

# EXPLOSIVE DUSTS

**ADVANCED IMPROVISED  
EXPLOSIVES**

**SEYMOUR LECKER**

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**Also by Seymour Lecker:**

Deadly Brew: Advanced Improvised Explosives

Improvised Explosives: How to Make Your Own Incendiaries: Advanced Improvised Explosives

Professional Booby Traps: Special Devices and Techniques

Shock Sensitive Industrial Materials: Advanced Improvised Explosives

*Explosive Dusts:*  
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by Seymour Lecker  
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# WARNING

The dusts and fine powders of all materials described in this manual are deadly explosives. Many of these materials are also extreme fire and explosive hazards in their natural forms, and some are deadly poisons. Whenever dealing with high explosives or hazardous materials, special precautions should be followed in accordance with industry standards for experimentation and production. Failure to strictly follow such industry standards may result in harm to life or limb.

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»Between 1910 and 1960, over two hundred fatalities were recorded as a result of explosions of agricultural dusts. In the same period, over one hundred additional fatalities were attributed to dust explosions in the plastics industry.«

*National Fire Prevention Association*

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# PREFACE

Dust explosions account for a significant percentage of the industrial fire deaths that occur every year in mines, grain elevators, food processing plants, chemical plants, and other types of facilities. It is difficult for the ordinary person to comprehend the degree of explosive power of dust deposits. They can be detonated or ignited by heat, spark, flame, static electricity, or other means.

Each dust has a different optimal particle size for maximum explosibility, but generally the finer the particles the higher the explosive capability. Experiments by the United States Department of the Interior Bureau of Mines have shown that dusts composed of irregularly shaped particles represent a greater explosion hazard than those composed of spherical particles.

Dusts represent the most severe danger when the air in an enclosed space is saturated, but dusts can also be detonated when loosely packed in a nonconfining container.

The extent of the hazard of any given dust is related to its ease of ignition and the severity of the ensuing explosion. All the dusts described in this manual are deemed to be severe explosive hazards by the Bureau of Mines.

All dusts should be considered potentially hazardous and toxic.

# CHAPTER 1

## INDUSTRIAL CHEMICALS

### ACETO ACETANILIDE



#### Synonyms

Alpha-Ketobutyranilide, Alpha-Acetyl Acetanalide, N-Phenyl-acetamide.

#### Description

White, odorless crystalline powder or solid. Slightly burning taste.

#### Uses

Manufacture of penicillin and other Pharmaceuticals, dyestuffs, cellulose ester coatings, rubber, synthetic camphor.

#### Hazards

Highly toxic. Can release highly toxic fumes upon heating.

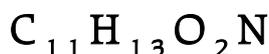
#### Fire Fighting

Alcohol foam, water mist, CO<sub>2</sub>, dry chemical.

#### Additional Information

Can react vigorously with oxidizing materials.

### ACETOCET-O-TOLUIDIDE



#### Synonyms

None.

#### Description

Fine white granular powder.

#### Uses

Manufacture of Hansa and benzidine yellows.

#### Hazards

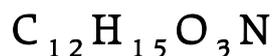
Moderately toxic. Avoid inhalation.

**Fire Fighting**

Water, foam, CO<sub>2</sub>, dry chemical.

**Additional Information**

Combustible.

**ACETOACET-P-PHENETIDIDE****Synonyms**

None.

**Description**

Crystalline powder.

**Uses**

Intermediate for azo pigments.

**Hazards**

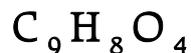
Moderately toxic. Avoid inhalation.

**Fire Fighting**

Water, foam, CO<sub>2</sub>, dry chemical.

**Additional Information**

Combustible. Can react with oxidizing materials.

**ACETYLSALICYLIC ACID****Synonyms**

Aspirin, Acetol, O-Acetoxybenzoic Acid.

**Description**

White crystals or powder. Slightly bitter taste.

**Uses**

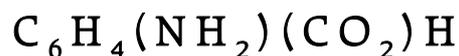
Medicine, most commonly aspirin tablets.

**Hazards**

A 10-gram dose can be fatal to an adult. Avoid inhalation of dust.

**Fire Fighting**

Water.

**ANTHRANILIC ACID****Synonym**

O-Amino Benzoic Acid.

**Description**

Yellow, needle-like crystals. Sweetish taste.

**Uses**

Manufacture of dyes, drugs, perfumes, and Pharmaceuticals.

**Hazards**

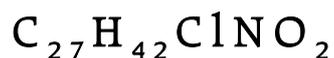
Moderately toxic. Avoid inhalation.

**Fire Fighting**

Water, alcohol foam.

**Additional Information**

Combustible.

**BENZETHONIUM CHLORIDE****Synonym**

Hyamine 1622.

