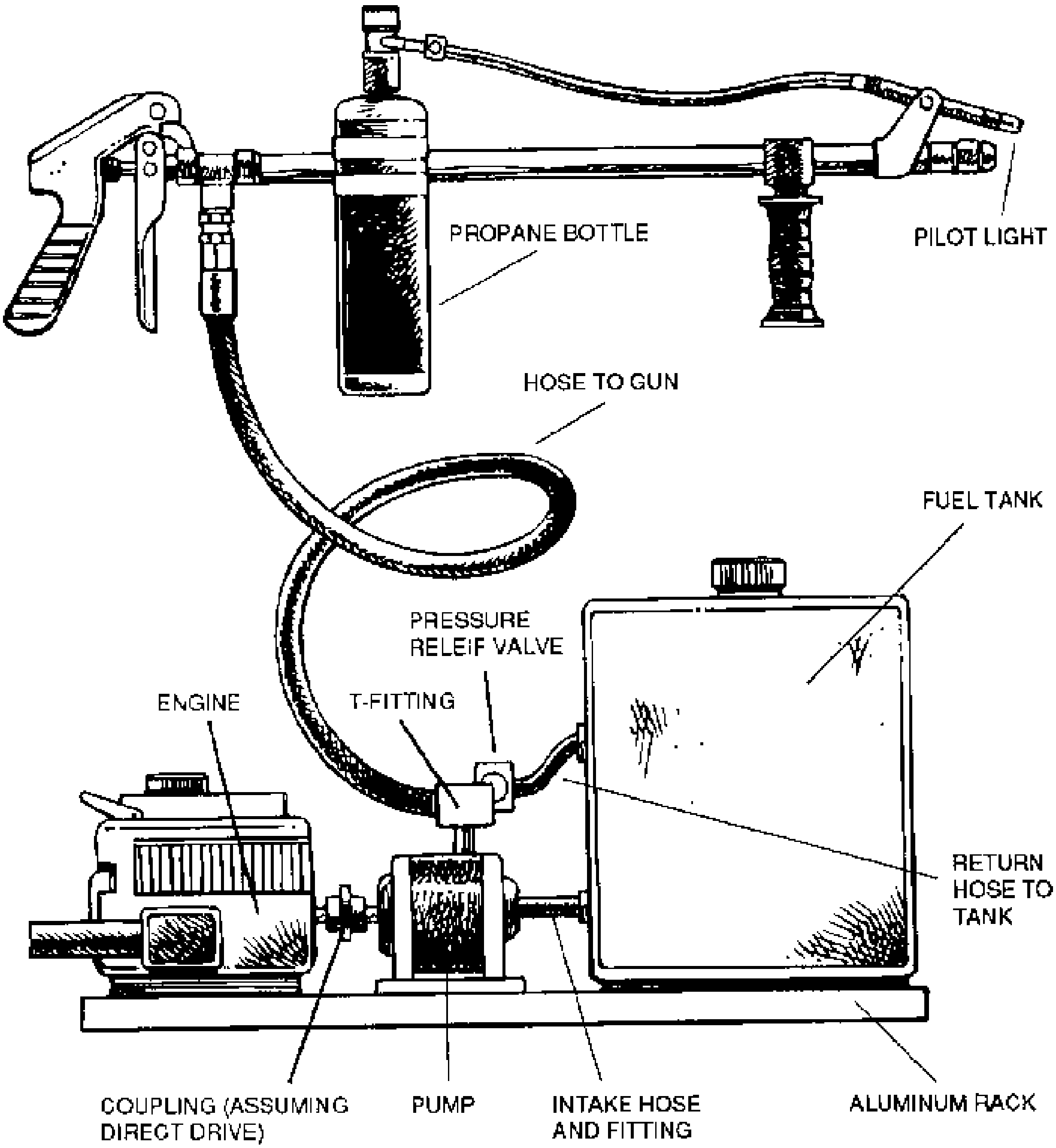

Breath Of the Dragon
by Ragnar Benson

Contents:

-INTRODUCTION-

Paramilitary survivors and others who have seriously contemplated their circumstances realize they need a powerful weapon to deal with armored police and/or military vehicles, including tanks and armored personnel carriers (APCs). Survivors also know that they might need a means by which to hold off a large number of hostile people.

To prepare for these and other survival scenarios, some have acquired superaccurate sniper rifles, homemade mortars, automatic weapons, exotic explosives, or Molotov cocktails. Unfortunately, these weapons aren't effective against extensive firepower and/or military-type police hardware.

Most traditional defenses have severe limitations. Sniper rifles, no matter how well handled, are totally ineffective against buttonedup armor. High explosives are dangerous, usually illegal, and require considerable skill to deploy because they are perishable and must be stored for an indeterminate period of time against the day of need.

Many of the most highly desirable devices are also highly illegal. Legality-or the lack thereof-may not be the determining factor for hard-core paramilitarists, but under some circumstances, it could be a consideration. Certainly some sort of destructive-device or weapons ordinance prohibiting possession of flamethrowers could be dredged up in places such as California or New York. In most places, however, one can safely assume that the Bureau of Alcohol, Tobacco, and Firearms (BATF) boys will not be looking for flamethrowers.

Military-grade flamethrowers can be built and operated legally by virtually anyone willing to invest the time and sweat. Unlike explosives requiring special training, flamethrowers can be used by anyone who can operate a garden hose and will take a few weekends to practice. For those willing to scrounge and improvise, the cost can be held to an extremely modest amount. So there is no reason for any survivor who might one day face otherwise overwhelming situations not to have a flamethrower. In inner-city locations, the owner of a flamethrower would almost certainly dominate his surroundings. Any survival bunker or retreat would be impregnable when defended by a determined owner with a good flamethrower and a modest supply of easily acquired fuel.

