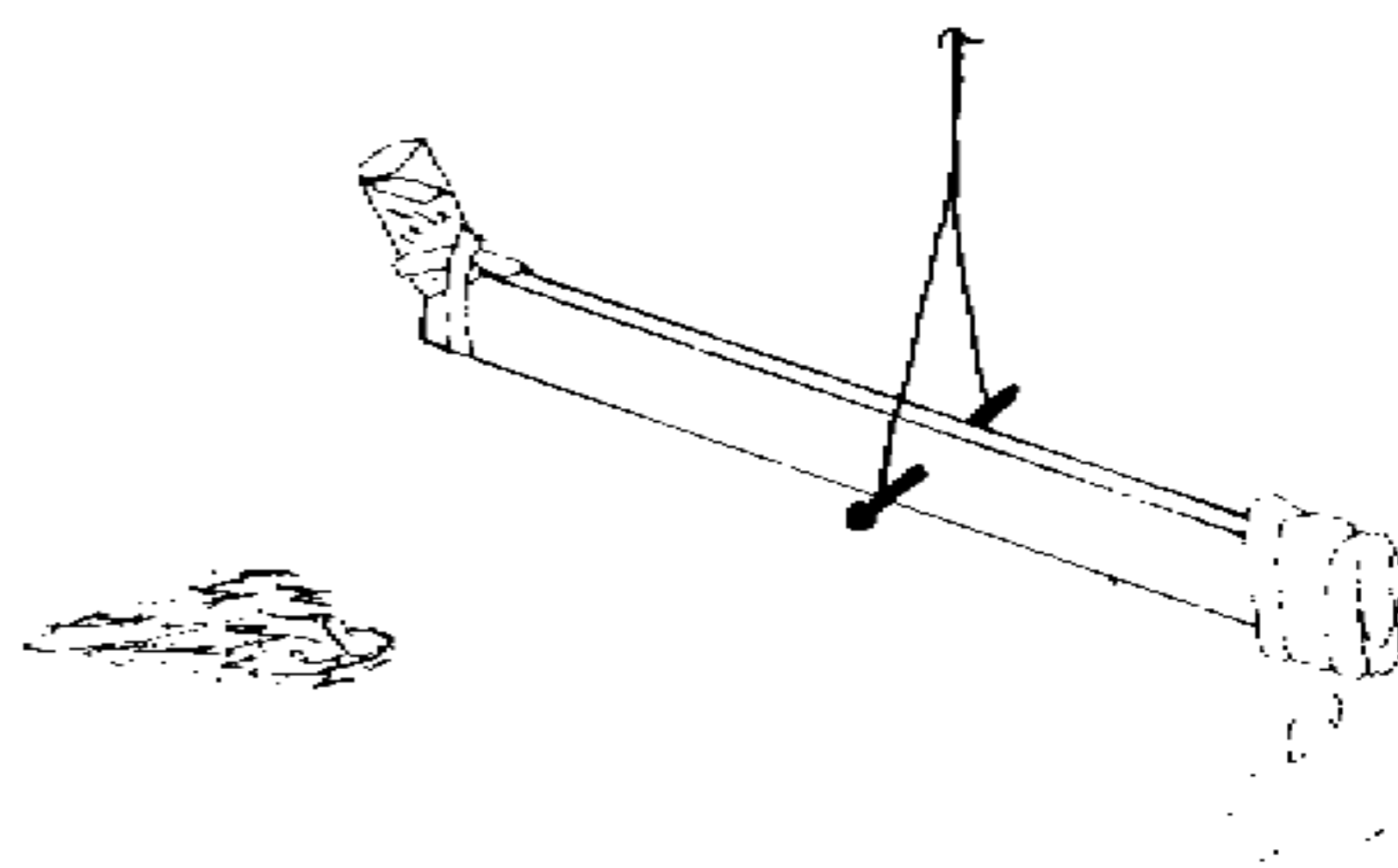
This delay device operates on the same principle on which a scale works. If a stick is pivoted in the middle, the heavy end of the stick will always go down. To prepare this delay,

