Implosion Fuel Air Explosive (FAE)

MOTHBALL BOMB

The mothball bomb is a somewhat facetious name for what is in reality one of the most advanced forms of pure fuel-air explosive in existence, the implosion FAE. When a combustible fuel is mixed with air there is a certain range of concentration that is combustible. Within this region there is a so-called detonation region or ratio that, for a typical hydrocarbon such as gasoline, runs from about ten to sixteen parts air per one part of fuel by weight. When the concentration of fuel is outside of the combustion region, no burning occurs. When the concentration is within the combustion region, the fuel ignites and burns. The rate of propagation of the flame is supersonic and creates a shock wave characterized by a sharp increase in pressure and temperature.

The usual high explosive source of this over-pressure in conventional explosive devices is essentially a point source, which causes a shock wave to propagate radially outward. The shock wave is slowed down by passage through air, and after it has passed a sufficient distance from its starting point, its velocity is subsonic and there is no longer any over-pressure. To generate very high over-pressure at any substantial distance from a detonation, large quantities of explosive must be used.

The FAE weapon differs substantially in that a quantity of fuel is distributed through the air so that the mixture of fuel and air is detonable in a large volume or cloud. When a detonation is started in such a cloud, it travels at a constant rate of speed throughout the extent of the cloud. In this manner, large over-pressures may be generated at substantial distances from the point of initiation. Although the maximum over-pressures are not as great as are obtained with conventional high explosives, the large levels are generated over wide areas and cause more damage than is possible with the same weight of high explosive. One of the problems with previous devices was the timing of the initiation of the cloud of fuel when at its optimum concentration for detonation. With liquid and gaseous fuels the amount of time it takes for this to occur varies widely with differences in altitude, temperature, and type of fuel.

The implosion FAE will function at optimum power, regardless of these variables. In addition, it is remarkably cheap and easy to build. The exact size or dimensions are not critical; nor, really, is the fuel. Many widely different types of fuel will perform serviceably in it. This was proven in testing by the fact that powdered polyethylene plastic rated very closely in power to the best fuel available—naphthalene moth crystals. Polyethylene is nontoxic, nonexplosive, and basically inert. Until it is imploded under these conditions, it is about as dangerous as sand. In an implosion FAE it is devastating.

The device itself is a simple plastic cylinder about twice as high as it is wide. The ends are closed with 1/2-inch-thick aluminum discs. In the center is a brittle glass or plastic tube containing the igniter mix. The igniter initiates combustion at the same time the cloud is disseminated by sending out high-temperature metallic fragments equally dispersed throughout the cloud. When the cloud reaches the proper air/fuel ratio to detonate, there will be ignition particles there to light it. That is why this device is so effective—it decides for itself when the conditions are optimal for detonation.

Wrapped around the exterior of the cylinder is a continuous layer of sheet explosive. Four electric detonators are placed every 90 degrees and are set off simultaneously. Upon detonation, a substantially cylindrical shock wave is propagated through the fuel towards the center of the device. The high-velocity shock wave ejects the fuel radially outward, and the aluminum end plates reflect the shock wave so that very little of the fuel is ejected vertically.

A device of this type was tested several years ago containing thirty-seven gallons of pentane (an industrial solvent) and surrounded by a layer of explosive 3/8 inch thick. Details of this test are as follows:

"For the first 2 to 3 milliseconds after firing, the principal effect noticed was that of the outwardly traveling shock wave from the high explosive surrounding the fuel. By about 6 milliseconds after initiation, however, the fuel had spread to a cloud diameter of about 60 feet, which represents a velocity of the forefront of the fuel cloud of about 5,000 ft/sec. At about ten milliseconds after initiation, the fuel cloud was over 88 feet in diameter and a relatively small amount of burning was observed, and what burning was occurring was largely obscured by the unburned fuel surrounding the implosion fireball. Shortly thereafter the cloud of expanding fuel reached a detonable mixture, and the flame front rapidly propagated across the entire cloud volume. At 150 milliseconds after initiation of implosion, a large fireball at extremely high temperature spread across the ground over approximately a 100-foot circle. The fireball continued to hug the ground for a time of about 1/3 second to provide considerable flash burning on a target and then commenced to rise from the ground. A substantial blast effect was obtained, and substantial burning in the fuel cloud was still occurring after a full second. A vehicle located about 30 feet from the point of initiation of the FAE was overturned and continued to burn for a substantial period of time after the dissipation of the fireball."