Imagine a small army of police, armed to the teeth, pulling up in bulletproof cruisers. Confidently and arrogantly, they confront what they suppose is a hapless victim, trembling in his retreat. Crouching behind their vehicles, they deliver their ultimatum: surrender or be blasted to oblivion.

Using his homemade dragon, the survivor silently proceeds to slime his attackers, their cruisers, and the ground around them with unlit napalm. The defender doesn't ignite the napalm in order to limit his own exposure to the extremely volatile chemical (it is hoped that none of the invaders were smoking as they were being sprayed). Outside, his opponents find that they are unable to wipe the slime from their clothing or skin.

As an added precaution-depending on the prevailing winds, the intensity of the threat, and the amount of fuel available-the survivor may lay down a napalm barrier between his position and the attackers. jelled napalm, as delivered from the flamethrower, will remain in an extremely dangerous form for a period of days. In some cases, its volatility may remain a week or more. Rain will eventually wash the substance away, but certainly not immediately.

If they have a lick of sense, the opposition (despite their firepower and hardware) will recognize their extremely exposed position. They will likely deduce that the survivor could easily fire a flare into the napalm, instantaneously wiping out the whole war party. Switching on the burner and giving them another shot of ignited material would settle the issue rather resolutely, destroying the armed force and most of their equipment. This use of the flamethrower is strictly defensive, useful from set (and often hidden) positions. The flamethrower can be quite noisy, causing survivors to worry that its location (and theirs) might be revealed, but the machine can be muffled and made to run almost silently. For people who want more portability out of their weapons for defensive and offensive use while on the move, flamethrowers can be scaled down easily and quickly to allow additional mobility. Models described in this book, even the smaller portable models, have great range when used with heavily thickened fuel. The basic difference is that portable units will not deliver the large volume of conflagration that a larger semistationary model will. A good compromise would be to mount a medium-sized dragon on an all-terrain vehicle, providing firepower, mobility, and versatility.

With the element of surprise assured, one should not underestimate the effective deployment of this device from a well-chosen defensive position. The range of raw, unlit, thickened napalm, when thrown into a calm environment, will be 150 feet or more depending on one's position. If the wind is cooperating, the results could be quite dynamic. Theoretically, a defender could neutralize a hostile group at a distance of a couple of city blocks or more.

Once having coated the enemy and/or established a napalmed perimeter, one need do little more than sit back and wait for developments. It may even be appropriate to detonate the napalm from another position should the attackers persist in their hostile behavior. If the authorities were to bring up an armored vehicle, the defenders might elect to fry it without further delay before the attackers understand what they face.

Unless one expects to defend against planes, helicopters, and/or mortars, a flamethrower offers the ultimate in retreat protection against ground attack. As an added bonus, flamethrowers are legal, relatively easy to build, reasonably inexpensive, and use common, inexpensive fuels.

- HISTORY OF FLAMETHROWERS -

Light rain misted over the sparse trees, bushes, and grass that remained after sixty days of heavy artillery bombardment. German troops commanded by the Duke of W rttemberg were scheduled to charge out of their muddy cesspool trenches at first light and take the Chateau de Hooge from the British. Two unsuccessful attempts and the unseasonably wet weather-which had turned the ground along the Menin Road three miles east of Ypres in Belgian Flanders into thin, runny, gruel-like mud-had dampened the Germans' optimism. Conditions on that gray, drizzly morning of July 30,1915, left even poets and historians groping for words to describe the horror. Men were being choked by poison gas or pounded to protoplasm at a collective rate of more than 11,000 per day. At one point, a British attack penetrated four miles along a nine-mile front, with only 18,000 killed or wounded, leading commentators to assert that the action was a good one, characterized by "acceptably light casualties. "

Starting at 3:00 A.M. German artillery fire saturated British lines, commanded by the popular but stoically methodical British General, Sir Herbert Plumer. Rounds, including some newly developed flammable projectiles, fell at a steady rate of twenty or more per minute. As on their two previous attempts to capture the Hooge on July 21 and 24, the Germans also used copious numbers of gas rounds and large cylinders of compressed gas released from their positions into the light westerly wind. Deadly fumes wafted toward the British lines. At one point they generated a cloud of death five miles long and more than forty feet deep. A year earlier, this action would have decided the battle immediately, but that morning the British donned their newly issued rubberized ponchos, hoods, and breathing masks. Although crude, these devices had enabled British defenders during the past week to gun down German infantrymen as they followed the gas cloud into no-man's land.

Though the British were equipped for poison gas, they saw something new that day for which they were unprepared. Between fifty and one hundred "flame projectors," as they were called at the time, had arrived at the German lines the week before. As is so often the case, German commanders anxious to capitalize on any tiny advantage rushed the untried weapons into the hands of untrained men who carned them to the front in an indecisive manner. Similarly, the British rushed into action with their tanks, the Americans with their squad automatic weapons, the French with their fighter planes.