drill a hole through the middle of the stick and insert a nail in the hole. The nail should be smaller in diameter than the hole and the stick should turn easily. Tie a short piece of string about 10 to 15 cm. long to the nail, tying each end of the string to opposite ends of the nail. This forms a loop by which the stick can be suspended. The stick may not balance exactly, but this is not important. To one end of the stick, tape a small glass vial. Tilt the vial when taping it so that when this end of the stick is about 20 cm. higher than the other end, the vial will be vertical and the open end will be up. Fill the vial about three-fourths full of water. Now to the other end of the stick, tie on enough of a strip of cloth or piece of string or rope so that it balances the other end of the stick. Pour the water out of the vial.

Application:

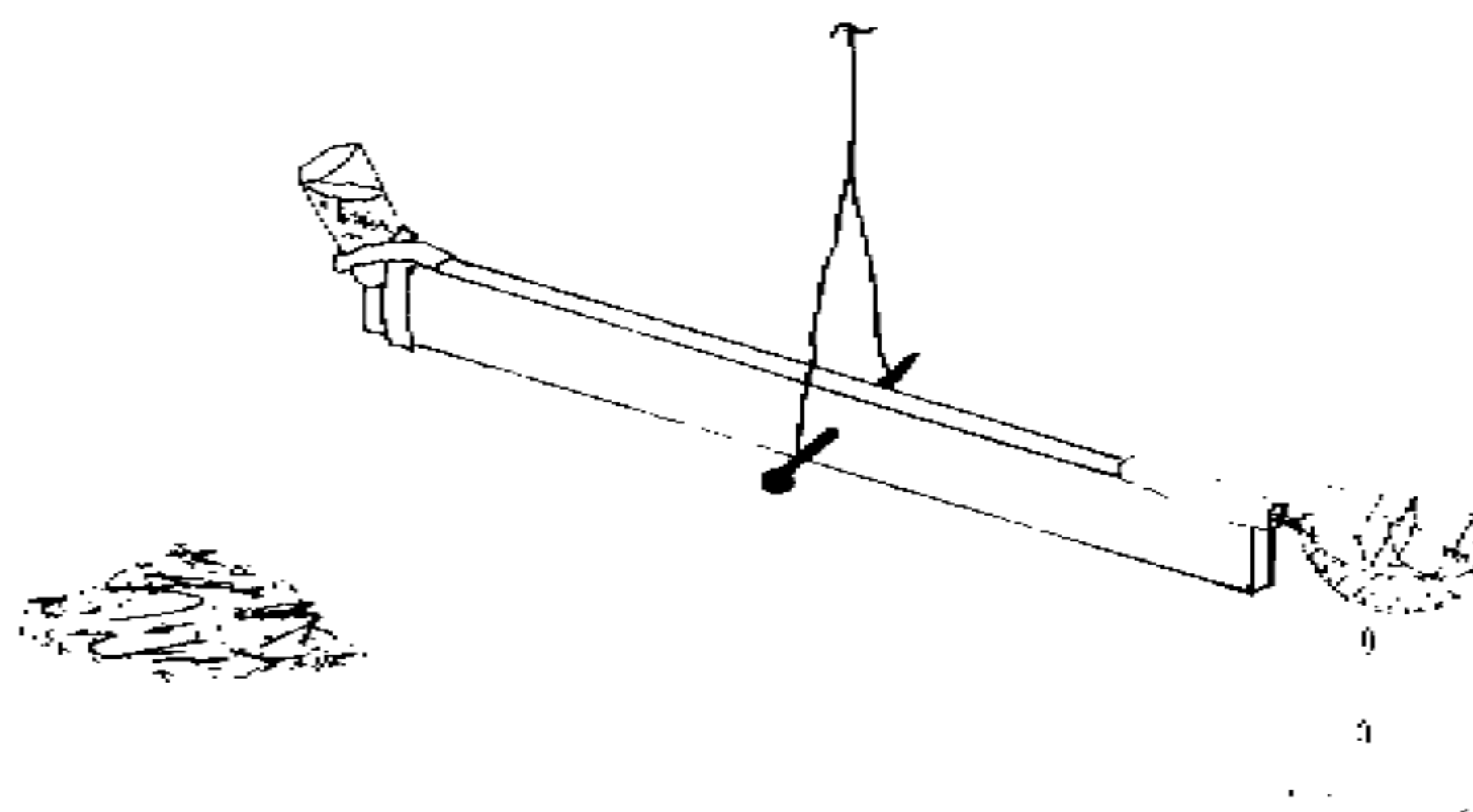
To use this delay, drive a long nail (at least 10 cm. long) part way into a wall or wooden box about 20 cm. above the floor. Leaving at least 5 cm. of the nail projecting. Put the loop of string on the nail right next to the head of the nail. The stick should not touch the box or wall, but should swing freely. The end with the rag will be touching the floor. Pour enough solvent on the rag to thoroughly soak it, pouring on at least 20 cc. Now, working quickly, add water, or sulfuric acid, or glycerin to fill the vial, then spill some of the proper igniter mixture on the floor where the vial will spill its liquid when the stick tips the other way. In a few minutes, depending mostly on which solvent and how much of it is used, the vial will tip and spill its liquid on the igniter mixture and start a fire. The incendiary should be placed so that the igniter mixture will start it burning.