**Description**

Colorless, odorless crystals. Very bitter taste.

**Uses**

Antiseptic, cationic detergent.

**Hazards**

Highly toxic. Heat or contact with acid or acid fumes can lead to the release of toxic gas.

**Fire Fighting**

Water, dry chemical, CO<sub>2</sub> foam.

**BENZOIC ACID**  
**C<sub>6</sub>H<sub>5</sub>COOH**

**Synonyms**

Carboxybenzene, Benzenecarboxylic Acid, Phenylformic Acid.

**Description**

White powder or white needle crystals.

**Uses**

Plasticizers, alkyd resins, food preservative, seasoning tobacco, flavors, perfumes, antifungal agent.

**Hazards**

Mildly toxic. Use in foods is restricted to 0.1%. Avoid skin contact or ingestion.

**Fire Fighting**

Water, CO<sub>2</sub>, dry chemical.

**Additional Information**

Combustible, Can react with oxidizing materials.

**1,2,3-BENZOTRIAZOLE**  
**C<sub>6</sub>H<sub>4</sub>NHN<sub>2</sub>**

**Synonyms**

Aziminobenzene, Benzene Azimide,

**Description**

White to light tan, odorless, crystalline powder or needlelike crystals.

**Uses**

Photographic restrainer, chemical intermediate.

**Hazards**

Highly toxic. Can release highly toxic fumes when heated.

**Fire Fighting**

Water, dry chemical.

**Additional Information**

Can detonate under vacuum distillation.

**CARBARYL**  
**C<sub>10</sub>H<sub>7</sub>OOCNHCH<sub>3</sub>**

**Synonyms**

Sevin, 1-Naphthyl Methyl Carbamate, 1-Naphthyl-N-Methylcarbamate.

**Description**

White crystals.

**Uses**

Insecticide.

**Hazards**

Highly toxic. Avoid inhalation, ingestion, or skin contact.

**Fire Fighting**

Water.

**DEHYDROACETIC ACID**



**Synonyms**

3-Acetyl-6-Methyl-1, 2-Pyran-2, 24(3H)-Dione Methylacetopyranone, DHA.

**Description**

Colorless, odorless, tasteless crystals.

**Uses**

Fungicide, bactericidal, medicated toothpastes, plasticizer, chemical intermediate.

**Hazards**

Highly toxic. Permitted as a food additive, but avoid ingestion.

**Fire Fighting**

Water, foam.

**Additional Information**

Mildly combustible.

## DIAZOAMINOBENZENE



### Synonyms

(Alpha) Diazoamidobenzol; 1, 3 Diphenyl-triazine; Benzeneazo-anilide.

### Description

Golden-yellow crystals.

### Uses

Insecticide, organic synthesis, dyes.

### Hazards

Highly toxic. Can release toxic fumes when heated,

### Fire Fighting

Dry chemical foam, CO<sub>2</sub>

### Additional Information

Can detonate if heated or shocked.

## DICYCLOPENTADIENE DIOXIDE



### Synonyms

None.

### Description

White crystalline powder,

### Uses

Intermediate for epoxy resins, plasticizers, and protective coatings.

### Hazards

Mildly toxic. Avoid inhalation.

### Fire Fighting

Alcohol foam, dry chemical.

## DIELDRIN



### Synonyms

Compound 497, Octalox, HEOD.

**Description**

White odorless crystals.

**Uses**

Insecticide.

**Hazards**

Extremely toxic. Can release extremely toxic fumes when heated.

**Fire Fighting**

Water, dry chemical, foam CO<sub>2</sub>.

**DIMETHYL TEREPHTHALATE****Synonyms**

DMT, Dimethyl-1, 4-Benzene-Dicarboxylate.

**Description**

Colorless crystals.

**Uses**

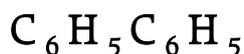
Polyester resins for film and fiber production.

**Hazards**

Moderately toxic. Avoid inhalation.

**Fire Fighting**

Alcohol foam.

**DIPHENYL****Synonym**

Biphenyl.

**Description**

White scales. Pleasant odor.

**Uses**

Organic synthesis, heat transfer agent, fungistat in packaging of citrus fruit, plant disease control, dyeing assistant for polyesters.

**Hazards**

Highly toxic. Avoid inhalation or ingestion.

**Fire Fighting**

Water, CO<sub>2</sub>, dry chemical.

**Additional Information**

Combustible. Can react with oxidizing materials.

**FERRIC DIMETHYL DITHIOCARBAMATE**  
 **$[(\text{CH}_3)_2\text{NCSS}]_3\text{Fe}$** **Synonyms**

Ferbam, Fennate.

**Description**

Dark to black fluffy powder. May be compressed to solid.