The first flame projectors consisted of bulky brass cylinders capable of carrying about six gallons of fuel and a leather-gasketed pump that created twenty-five to thirty pounds of pressure per square inch (psi). The Germans lacked the ability to thicken the fuel, so range was limited to about forty yards under ideal conditions. The fuel was a mixture of lamp oil and gasoline, with perhaps a small percentage of pitch (contrary to British speculation that the fuel was a coal-tar product). It was ignited by a crude oil-soaked cotton wick that functioned as the pilot light for the sprayer nozzle. As a result of the thin fuel and the relatively weak pump pressures, ranges were such that the user had to charge right up to the lip of the enemy's track before the device had the slightest effect. The burning wick exposed the user to the enemy, and shortly defenders knew what to guard against.

The flamethrowers had other flaws as well. Simple tanks were fastened to a crude rack that was in turn strapped to the user, creating weight and balance problems for the soldier. Severely limiting its usefulness was the fact that the user could expect about five shots before emptying the reservoirs. If the flaming wick didn't attract fatal fire, the hapless soldier found he had at best a minute or two of combat effectiveness before running out of fuel. In that regard, flamethrowers were not particularly effective weapons, but their presence that day-along with napalm artillery rounds, which were mixed with high explosives and gas canisters and used for the first time in modern warfare so surprised the British that they surrendered their forward positions (although the use of napalm was a major tactical leap, many of the details went unnoted or have been lost with time). Historical accounts noted that the British suffered about 2,000 killed, wounded, or captured that morning. The three-tiered organization by both armies precluded a victory by either side. An attacking force quickly overran its communications line before reaching the third system of trenches. Advancing troops sometimes were shelled by their own artillery; or, at best, they were were forced to wait while the enemy repaired the breech.

Although the first use of flamethrowers was historically indecisive, the event was briefly noted by several writers. More than seventyfive years later, most historians know the event at the Hooge occurred but have no idea exact?y when and under what conditions. The fact that flamethrowers are an offensive weapon, valuable only in a set-piece urban war, seems to have been overlooked by military commentators. Virtually no additional mention of flamethrowers can be found until well into World War II. Russian soldiers used them in Finland without averting the disaster that Finland was to become. Against the U.S.S.R. in Europe, the Germans designed more effective flamethrowers for urban use. They also used them to flush French, British, Czech, and Belgian troops out of their bunkers. British defenders installed vast networks of flamethrowers along their channel coasts to thwart Nazi invasions.

Given the experiences in Europe and the perceived need in the South Pacific, U.S. tacticians reasoned that man-carried flamethrowers would be ideal to clear japanese bunkers. But they soon realized it was not possible to project unthickened gasoline, motor oil, or coal oil any appreciable distance. Late in 1942, the U.S. Chemical Warfare Service contracted with the Standard Oil Development Company or materia s t at cou e mixe in the field with common petroleum products to pro uce napa m. Standard Oil was able to quickly produce a material that: "...throws a cohesive rod of fire with such accuracy that it can be directed into a two-inch bunker slit sixty yards away. The jet, traveling at nearly two miles a minute, does not billow out but strikes its target as a solid, glowing stream, then splatters and sticks to any object, blazing with terrific heat that destroys guns and all life within a pillbox."

The thickening agents developed by Standard Oil were simply mixtures of aluminum and soap, but they were treated as closely guarded military secrets. Military planners were not about to compromise what they thought was a significant military breakthrough with loose talk.

As a result, the Americans developed the model M1-A1 flamethrower. Some of these models are still seen in Third World arsenals around the world. The M1-A1 had two separate fuel cells containing about four gallons of napalm when fully charged. Use of two smaller fuel tanks rather than one big one gave the user a lower, lighter, more balanced profile. To these two tanks, developers mounted a third smaller tank containing massively compressed air to provide propulsion. In theory, the compressed air propellant lasted as long as the contents of the fuel tanks without diminished performance. (At one time, it was thought that napalm had to be propelled with inert nitrogen gas, which further limited the use of flamethrowers. Most modern models are designed to use regular compressed air.)

Special electrically fired blank flash cartridges ignited the napalm. At best, the M1-A1 flame-thrower could produce seven one-second blasts. On Munda airfield in the South Pacific, U.S. Marines destroyed sixty-seven Japanese bunkers using flamethrowers. Most of these bunkers had already withstood protracted shelling, including direct hits from fighter bombers. By rolling in smoke grenades and deploying smoke pots upwind of the bunker, marine "hot foot" units, as they were called, could get close enough to splash napalm through the cracks in the bunkers, killing or routing the occupants.

Meanwhile, on the European front, the British developed a forty-one-ton, armored, self-propelled flamethrower they dubbed the "crocodile." Reportedly, the crocodile had an accurate range of 450 feet. The Allies deployed a few in Europe against fixed positions, and U.S. forces made limited use ofthem in the South Pacific.

Somewhat improved U.S. flamethrowers saw action again in Korea and Vietnam. As a tool for burning villages and flushing out tunnels, they filled a valuable niche for U.S. servicemen. However, by the end of the Vietnam War, the handwriting was on the wall. Small, easily portable white phosphorous and magnesium grenades were proving to be superior to the inconvenience of the flamethrower's clumsy tanks racks, and hose.

Today, the U.S. military's inventory of flamethrowers is decreasing. Flamethrowers are an ideal urban weapon, but few military planners envision a war fought in cities and towns. Contingency plans call for bypassing cities or blowing them off the face of the Earth. At the battalion level, the armorer may have one or two among his stores, but the military relies primarily on modern explosives. Only rarely do soldiers receive training on the use of flamethrowers.