Where no solvent is available or where the odor of solvent might make the delay easy to detect, the same procedure is used except that instead of wrapping a piece of cloth or string around one end of the stick, a small basket made of wire screen is suspended. The wire basket end would balance the vial end with the vial empty. If the wire basket end is too heavy, add tape to the vial end until a balance is reached. If the vial end is slightly too heavy, it can be used that way. The wire basket should be about 5 cm by 5 cm and about 2 cm deep. Tape it or tie it to the stick with the open end up.



EVAPORATING LIQUID TIPPING DELAY

To use the delay, fill the wire basket with small pieces of ice or with calcium chloride or zinc chloride, or sodium hydroxide crystals, fill the vial with the proper liquid for the igniter used, then sprinkle the igniter mixture on the floor where the vial will spill its contents when it dips down. When ice is used the delay time will be a matter of minutes, depending on how warm the temperature is.



MELTING ICE TIPPING DELAY

When calcium chloride, zinc chloride, or sodium hydroxide crystals are used to fill the wire basket, the delay time will be days or even weeks, depending mostly on how dry the air is. When using these chemicals do not use a water actuated igniter because the igniter will usually be self-igniting before the delay device can ignite it. When using ice, any of the igniters listed under "TO BE USED FOR IGNITING" can be used.

Advantages:

1. Easily prepared.
2. May be used with a large number of igniters.

Disadvantages:

1. Does not give accurate delay times.
2. Does not work well at temperatures below 10° C.

Materials Needed:

A small glass bottle which tips easily, a rubber band, gasoline or carbon disulfide, a small jar or can with a tight fitting lid for carrying the gasoline or carbon disulfide, nails, and one of the igniters mentioned above.