It is a little-known fact that FAEs create the blast and flash equivalent of nuclear weapons within the volume of their cloud. The implosion FAE provides greater destructive capability than previously known weapons, whether they are measured on the basis of effectiveness per unit of weight or unit cost of the explosive device. Let's examine the three main parts of the implosion FAE—igniter, fuel, and explosive—in more detail.

Igniter

The igniter is a brittle glass or plastic tube containing an intimate mixture of copper oxide and aluminum powder. Interspersed within these powders are about 10 percent by volume of glass or plastic microspheres and about 10 percent by volume of puffed rice. These provide void spaces to promote reaction of the two metals and also ensure that there are many different fragment sizes and weights. This is so there will be ignition particles spread throughout the cloud when the time for detonation arrives. These particles are compressed and heated by the shock wave and actually become white hot. The ends of the tube must be plugged or capped to keep the fuel out. If desired, the igniter mix may be pressed into pellets for ease of handling and to provide the void spaces for initiation. Thermite is an acceptable substitute if available.

Fuel

The best type of fuel is one having a heat of combustion of at least 750,000 BTUs (British Thermal Units) per cubic foot. Certain fuels (i.e., the liquid hydrocarbons such as gasoline, benzene, pentane, etc.) are especially desirable since they allow the device to be field-loaded easily. Other types of fuels are good because they are not normally detonable. The previously mentioned naphthalene crystals have a heat of combustion of about 1,200,000 BTUs and are safe to handle in their solid form. The mothball bomb will function with just about anything that burns, ranging from such things as vegetable oil to starches and sugars to fuel oils, alcohol, or ammonia (see list). However, your best performance comes from a fuel having the aforementioned heat of combustion.