**Uses**

Fungicide.

**Hazards**

Moderately toxic. Can release highly toxic fumes when heated.

**Fire Fighting**

Water, dry chemical.

**HEXAMETHYLENETETRAMINE**  
 **$(\text{CH}_2)_6\text{N}_4$** **Synonyms**

Methenamine, HMTA, Aminoform, Hexamine Formamine, Urotropin, Metramine. Often erroneously called Hexamethyleneamine.

**Description**

Colorless, lustrous crystals or white crystalline powder.

**Uses**

Curing of phenolformaldehyde; adhering rubber to textile; protein modifier; organic synthesis; manufacture of pharmaceuticals, fuel tablets, and shrinkproof textiles; fungicide; antibacterial; corrosion inhibitor.

**Hazards**

A skin irritant. Can release toxic fumes when heated.

**Fire Fighting**

Water, foam.

**Additional Information**

Combustible. Can react with oxidizing materials. Reacts violently with  $\text{Na}_2\text{O}_2$ .

**METHIONINE****Synonyms**

Methionine, 2-Amino-4-(methylthio)butyric acid.

**Description**

White crystalline powder.

**Uses**

Feed additive, vegetable oil enrichment, manufacture of pharmaceuticals. A nutrient.

**Hazards**

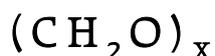
Unknown. Permitted as a food additive for humans.

**Fire Fighting**

Water, alcohol foam.

**Additional Information**

May react violently with powerful oxidizers or acids.

**PARAFORMALDEHYDE****Synonym**

Paraform.

**Description**

White crystals, flakes, or powder. Odor of formaldehyde.

**Uses**

Fungicides, bactericides, disinfectants, adhesives, contraceptive creams, hardener, waterproofing agent for gelatin.

**Hazards**

Moderately toxic. Releases oxides of carbon and formaldehyde gas

when heated.

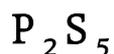
**Fire Fighting**

Alcohol foam, CO<sub>2</sub>, dry chemical.

**Additional Information**

Can react with oxidizing materials. Reacts violently with O<sub>2</sub> liquid.

**PHOSPHORUS PENTASULFIDE**



**Synonym**

Phosphoric Sulfide, Phosphorus Persulfide, Thiophosphoric Anhydride.

**Description**

Light yellow or greenish yellow crystalline mass. Odor similar to hydrogen sulfide.

**Uses**

Insecticides, float agents, safety matches and other ignition compounds, intermediate for lubrication oil additives.

**Hazards**

Highly toxic. Can release highly toxic fumes when heated. Will react with water, steam, or acids to produce toxic and flammable vapors.

**Fire Fighting**

CO<sub>2</sub>, snow, dry chemical, sand.

**Additional Information**

Can react vigorously with oxidizing materials. Combustible; ignites by friction.

**PHTHALIC ANHYDRIDE**



**Synonym**

Phthalandione.

**Description**

White crystalline needles. Mild odor.

**Uses**

Manufacture of resins, plasticizers, dyes, chlorinated products,

pharmaceuticals, and insecticides,

### **Hazards**

Moderately toxic. A common air contaminant. Avoid inhalation.

### **Fire Fighting**

CO<sub>2</sub>, dry chemical,

### **Additional Information**

Combustible. Can react with oxidizing materials. Explodes on contact with HNO<sub>3</sub>.

## **PHTHALIMIDE**



### **Synonym**

1, 3-Isoindole-dione.

### **Description**

Light tan to white powder.

### **Uses**

Fungicide, organic synthesis, laboratory reagent, manufacture of synthetic indigo.

### **Hazards**

Can release toxic fumes when heated. Other toxic properties are unknown.

### **Fire Fighting**

Water, dry chemical.

### **Additional Information**

Combustible.

## **POLYCARBONATE**



### **Synonyms**

None.

### **Description**

Transparent solid.

### **Uses**

Heavily used in the manufacture of molded plastic products,

particularly those where strength of construction is of high importance.

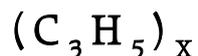
#### **Hazards**

Mildly toxic. Avoid inhalation or ingestion.

#### **Fire Fighting**

Self-extinguishing.

### **POLYPROPYLENE**



#### **Synonyms**

None.

#### **Description**

Translucent, white to yellow solid.

#### **Uses**

Manufacture of molded plastic products, packaging film, acid-dyed clothing, artificial turf, surgical casts, synthetic paper, nonwoven disposable filters, and strapping.

#### **Hazards**

Mildly toxic. Permitted additive in food for human consumption.

#### **Fire Fighting**

Water, dry chemical.

#### **Additional Information**

Combustible, but slow burning. Reacts violently with strong oxidizing agents.