Obsolete U.S. military models that one may encounter around the world include the M2-A1-7 or the ABC-M9-7. Both are basically three-tank, four-gallon models, lit by electrically fired ignition cartridges. Both weigh about twenty-one kilos, or forty-six pounds. U.S. training manuals often showed users deploying their dragons from behind an obstacle, while the tanks were set to the side. (Undoubtedly, this is the position preferred by survivors.) The M9-E1-7 is the only model considered to be current in the U.S. armed forces today. Basically, this model is much like its predecessors. Filled, it weighs about forty-six pounds; maximum range with properly thickened fuel is forty-five to fifty meters. All mod- els have three tanks, cartridge ignition, and a pack rack for soldiers. Useful life of the fuel in combat is from five to seven seconds.

Soviet flamethrowers employ a somewhat different mode of operation. The LPO-50 is the flamethrower currently in use among Warsaw Pact armies. The LPO-50 consists of a threetank unit with manifold. Each tank contains an electrically fired pressurizing cartridge that, when fired, provides the propellant necessary to project the napalm from the gun. Individual tanks contain about one gallon of fuel, enough for a single two- to three-second burst. Effective operating distance is said to be about forty meters. A second and third burst are accomplished by moving a selection lever on the gun. The Soviet flamethrower weighs about forty-six pounds. Three electrically fired ignition cartridges provide traditional lighting.

In a purely military situation, the flamethrower operator may not wish to risk having his position revealed by the pilot light flame. Soldiers are also not usually in the position of wanting to coat their opponents with napalm before giving them the option of retreating, frying, or surrendering. In a paramilitary context, however, a propane pilot light can be simpler and does offer the flexibility of igniting the napalm later.

Most experts agree that either the Italians or the Brazilians, depending on one's point of view, currently manufacture the world's most advanced flamethrower. Both are capable of seventy-meter (215 feet) ranges. The LC-T1-M1 Brazilian model has three tanks and weighs thirty-five kilos fully charged. Its outstanding feature is an electronic ignition system powered by eight standard 1.5-volt dry cells. Reportedly, a fresh set of batteries will light one thousand shots before going dead. On the average, users expect five to seven seconds of actual operation before the fuel is expended.

The model T-148/A Italian flamethrower also has an electronic ignition, and its manufacturer claims it will function satisfactorily under water! This may be of value on rainy or snowy days. The Italian model's advanced tank design gives it the same basic fuel load as most other models, but with a total weight (filled) of only twenty-five and one-half kilograms-as opposed to most other models weighing in at around thirty-five kilos.

Problems inherent in the military application of flamethrowers are availability of proper chemicals, a ready source of fuel, and difficult-to-maintain compressing equipment-are either alleviated by civilian models or not as serious to survivors who have better access to chemicals and fuel and aren't as mobile as an army on the move. Civilian paramilitary models use smaller engines and pumps instead of high-pressure tanks and are generally simpler and more effective than the rugged, more reliable three-tank military models. Lighter civilian models can use thicker napalm, which allows greater throwing distance. Most important, the civilian unit can be deployed and field-served without large amounts of sophisticated support equipment. Those who are not satisfied with the pilot-light ignition standard on civilian models and who are electronically adept may wish to design and construct a sparking system for their homebuilt dragons.

For the foreseeable future, flamethrowers will be with at least some elements of the world's armies. And, as was true in the case of the U.S. Marines at Munda, flamethrowers may provide exactly the same deterrent for civilians wanting to protect their urban safe havens.

Builders of flamethrowers should keep several basic guidelines in mind throughout the process of construction and use. Chief among these is the fact that flamethrowers-especially the smaller, portable, expedient models can be very dangerous. Larger commercial models (as recommended and described in this chapter) include a number of design features that make them relatively safe to own and operate. Amateur assemblers should keep these safety features in mind as they alter or modify their own weapons to accommodate surplus or scrounged components.

Gls who are assigned to flamethrower duty do not consider it particularly desirable or even rational. Handling one is intrinsically dirly, disagreeable, and dangerous. They consider flamethrowers to be weapons of last resort, useful when nothing else is at hand to do the job.

Makers who want a flamethrower for commercial applications-including starting fires, disinfecting buildings, destroying trash and refuse, or just cleaning up-should in all cases choose the more durable, conservative model. Those who want an inexpensive version principally to use in an emergency to defend their retreat could opt for a simpler design.

Flamethrowers, when viewed as a collection of their parts, are extremely simple. They consist ofthe following components:

1. Pump needed to propel the thickened petroleum. This pump adds cost and weight to the package but gives the machine greater utility over many military models, making it more valuable to survivors.

2. An engine, pressure tank, or other device used to power the pump. Military models use heavy, cumbersome pressure tanks. Expedient or commercial models work best with a small two-cycle engine. Miniaturization of these power plants in recent years has made it possible to develop even smaller flamethrowers.

3. Spray nozzle or gun that disperses the napalm, allowing the user to propel the napalm out onto the target. For safety and accuracy, the gun must include a forward hand grip.

4. Lighting mechanism used to flame the napalm after it leaves the hand-held gun.

5. High-pressure hoses necessary to transport the thickened hydrocarbons from tank to pump to gun.

6. Pressure valve to allow the pump to recirculate the napalm back into the storage tank when the pump pressure is not relieved by pulling the gun trigger. Some builders may want to include a pressure gauge so that they can know precisely what the system is doing.

7. Napalm fuel storage tank. To a major extent, this component is the limiting factor of any flamethrower design. Ideally, the tank should be as large as possible to provide as many shots as possible. However, weight and maneuverability considerations preclude anything much greater than 10 or 12 gallons on a backpack design or 135 gallons when mounted on a small truck or all-terrain vehicle. Using longer delivery hoses, the truck-mounted design-which at first seems cumbersome and basically immobile, can be of great tactical value.