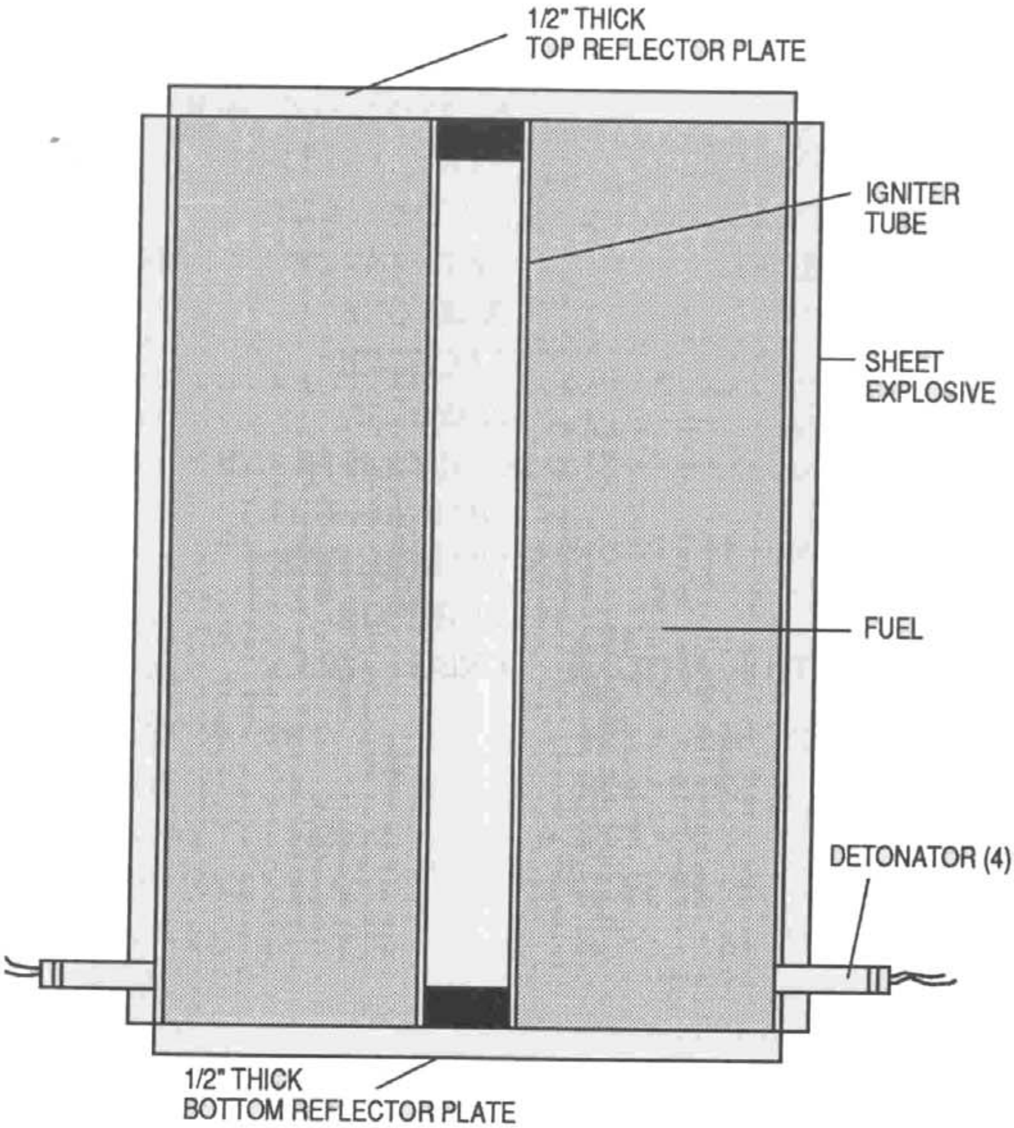
Explosive

The normal explosive thickness is 1/4 inch, which is the thickness of most sheet explosives (3/8 inch was recommended primarily, I believe, due to the military custom of using more than is needed to be on the safe side. Tests showed only a 5-percent increase in cloud performance for 3/8 inch as opposed to 1/4 inch).

If sheet explosive is unavailable, you can construct the bomb body as two concentric tubes and pack or cast the explosive in the space between them. If this is done it is best to stick to an explosive thickness of at least 3/8 inch to ensure reliable detonation. Almost any explosive may be used, but your best performance comes from one with at least as much power as TNT, preferably more.

Suitable Fuels for Implosive FAE Devices

PROPANE	OLIVE OIL
STARCHES	BUTANE
CASTOR OIL	POLYVINYL CHLORIDE
PENTANE	PEANUT OIL
EPOXY POLYMERS	HEXANE
CORN OIL	GLYCOL
ETHYLENE OXIDE	BEEF TALLOW
AMMONIA	POLYETHYLENE
LARD	PROPYLENE OXIDE
CELLULOSE (SUCH AS COTTON, SAWDUST, STRAW, AND PAPER)	POLYPROPYLENE
	SOYBEAN OIL
	STYRENE
COTTONSEED OIL	ACETYLENE
POLYSTYRENE	BENZENE
TUNG OIL	TOLUENE
LINSEED OIL	PITCH
GASOLINE	CHARCOAL
KEROSENE	PARAFFIN
JET ENGINE FUEL	XYLENE
BUNKER OIL	NAPHTHALENE
GAS OIL	METHYL ALCOHOL
LUBRICATING OIL	ETHYL ALCOHOL
PETROLEUM ETHER	DIETHYL ETHER
MINERAL SPIRITS	TETRAHYDROFURAN
ASPHALT	ACETONE
WAXES	LACQUER
FLOUR	NAPALM
GLUCOSE	NITROMETHANE
FRUCTOSE	NITROBENZENE
SUCROSE	NITROETHANE
LACTOSE	LIGHT OIL
METHYL ETHYL KETONE	CREOSOTE OIL



Implosive-type FAE device.