### **POLYSTYRENE**



#### **Synonyms**

Polystyrol, Styrene Polymer, Styron, Styrofoam.

#### **Description**

Transparent to light yellow solid.

#### **Uses**

Manufacture of molded plastic products. As a foam it is a commonly used insulation.

**Hazards**

Mildly toxic. Avoid inhalation or ingestion.

**Fire Fighting**

Water, dry chemical.

**Additional Information**

Combustible.

**Synonyms**

Anasadol, Salinidol.

**Description**

White or slightly pink, odorless crystals.

**Uses**

Fungicide, slimicide, antimildew agent.

**Hazards**

Moderately toxic. Will irritate skin. Can release toxic fumes when heated.

**Fire Fighting**

Alcohol foam, CO<sub>2</sub>, dry chemical.

**Synonyms**

2,4-Hexadienoic acid.

**Description**

Colorless needles.

**Uses**

Fungicide, mold inhibitor in food products, alkyd resin coatings, cold rubber additive, intermediate for plasticizers and lubricants.

**Hazards**

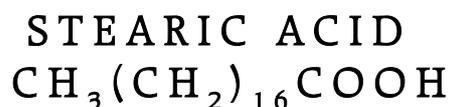
Mildly toxic. Avoid inhalation or ingestion.

**Fire Fighting**

Water.

### **Additional Information**

Can react with oxidizing materials.



### **Synonyms**

Octadecanoic Acid, N-Octadecanoic acid.

### **Description**

White amorphous solid. Slight odor and taste of tallow.

### **Uses**

Manufacture of lubricants, soaps, pharmaceuticals, cosmetics, shoe polish, metal polish, and ointments; dispersing agent and softener in rubber compounds.

### **Hazards**

Highly toxic. Avoid inhalation, ingestion, or skin contact.

### **Fire Fighting**

CO<sub>2</sub>, dry chemical.



### **Synonyms**

P-Phthalic Acid, TPA, Benzene-p-dicarboxylic acid.

### **Description**

White crystals or powder.

### **Uses**

Additive in poultry feeds; reagent for alkali in wool; production of linear, crystalline polyester resins, fibers, and films by combination with glycols.

### **Hazards**

Moderately toxic. Avoid inhalation or ingestion.

### **Fire Fighting**

CO<sub>2</sub>, dry chemical.

### **Additional Information**

Combustible. This was the twenty-first-highest chemical produced

by volume in the United States in 1985.

# CHAPTER 2

## METALS

### ALUMINUM

Al

#### **Synonyms**

None.

#### **Description**

Silvery white crystalline solid.

#### **Uses**

Building and construction, corrosion-resistant equipment, die-cast auto parts, power transmission lines, paints, protective coating, packaging foil.

#### **Hazards**

Nontoxic. Avoid inhalation of powder.

#### **Fire Fighting**

Specially prepared dry powder.

#### **Additional Information**

Will react violently with powerful oxidizers. The most abundant metal in the Earth's crust.

### IRON

Fe

#### **Synonym**

Ferrum.

#### **Description**

Silver white lustrous metal.

#### **Uses**

Manufacture of steel. Iron powder is used in manufacture of magnets, high-frequency cores, and auto parts. Used as a catalyst in ammonia synthesis.

**H a z a r d s**

Dust is highly toxic. Iron oxide fumes are also highly toxic.

**F i r e F i g h t i n g**

Special mixtures of dry chemicals.

**A d d i t i o n a l I n f o r m a t i o n**

Can react vigorously with oxidizing materials.

**M A G N E S I U M****M g****S y n o n y m s**

None.

**D e s c r i p t i o n**

Silver white crystals of metal.

**U s e s**

Flash photography, antiknock gasoline additives, optical mirrors, die-cast auto parts, dry and wet batteries, reducing agent; production of iron, nickel, zinc, titanium, zirconium, and steel.

**H a z a r d s**

Moderately toxic. Avoid inhalation. Will release toxic fumes when heated.

**F i r e F i g h t i n g**

Powdered talc, powdered graphite, sand.

**A d d i t i o n a l I n f o r m a t i o n**

Combustible. Will react violently with oxidizing materials, moisture, or metals. *Dusts from aluminum-magnesium alloys are extremely explosive.*

**T H O R I U M****T h****S y n o n y m s**

None.

**D e s c r i p t i o n**

Silver white soft metal or powder.

**U s e s**

Sun lamps, photoelectric cells, target in X-ray tubes, *nuclear fuel.*

**Hazards**

Radioactive.

**Fire Fighting**

Dry chemical, powdered talc, graphite.

**Additional Information**

Dust can ignite at room temperature. Can react with oxidizing materials.

**TITANIUM****Ti****Synonyms**

None.