8. Clutch or engine/pump coupling. This connection can be very complex. In some cases, the engine will run slowly enough under load to allow a direct link. However, for safety reasons, the user may demand an electric clutch that engages only when the gun trigger is pulled. In still other cases, the builder will find that he must purchase an expensive speed-reduction unit.

Using the above component list, the builder should start with the mortar and pump. Large commercial units employ a standard eleven-horsepower Briggs & Stratton electric-start gas engine. Models 221400, 252400, or 254400 are all acceptable. Tecumseh model 912210B at 12 horsepower is also an excellent choice for heavier, truckmounted commercial units.

These larger engines don't have to be electric start. Yet on many commercial applications, users often enjoy the simplicity of punching a button to start the power plant. Scroungers can use a four-cycle engine from an unused riding mower, generator, farm implement, paint sprayer, compressor pump, or other available power plant.

Those wanting a smaller portable unit may elect to use a 3.5 horsepower, two-cycle engine, such as a Tecumseh model 800110, available new from Graingers Supply. These are pullstart, direct-drive engines that are eminently suitable for smaller flamethrowers.

Since these new engines purchased from farm and ranch supply houses and/or wholesale hardware dealers can be quite expensive, survivors may elect to use a small surplus chain-saw or go-cart engine. Although many pump manufacturers claim that a unit as small as one-half horsepower will run their pumps at or near full capacity, survivors must still exercise caution so that the marriage between engine and pump is a good one. Scrounged power plants must possess sufficient remaining life to operate the intended pump moving heavy, viscous napalm.

Chain-saw engines having a 3.1 cubic inch displacement theoretically have about 3.4 horsepower. Larger, more desirable 4.9 cubic inch displacement models will have in the neighborhood of 6 horsepower, which is sufficient zip to adequately power most pumps and to get the napalm out to where it can do some beneficial work. Three-and-one-half horsepower will work, but the spray-gun orifice must be reduced so that sufficient pressure can be developed, which limits the amount of material that can be delivered. As a general rule, the unit should be run on pressures from 90 pounds per square inch (psi) to a maximum of 125 psi. Beyond this point, delivery performance is not increased.

My own supersafe model uses a Continental Belton Co. model B0201 pump with brass gears. This pump, available from many automotive supply houses, is virtually product specific for napalm. The survivor can also choose from a host of other suitable pumps. Graingers lists a number of cast-iron or aluminum rotary gear pumps that will handle viscous No. 2 through No. 6 fuel oil. Most farm supply houses also have lighter aluminum-bodied gear pumps designed to handle chemicals and petroleum products. Speciality engineering supply houses, such as McMaster-Carr, stock extremely light plastic epoxy or bronze body pumps with impellers that are specifically designed to move petroleum products. Some of these pumps are designed to operate using engines as small as one horsepower or less.

Anyone with sufficient funds can buy a suitable new pump. Those whose resources limit their acquisitions to scrounging may spend a bit more time looking for a pump that will reliably handle heavy petroleum-based material without dissolving or detonating the entire apparatus.

Connecting the pump to the engine is probably the trickiest procedure involved in assembling the various parts of a flamethrower. Tried and true safer commercial models use an Everco A8433 electrically engaged clutch. These clutches are cumbersome, heavy, and expensive. If purchased, successful operation requires that these units have a wet-cell battery wired in as a permanent fixture. An A8433 clutch can be scrounged from an old Ford automobile air conditioner system. They are used in conjunction with a microswitch wired into the gun trigger so that the hoses varrying the voilatile napalm are not under constant pressure. Pulling the trigger kicks in the clutch, putting the engine under load as the pump pushes the snotty napalm down the hose.

On smaller, more expedient models the maker may elect to run the hoses under constant pressure. All hoses must be the high-pressure type, double fastened at all connections. Makers should also install a good pressure-release valve that will allow excess napalm to be recycled back into the storage tank. This recycling process prevents the user from having to mix the napalm in a separate container and then empty it back into the flamethrower tank.

Most gear-type pumps require about 2,000 revolutions per minute (rpm) to perform satisfactorily at full pressure, with something approaching full delivery potential. New commercial engines run wide open at about 3,600 rpm. This would suggest that a direct-drive system avoiding heavy pulleys and belts would not be feasible. However, in actual ractice most pumps will accommodate higher rpm, while smaller engines under load seldom run at a full 3,600 rpm. It all depends on the engine and the pump. Builders will find that they must field engineer their specific pumps and engines to achieve the best results. Theoretically, engines running at 3,600 rpm that are geared or belted back 50 percent to 1,800 rpm have twice the torque and would be expected to perform more suitably. In actual practice, this is not always true. Some surplus chain-saw engines run faster than 3,600 rpm and absolutely must be geared back to be effective.

Before I set up a belt and pulley system or purchased an expensive reduction coupling, I would try a simple collar, hooking up pump and motor face-to-face. This simple, cheap approach is preferable unless the survivor's needs require the safer, more conservative model, necessitating the use of an electrically engaged clutch.

Once the pump and engine are matched, the unit must be bolted to a small aluminum-angle carrying rack. I use four 1-1/2-inch aluminum angles. Since most survivors cannot weld aluminum angle, the pieces must be cut to size, drilled, and then bolted together. Aluminum angle is ideal because of its weight, ease of handling, and nonsparking nature.