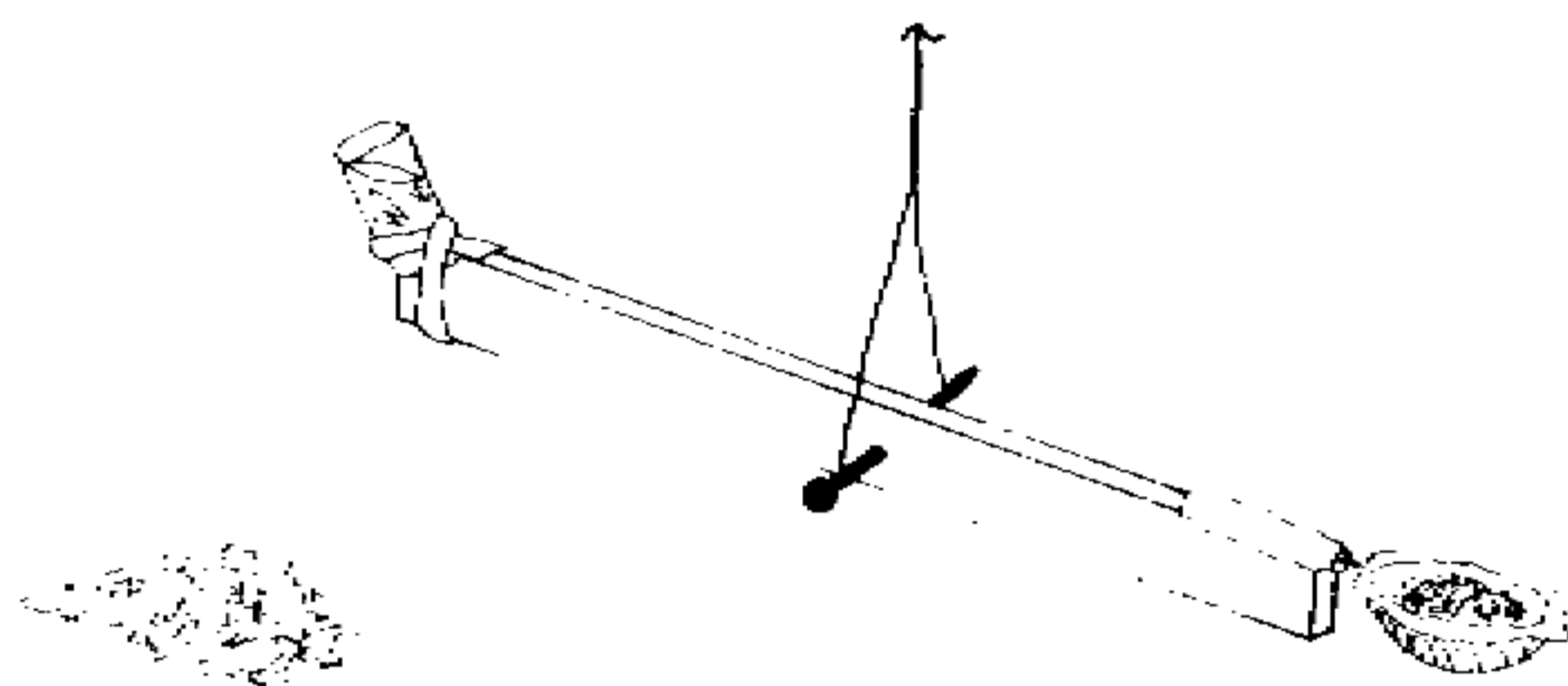
Equipment Needed:

No special equipment is needed.

Preparation:

This delay device usually gives a delay time of only a few minutes. It is easily prepared and operated. If a rubber band is placed in certain liquids the rubber band will swell and stretch. If this rubber band is removed from this liquid, the liquid will evaporate, and the rubber band will shrink back almost to its original size. It is the shrinking of the rubber band which makes this delay work.

To prepare the delay, first soak some rubber bands in gasoline or carbon disulfide for about an hour. This should be done just before it is desired to use the delay. Leaving the rubber bands in the solvent for more than an hour may weaken them too much. At the place where the delay is to be used, drive a nail part way into the wall, leaving about 4 or 5 cm. sticking out. Use a nail with a large head. Fill a small glass bottle of about 25 to 50 cc capacity with the proper liquid for the igniter mixture which is to be used. Place the bottle a few centimeters from the nail. Slip one of the solvent soaked rubber bands over both the nail and the neck of the bottle. Quickly adjust the tension on the rubber band by moving the bottle forward or backward until there is enough tension to hold the rubber band in place. Be sure it isn't too tight or the bottle will topple as soon as you let go of it. Sprinkle ten spoon-



MOISTURE ABSORBING TIPPING DELAY

Because this delay device is difficult to prepare and to use, it is not recommended where other types of delays can be prepared. Always check this delay at home and know exactly how to make it work before attempting to use it on an objective.