**Description**

Dark gray powder or white lustrous metal.

**Uses**

X-ray tube target, electrodes in chlorine batteries, manufacture of alloys for a variety of special applications,

**Hazards**

Nontoxic. Dust is considered to be in the nuisance category.

**Fire Fighting**

Powdered talc or sand.

**Additional Information**

Combustible. Can react violently with a wide variety of chemicals. *Dusts from titanium-iron alloys (ferrotitanium) are extremely explosive.*

**TITANIUM HYDRIDE****TiH<sub>2</sub>****Synonyms**

None.

**Description**

Dark gray or black metallic powder or crystals.

**Uses**

Production of pure hydrogen and foamed-metals solder for metal-glass composites, reducing atmosphere for furnaces.

**Hazards**

Moderately toxic. Avoid inhalation.

**Fire Fighting**

Dry chemical, powdered talc, sand.

**Additional Information**

Combustible. May react violently with oxidizing materials.

**ZIRCONIUM****Zr****Synonyms**

None.

**Description**

Grayish white lustrous metal.

**Uses**

Corrosion-resistant alloys, flashbulbs, special welding fluxes, getter in vacuum tubes, lab crucibles, manufacture of steel.

**Hazards**

Moderately toxic. Avoid inhalation of powder.

**Fire Fighting**

Dry powder, salt, sand.

**Additional Information**

Combustible. Can react with oxidizing materials. Dusts must be kept dry or completely soaked.

**ZIRCONIUM HYDRIDE****ZrH<sub>2</sub>****Synonyms**

None.

**Description**

Gray black metallic powder.

**Uses**

Getter in vacuum-tube, source of hydrogen, metal foaming agent, reducing agent, nuclear moderator.

**H a z a r d s**

Moderately toxic. Avoid inhalation.

**F i r e F i g h t i n g**

Dry chemical, powdered talc, sand.

**A d d i t i o n a l I n f o r m a t i o n**

Combustible, especially when wet. Can react with oxidizing materials.

# CHAPTER 3

## CARBONACEOUS MATERIALS

### ASPHALT

**Synonyms**

Bitumen, Petroleum Pitch.

**Description**

Black or dark brown mass.

**Uses**

Hot-melt adhesives, sealants, roof and road coatings.

**Hazards**

Moderately toxic. Can irritate skin.

**Fire Fighting**

Foam, CO<sub>2</sub>, dry chemical.

**Additional Information**

Can react with fluorine.

### COAL

**Synonym**

Anthracite.

**Description**

Black powder or chunks.

**Uses**

Heat, energy, production of synthetic crude oil and fuel gas.

**Hazards**

Moderately toxic. Avoid inhalation or ingestion.

**Fire Fighting**

Foam, CO<sub>2</sub>, dry chemical.

**Additional Information**

Can react with oxidizing material.

## GILSONITE

### **Synonym**

Uintaite.

### **Description**

Solid black asphaltic material.

### **Uses**

Wire insulation compounds, black varnish, lacquers, baking enamels, linoleum and floor tile, paving, insulation, diluent in low-grade rubber compounds; add, alkali, and waterproof coatings.

### **Hazards**

Moderately toxic. Can release toxic fumes upon heating.

### **Fire Fighting**

Water foam, dry chemical, CO<sub>2</sub>.

## LIGNITE

### **Synonym**

Brown Coal.

### **Description**

Brown peat-like material. May contain 40-percent water before drying.

### **Uses**

Fuel, production of polymer resins. May be used in the future to produce methanol.

### **Hazards**

A nuisance dust. Avoid inhalation.

### **Fire Fighting**

Water.

### **Additional Information**

Can react with oxidizing materials.