As a general rule, pumps used for flamethrowers will be engineered with 1/2-inch pipe intake and output ports. Securely thread a 2-inch black pipe nipple into the output port. Onto this nipple, securely thread a common black 1/2 tee. All pipe fittings must be in excellent condition. Into one side of the tee, thread either a preset or adjustable relief valve. Set the relief valve at 100 pounds ofpressure or use a preset version of that strength. Past experience indicates that 100 psi is about maximum for a flamethrower. At 125 psi we start to lose distance and efficiency, while below 90 psi performance drops dramatically. As the engine builds pressure in the system, the valve will open, allowing the napalm to cycle through the tank. Commercial models are constructed with permanent ball valves built into the system that, when opened or closed, allow the material to be cycled to the tank, the gun, or in some cases an external tank, such as those used on helicopters.

Throughout the system you should use high-pressure spray hose designed for agricultural use, including petroleum products. Design working pressure should be 600 psi or more. This hose is commonly available at full-service farm or automotive supply houses. Suppliers will press on appropriate fittings to the specification of the builder. It is possible to obtain three-eighths-inch inside diameter hose for use over one-fourth-inch pipe fitting or three-fourths-inch pipe over one-half-inch nipples, but these require double hose clamps and are not as secure as pressed factory fittings.

Use the largest inside diameter hose available. Do not settle for anything less than one-fourth-inch. On larger models, the three-fourths-inch hose is expensive to buy and cumbersome to use, but on smaller, expedient models where hose lengths are limited, this price/utility problem seems minimal. Three-fourths-inch hose delivers more napalm and fits tightly over a one half-inch pipe nipple, making it the hose of choice if the builder can work it out.

Storage tanks don't pose as severe a problem as one might initially think. My large commercial unit uses a 135-gallon tank made from welded aluminum sheet. Other units use 55-gallon surplus poly barrels with movable hoses. For one small portable unit, we scrounged a 12-gallon poly tank from an orchard sprayer. Since the tanks aren't pressurized, they must meet only one speciflc criterion: they must be nonsparking.

Poly and fiberglass tanks are especially easy to work with since most come with secure caps and can be easily fitted with suction (on the bottom) and discharge (in the top side) fittings using epoxy and/or fiberglass kits. Even common tap-and-die fittings can be placed on a poly tank as long as the tank will not be subjected to destructive pressures.

From the second T-outlet on the pump, run an appropriate length of pressure hose to the gun. The outlet tee on the pump now has one hose running to the back of the tank through the relief valve and another to the gun. Commercial semistationary models are generally built with fifty-foot gun hoses so that the user can walk around. On backpack models, four feet of discharge hose may be adequate, but a longer hose of up to twenty-five feet is more practical so that the user can set the unit down, pull the starting cord to ignite the engine, and then crawl around relatively unencumbered with the flametrower gun. When connecting suction hoses from the bottom of the tank to the pump intake, inspect carefully to make certain that all connections are secure.

Finding and assembling a high-pressure gun is the last task facing the determined paramilitarist. Once this is done, the user can be reasonably confident that he can defend his retreat against heavy-duty hardware.

Most full-service farm supply stores will carry a number of high-pressure spray guns. Ask for a model that will handle highly viscous petroleum products. The gun should accept an eighteen- to twentyfour-inch barrel extension. The nozzle should be capable of handling at least two and one-half gallons per minute at 500 psi. These pressure and volume requirements may seem excessive, but they do allow for some margin of error when handling fairly dangerous materials.

If possible, use a gun with a drop-forged brass body with positive nondrip trigger action. The gun must accept a twenty-four-inch barrel extension. Using a flamethrower without an extra-long barrel to keep the discharge away from the user is foolish and dangerous. The barrel extension also provides a place to mount a forward hand grip for the user to hold onto, as well as a mounting plane for the pilot-light assembly. The forward hand grip should be mounted at a comfortable place on the barrel using U-bolts of hose clamps.

Setting up one's hoses to adequately and safely attach to the gun, as well as fitting the unit with appropriate nozzles, can become an expensive, time-consuming exercise. To find the correct nozzles for a specific gun, the only method seems to be trial and error.

Every high-pressure gun maker seems to have his own set of nozzles and nozzle codes. At times, I have had to call the distributor or factory to get appropriate numbers, which causes long and exasperating delays.

Commercial models that have a battery as an integral part of the assembly are drilled and tapped so that a microswitch can be placed in the trigger mechanism of the gun (suitable switches are available from Radio Shack or other electronics stores). Pulling the trigger also engages the electric clutch between the pump and engine. Electric lines from the battery to the clutch must be run up the hose, adding marginally to the total weight. Pressing the switch results in a momentary pause as the system builds enough pressure to expel napalm over its design distance. Before installing the pilot light, be absolutely sure the machine will operate reliably without leaks or spills. Extra care taken in the assembling and mounting of the pilot light will eliminate or minimize problems that might otherwise arise. One trick to remember in mounting the pilot light is to position the flame at least four inches away from the discharge port on the gun. This almost always entails using a piece of copper pipe to extend the flame to its correct position. Use a common propane cylinder fitted with an extra-long nozzle assembly. Hose-clamp the proper cylinder in a balanced, easy-to-use position back on the gun-extension pipe. Keep the tank at least twelve inches to the rear of the discharge nozzle. Run the piece of copper extension from the cylinder regulator up past the end of the gun. Aim the flame down at a twenty-degree angle through the stream ofnapalm.