STRETCHED RUBBER BAND DELAYS

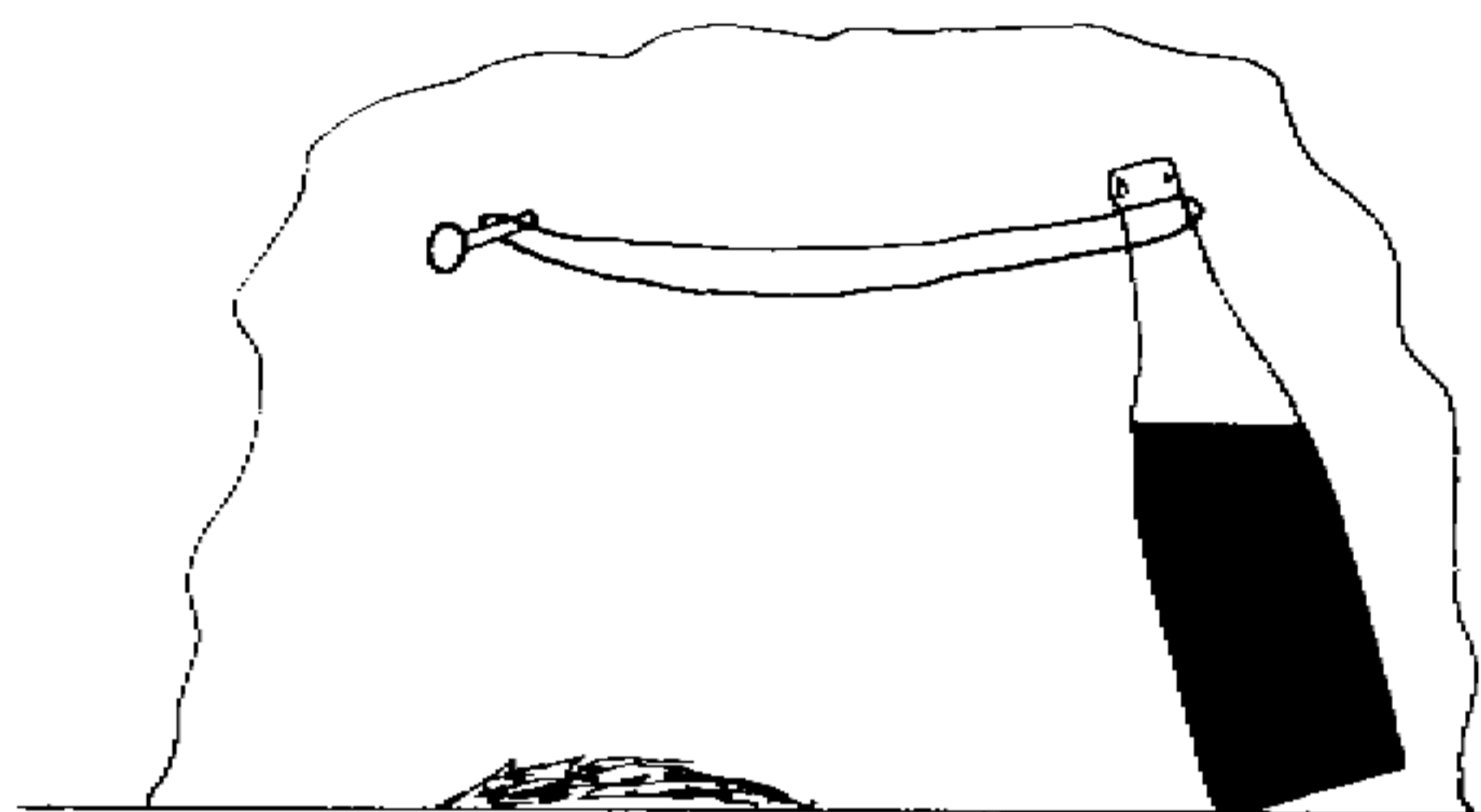
To Be Used For Igniting:

Water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and zinc dust-ammonium nitrate; acid actuated igniters which are: sugar-chlorate and fire fudge and potassium permanganate-glycerin igniter.