# CHAPTER 4

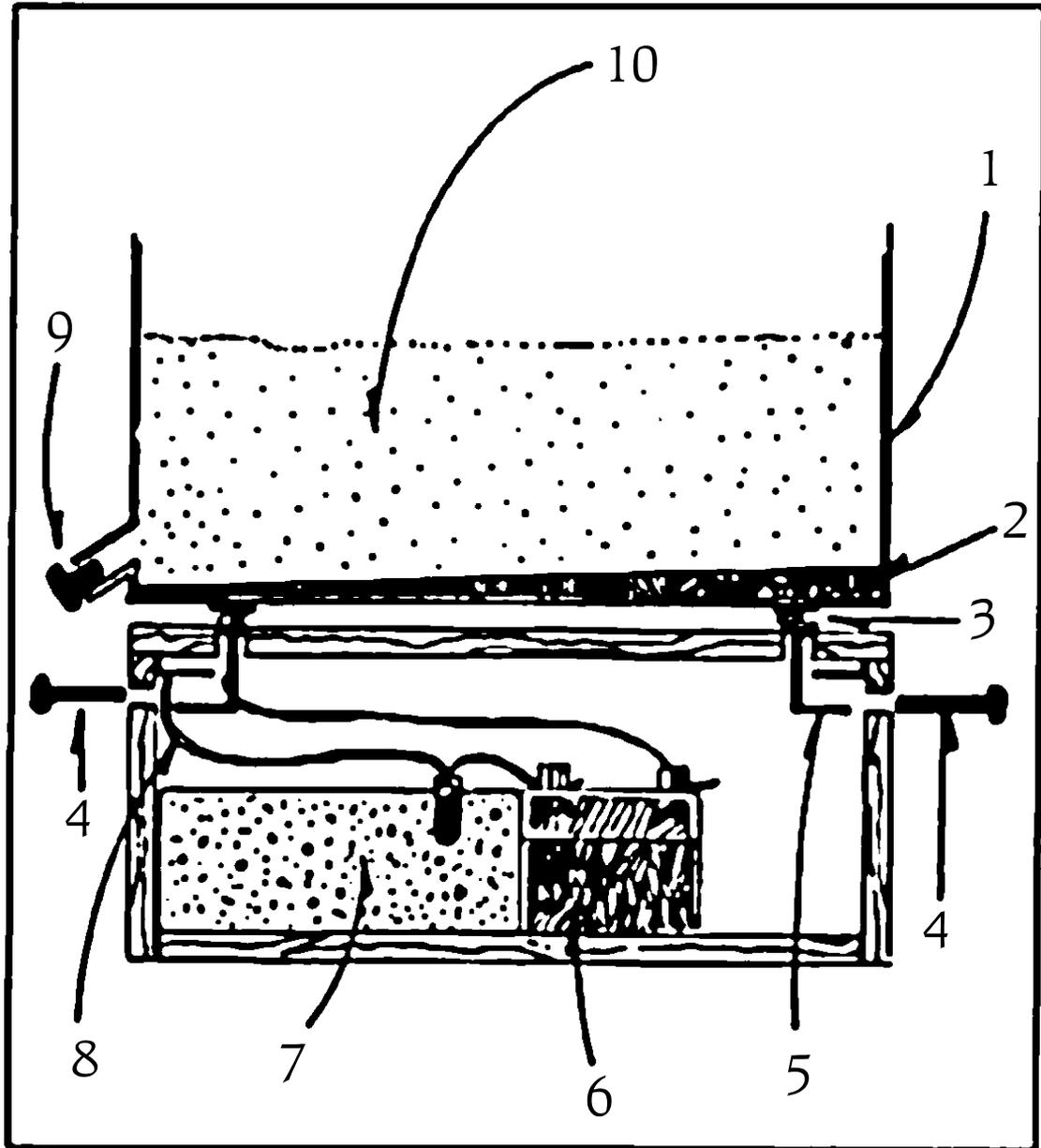
## AGRICULTURAL PRODUCTS

*Dusts of these agricultural products represent severe explosive dangers.*

- ▶ Apricot pit
- ▶ Barley
- ▶ Brown sugar
- ▶ Cake flour (25-percent commeal)
- ▶ Cherry pit
- ▶ Cinnamon
- ▶ Cocoa bean shell
- ▶ Coconut shell
- ▶ Corn
- ▶ Corncobs
- ▶ Cornstarch
- ▶ Dehydrated citrus peel
- ▶ Filbert shell
- ▶ Hemp
- ▶ Oats
- ▶ Pea flour
- ▶ Peach pit shell
- ▶ Peanut hull
- ▶ Pecan shell
- ▶ Pectin
- ▶ Potato starch
- ▶ Rice
- ▶ Safflower
- ▶ Skimmed milk
- ▶ Soy
- ▶ Sugar
- ▶ Walnut shell
- ▶ Wheat
- ▶ Wheat starch
- ▶ Yeast