Turn the cylinder on and adjust the flame so that it is bright and vigorous. Users will discover that it takes several four-hundred-gram cylinders to keep their dragons running for any length of time. Gas consumption can be cut by turning the flame down so that it is barely visible when not actually in use. However, the wise user will plan for rapid depletion ofhis LP gas supply and have extra canisters available.

After confirming that the engine and pump are properly matched, the next step is to mix the napalm and do a trial run. Successfully mixing napalm is much more difficult than one might expect, especially when the proper commercial chemicals are unavailable. (Since the quality of the fuel is the principal determinant of the flamethrower's effectiveness, the next chapter is on fuelmixing procedures.)

By whatever means, make certain that you have thoroughly tested the pump and engine as a napalm slimer before even thinking about turning on the burner. Check for leaks or spills anyplace on the device. If any fittings show signs of leaking, do not economize on parts. Remove the defective parts and start anew. As an added precaution, I would recommend setting backpack flamethrowers on the ground before deploying, unless an emergency dictates otherwise.

Prices may vary a bit from place to place, but when assernbling a dragon, the following budget should be close, although perhaps a bit on the high side:

12-HP electric-start gas engine	$400
High-pressure bronze gear pump	100
Gun fitted with electric pressure switch	100
Electric clutch assembly	150
Industrial grade hose (50 feet)	65
Surplus poly tank (55 gallon)	25
Aluminum hame material	15
Battery	50
Fittings and wire	25
Total	$ 930

Add another $20 if a new pack frame for a man-portable unit is needed. Total price would still be well under $ 1,000, a small price to pay for something that would easily take out an armored car.

People who enjoy puttering around with devices of this sort can usually pick up all of the essential components at greatly reduced prices. Using a surplus chain-saw engine and farm chemical pump will usually keep the price under $500. At one me, I even found an adequate gun among some old farm supplies that was fitted with a barrel extension, pressure switch, and new nozzle for use on a portable unit. The only used components you should avoid are high-pressure hoses and pressure-relief valves.

Although novice builders generally overestimate the amount of money needed to make a flamethrower, they generally underestimate the amount of time needed to scrounge and construct their first unit. Assuming one has access to a well-supplied agriculture or autosupply store (and a lot of cash), a good estimate is about one solid week the first time through, using all new parts.

It seems like a thousand years ago, but I can vividly recall as a kid crouching next to a three-gallon lard can half-filled with gasoline that I was heating on a small camp stove. I was trying to make napalm following instructions from an old World War II Office of Strategic Services (OSS) operations manual. The incident occurred so long ago that most of the details are blurred. For instance, I don't remember exactly why I was trying to make napalm. I do remember that I had no practical use for it; we didn't own a flamethrower, and I had no idea how to construct one. One thing is very clear to me, however. Even though I was operating upwind of a steady breeze, I remember my sixth sense kept telling me this was really a very dangerous, dumb thing to do.

Every time I put the can on the fire, the gasoline started boiling furiously. Carefully and meticulously, I shaved microscopically thin slivers from a bar of 99-percent pure Ivory soap into the boiling gasoline. Eventually, most of the gasoline boiled away leaving a brown, varnishlike sludge in the bottom of the can. The soap never did jell the gasoline, leading me to the conclusion that there really was no such animal as an expedient napalm formula. As a result, I abandoned this project until much later in life when I discovered good, reliable commercial napalm chemicals.

Commercial uses maintain that producing a good batch of napalm is tougher than building the flamethrower. The task of getting the napalm right would be virtually impossible were it not for the new, improved chemical formulations. However, variations in temperature and humidity still preclude the procedure from ever being cut and dried. To make matters worse, in addition to being sensitive to weather conditions, the formula is always peculiar to each individual flamethrower, as well as being subject to the availability of various chemicals.

For a number of years I used military-grade petroleum gel chemicals purchased from surplus stores, which were usually quite cheap. Invariably they came in battered five-gallon pails containing twenty pounds of cream-colored chemical. The pails were rugged, durable containers that were in and of themselves worth the forty cents per pound I usually paid for the chemical inside. The chemical was called alumagel, and it came in two distinct varieties: M-2 for use in warm weather (defined as temperatures above 60øF) and M-4 for cold-weather use. I carried both M-2 and M-4 to the field for testing, and it was usually a toss-up as to which formula would perform best on a given day. As a general rule, it always took considerably more chemical of either type to achieve the desired performance when temperatures were at the lower end of the range.

Assuming alumagel is still sold in a surplus store near you, I recommend the following percentages as a starting point:

Fuel/gal.	M-2/lbs.
55	10.00
40	6.75
30	5.00
25	4.50
20	3.40
15	2.50
10	1.70
5	0.81

M-2 (warm-weather alumagel) is for use when temperatures exceed 60øF. When the temperature falls below 6øF, flamethrower operators must switch from M-2 to M-4 alumagel. Use the following ratios as starting points for a cold weather M-4 mix. (All ratios are approximations that must be adjusted for local conditions.)

Fuel/gal.	M-4/lbs.
55	6.70
40	4.50
30	3.75
25	3.00
20	2.30
15	1.75
10	1.20
5	0.60

Generally, five to fifteen minutes of mixing time will be required to whip up a batch of gel. Using the above ratios, begin with a small amount of fuel to try the formula. Sift the alumagel through a screen to break up any lumps that may have formed because of high humidity or long storage. Caution: you must sift all of the recommended amount of alumagel into the fuel on the initial pour. Adding extra alumagel powder later to correct a runny formula causes uneven distribution of the powder in the fuel, producing napalm that is too thick, ropy, and lumpy to be usable.