Method Of Operation:

A rubber band, as it contracts, tips a bottle of liquid onto an appropriate igniter mixture and causes it to ignite.

fuls of the proper igniter mixture in a ring around the bottle in such a manner that when the bottle tips it will spill its contents on the igniter mixture. By using a ring of igniter mixture, it makes no difference in which direction the bottle falls. The incendiary material which is to be ignited by the igniter must be where the igniter flame can reach it. As the solvent evaporates, the rubber band will shrink and tip the bottle, spilling the liquid.



STRETCHED RUBBER BAND DELAY

Once the rubber band is removed from the solvent, all the other operations must be performed quickly. It is a good idea to pile the incendiary material in the proper place before attempting to set up the delay.

Cold weather will slow down the delay time, but it will work in cold weather. As with all other delays or igniters in which water or concentrated sulfuric acid are used, they may freeze near 0° C. and, therefore, should not be used when the temperature is lower than that. The potassium permanganate-glycerin igniter should not be used when the temperature falls below 10° C.

When using this delay, the delay time is quite unpredictable. Using the same materials, the results may vary from as little as one minute up to ten minutes. Never trust this delay to give more than one minute of delay.

Because it is so unpredictable this delay is not recommended where other types of delays described in this manual may be used.

To Be Used For Igniting:

Water actuated igniters which are: sugar-sodium peroxide, aluminum powder-sodium peroxide, silver nitrate-magnesium powder, and zinc dust-ammonium nitrate; acid actuated delays which are: sugar-chlorate and fire fudge and potassium permanganate-glycerin igniter.

Method Of Operation:

When the alarm goes off at the pre-set time, a piece of string attached to the alarm winding key and to a bottle or vial full of liquid will pull the bottle, spilling the liquid on an appropriate igniter mixture.

Advantages:

1. Gives an accurate delay for any time between one and eleven hours.
2. Easily prepared.
3. Delay time is not affected by variations in temperature.

Disadvantages:

1. Unless the clock is muffled, its ticking may make the delay easy to detect.
2. Discovery of a clock mechanism after the fire was out, would practically prove that the fire had not started accidentally.

Materials Needed:

An alarm clock, a small vial or bottle for carrying acid, strips of cloth 2 to 3 cm wide, a piece of string, and one of the following:

1. Concentrated sulfuric acid and an acid actuated igniter.
2. A water actuated igniter, or
3. A glycerin-potassium permanganate igniter.

Equipment Needed:

No special equipment is needed.

Preparation:

An alarm clock is required. If it has an external bell it is advisable to remove it. If the