# CHAPTER 5

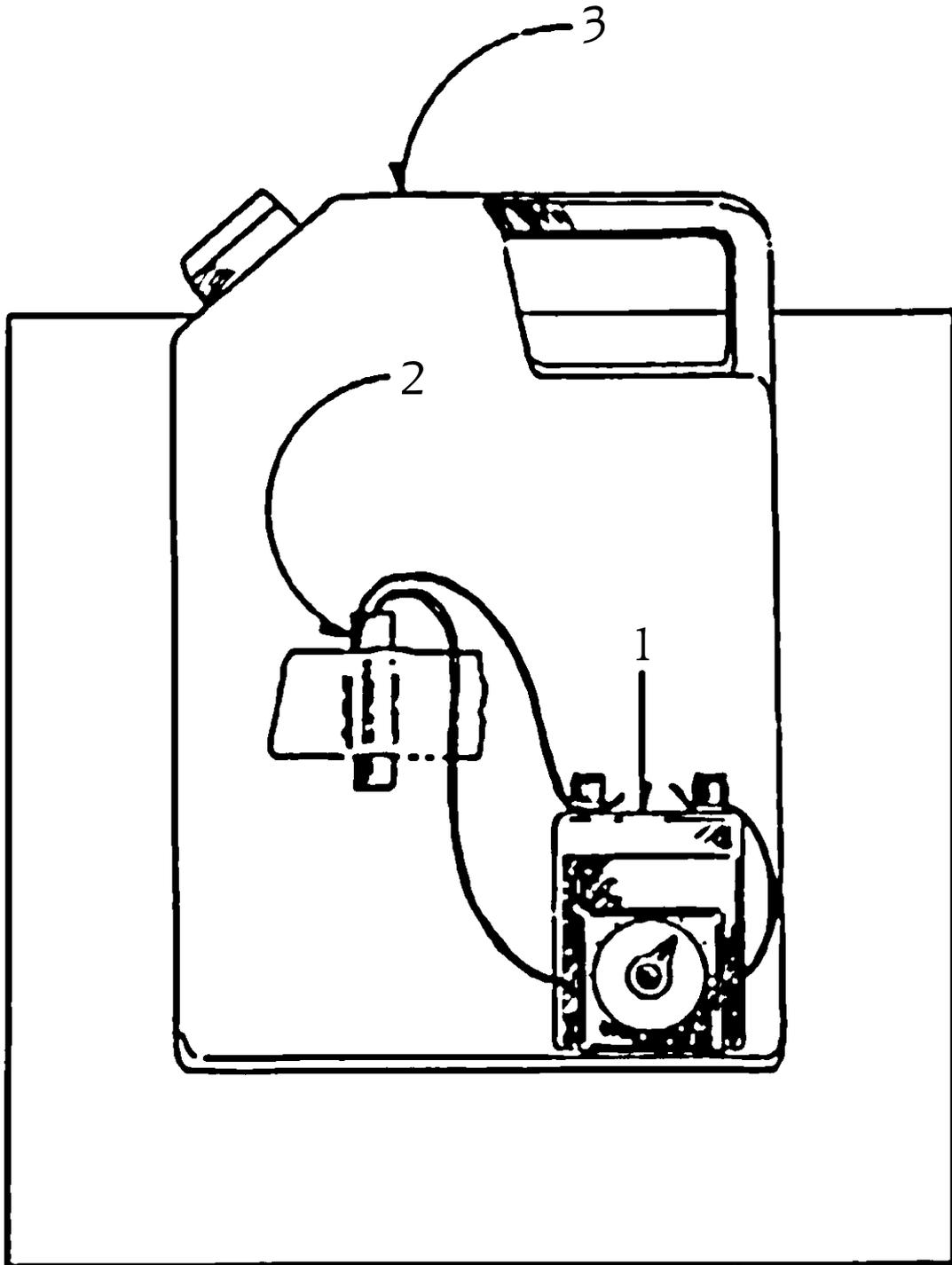
## DEVICES



1. Container
2. Wedge (aids duet flow)
3. Spring

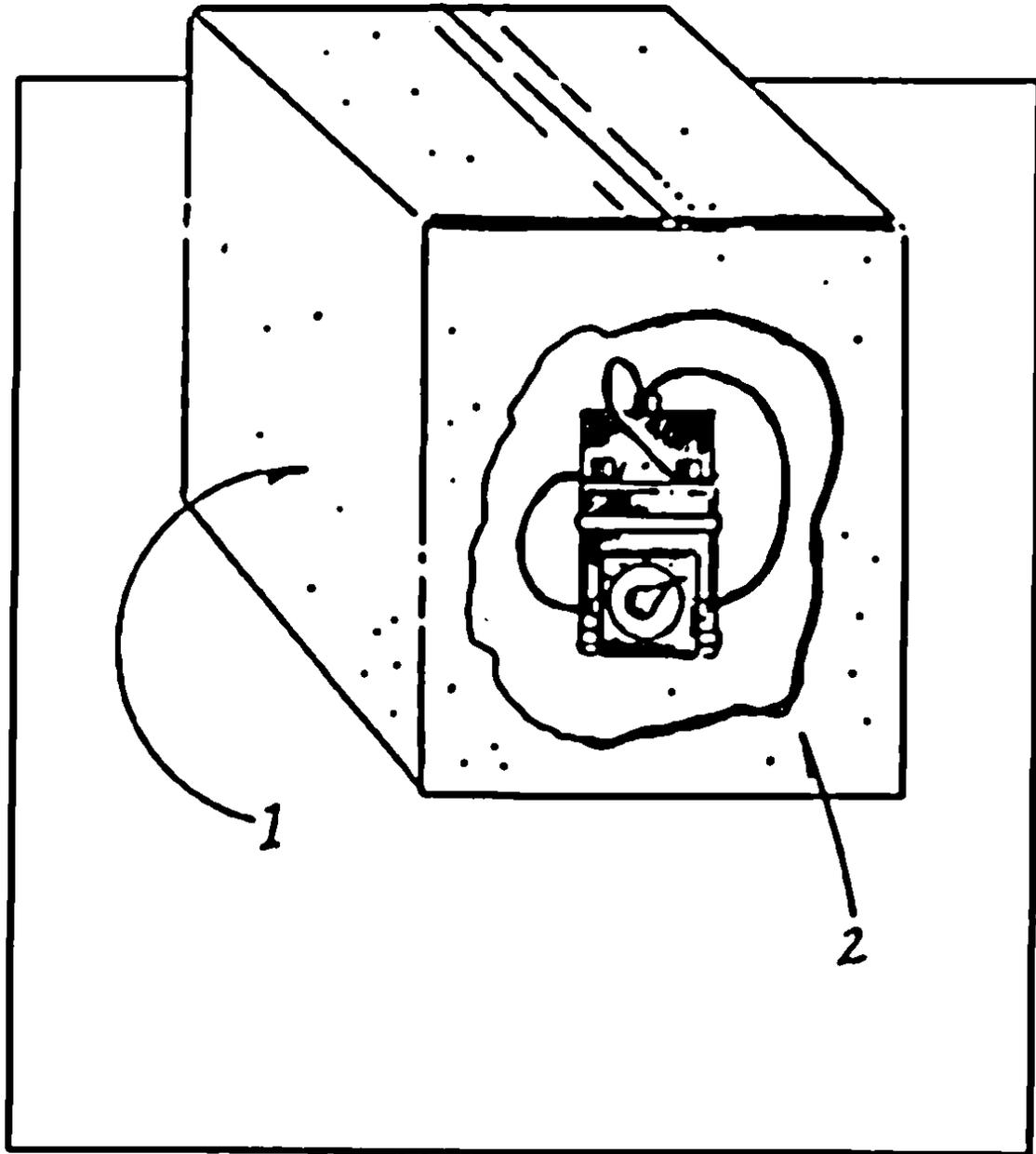
4. Safety plug
5. Optional second firing system
6. Battery
7.  $\frac{1}{4}$  lb. explosive charge
8. Pressure-release firing system
9. Spout and plug
- 10.5 lbs. of dust (minimum)

Fill the container with a minimum of five pounds of dust. *Do not tamp the dust.* The weight of the dust keeps the pressure-release firing system in the open position. Place the device in the center of a closed room in an elevated position. Remove the plug from the container. Dust will flow from the container and form an extremely explosive mixture with the air. As the dust flows from the container, the pressure on the springs will weaken and the pressure-release firing system will detonate the charge.



1. Electrical firing system
2.  $\frac{1}{4}$  lb. of explosive charge
3. Plastic jerry can containing 5 lbs. (minimum) of dust

Pour the dust into the jerry can at the last possible minute. Dust should not be allowed to settle and compress itself. Set timer to detonate at the appropriate time. Allow enough time to leave the vicinity but not enough time for the dust to settle in the jerry can.



1. Cardboard carton containing 5 lbs. (minimum) of dust
2. Electrical firing system with  $\frac{1}{4}$  lb. explosive charge

Electrical firing system and charge should be wrapped in plastic and placed in the center of the carton. Set timer to detonate at the appropriate time. Allow enough time to leave the vicinity but not

enough time for the dust to settle in the box.

# APPENDIX

## RECOMMENDED READING

*Improvised Munitions Black Book, Volume I*  
Frankford Arsenal (available from Paladin Press)

*Special Forces Demolition Techniques*  
Paladin Press

*Explosibility of Agricultural Dusts*  
U.S. Bureau of Mines  
Report #5753

*Explosibility of Metal Powders*  
U.S. Bureau of Mines  
Report #6516

*Explosibility of Carbonaceous Dusts*  
U.S. Bureau of Mines  
Report #6597

*Dust Explosibility of Chemicals, Drugs, Dyes, and Pesticides*  
U.S. Bureau of Mines  
Report #7132

*Explosibility of Miscellaneous Dusts*  
U.S. Bureau of Mines  
Report #7208

*Report of Important Dust Explosions (1957)*  
National Fire Protection Association

*Theory and Nature of Dust Explosions*  
D.J. Price and H.H. Brown National Fire Protection Association