Those whose dragons will mix the napalm by running it through the system can expect a far superior product of much smoother consistency than that which results from stirnng it in a tank with a paddle. Too much alumagel sifted into the base fuel creates a final product that is beyond the capabilities of the dragon's motor and pump. Should this happen, wait ten minutes to be sure it has completed the jelling process and then mix in two to three additional gallons of gasoline-assuming that this is a twenty-five to fifty-five gallon starting batch. If the test batch is five gallons or less, one-half gallon of additional gasoline should thin the batch sufficiently to run through the machine. Always use gasoline to thin, never diesel fuel, even if the mixture was originally thought to be low on fuel oil.

If the gel will be carried around for several hours before using, make the mixture slightly thinner than usual. It should set up adequately after a few hours, especially in rising temperatures. Remember to circulate it through similar in color and consistency to apple butter, and it loses some of its intense volatility. Jelled gasoline burns more like lighter fuel, except it has greater endurance and body. The end product should have the same thickness and stickiness as Karo syrup, with a few floating soft lumps that look much like whipped margarine.

The best starting fuels usually combine gasoline and fuel oil. Gasoline provides volatility, while the fuel oil adds the staying power necessary to eat through body panels and plaster walls and to set vehicle engines on fire. A heavier mixture will propel farther and will splash and ricochet, causing more mayhem. My preferred formula for small portable flamethrowers is about fifty/fifty gas and diesel. Your experiments may show that a mixture of 40 percent oil and 60 percent gasoline works better on a given day. Because alumagel is extremely sensitive to atmospheric conditions, it is difficult to predict ahead of time which formula will work best.

Larger commercial units often perform best by reversing the ratios to 60 percent oil and 40 percent gasoline. Surplus JP-4 (jet fuel) is often available from aircraft fuel-tank maintenance. It makes excellent flamethrower fuel. Napalm made from JP-4 will often remain in good condition for two to three weeks. At about two weeks, napalm made from regular fuel oil and gasoline usually starts separating into a thin, watery solution or congealing into a heavy gluelike substance. Neither is usable. To test your formula's shelf life set aside five or ten gallons for a few weeks and see what happens.

In my opinion, expedient methods of making napalm have not improved since my failed childhood experiment. I strongly recommend that you use only commercial or military surplus chemicals when preparing napalm, especially if the situation is a serious paramilitary one. Some readers may develop a workable, expedient method of jelling petroleum, but at this point, I doubt it.

Military-surplus alumagel performs adequately for its intended purpose, but because it is so sensitive to temperature and moisture fluctuations, I now use a material called SureFire (available from Simplex Manufacturing Co., 13340 N.E. Whitaker Way, Portland, Oregon 97230; 503-257-3511). Sure-Fire works well under most moisture conditions and in temperatures ranging from 32ø to 70øF.

As do all "miracle" products, Sure-Fire has a downside. While alumagel costs between forty cents and one dollar per pound, SureFire costs a minimum of four dollars per pound. As an added disincentive (in case this didn't make up your mind), Sure-Fire is almost always sold in fifty-pound bags. Western Helicopters (Box 369, Newburg, Oregon 97132; 503-538-9469) will occasionally ship smaller quantities. Contact them directly to find out about selection, price, quantity, and shipping instructions. Both Western Helicopters and Simplex are basically farm and logger supply houses, so inquiring about Sure-Fire will not generate concern or hostility, provided the inquirer maintains the posture of having an agricultural or forestry use for the material.

Sure-Fire is used in far smaller quantities than alumagel, mitigating its cost per pound somewhat. One-twentieth of a pound (at a cost of about twenty cents) will usually jell one gallon of regular gasoline and oil mixture in about twenty-three minutes. If the temperature drops below 30"F, it may take two-thirds of a pound per gallon to do the job in the same time.

Plan to use three pounds of Sure-Fire in thirty gallons of fuel to jell the mixture in twenty minutes at 50"F. As with other products of this nature, Sure-Fire must be sifted gently into the fuel to avoid caking, roping, and lumping. Using the flamethrower's pump to circulate this mixture is the preferred method of mixing, assuming one's dragon has this internal ability. Note that with all chemicals of this nature, these figures are to be used only as starting points. Intelligent users will experiment to find suitable mixtures that perform well in their weapons. Owners are looking for a formula that will give them the longest propulsion, hottest burn, and most sustained jell.

Experienced fire fighters wear Nomex pants and shirts when working around flamethrowers. It may not be necessary to wear this special flame-resistant clothing, but it is imperative that users never wear synthetic clothingincluding nylon, rayon, or polyester of any sort-when using a dragon. When subjected to high heat, synthetics melt to one's skin, subjecting it to ugly, painful burns that would not result from natural fabrics.

When trying the flamethrower for the first few times, be especially cautious that errant breezes do not send the napalm arcing back onto you. It is always best to throw the napalm with the wind, but this may not be possible, especially from a defensive position. In the case of an upwind attack, try to operate from an uphill position. After some trial runs, it may even be necessary to install a different, more appropriate orifice in the gun.

Mixing suitable napalm, even with a superior product such as Sure-Fire, is more an art than a science. Determined survivors who elect to use flamethrowers must decide ahead to invest enough money and time to do the job properly.

This text is a chapter in the book "Ragnar's Big Book of Homemade Weapons" and the ISBN # is 0-87364-660-6 if you would want to order it.