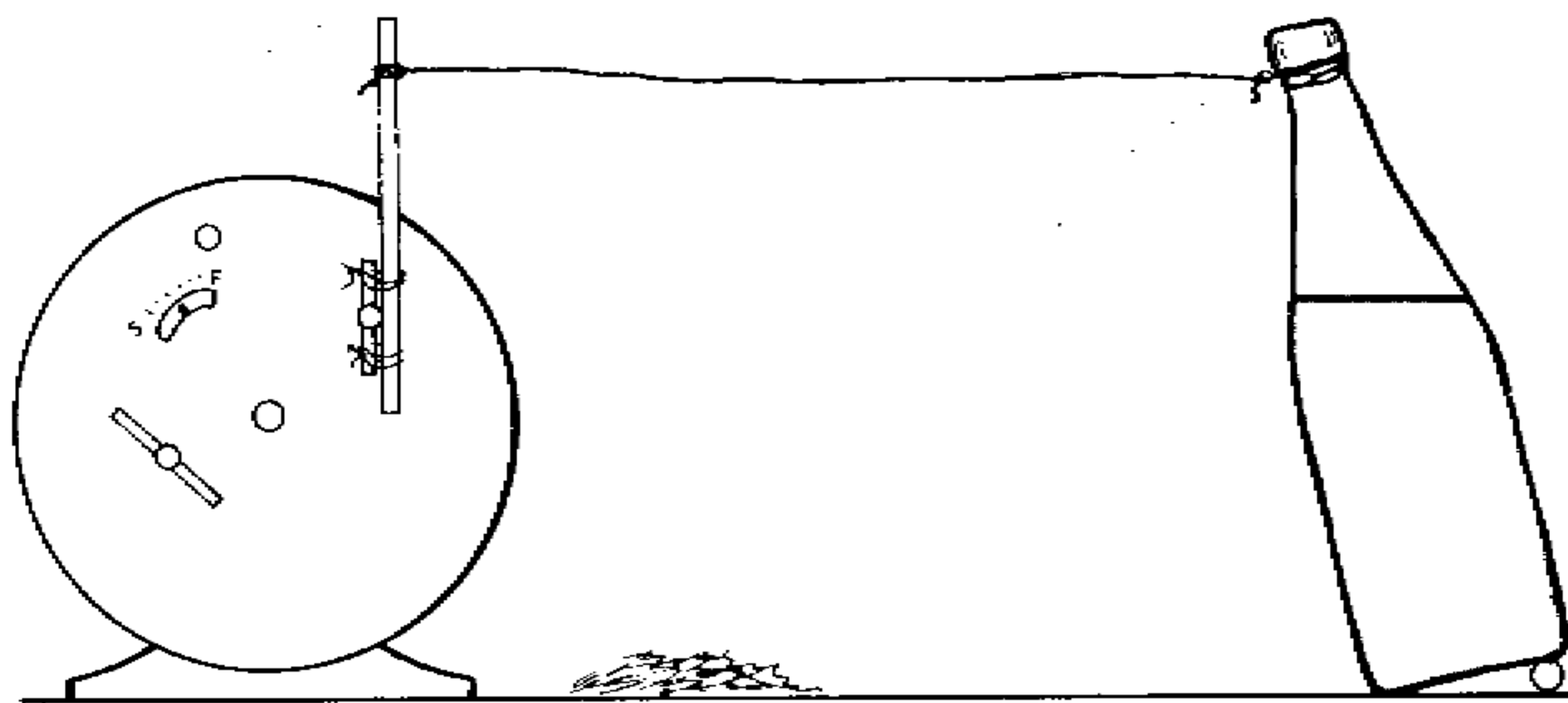
bell is on the inside of the clock nothing can be done about removing it. The reason for removing the bell is that the ringing of the bell may bring someone to the scene of the fire before it has had a chance to start burning well. The clock should be wrapped in rags to muffle the sound of the ticking of the clock and the ringing of the bell.

Fully wind the time key and the alarm key. Tie a piece of string about 20 to 30 cm long to the key which winds the alarm. Tie the string in such a manner that when the alarm rings, the alarm key will wind the string around itself. Check this carefully because if the string doesn't wind around the key, this delay will not work. Now tie the other end of the string around the top of a small glass bottle or vial of about 25 to 50 cc capacity. Place a small object such as a match or pencil under the bottom so that the bottle tilts in the direction it will be pulled. Place the clock and bottle far enough apart so that the string has no sag. Set the alarm for the time at which

you want the fire to start. Now fill the bottle or vial with the liquid which is to be used with the igniter mixture and sprinkle about ten spoonfuls of the proper igniter mixture in a ring around the bottle or vial where the liquid will spill when the bottle or vial falls over. Place the incendiary material where the igniter will ignite it.

This is the most accurate delay device you can use for delays of one to eleven hours. It is completely unaffected by cold weather except that when the temperature drops below 0° C., water and concentrated sulfuric acid will usually freeze, and potassium permanganate-glycerin igniter does not work below 10° C.

It is usually advisable to wrap the clock in rags to muffle the sound of the clock ticking and the alarm ringing; or the delay device may be concealed in a closet or a drawer which will muffle the sound. The closet or drawer must be left slightly open for air to get to the fire or the fire will go out from lack of air.



ALARM CLOCK DELAY