U.S. Army Flamethrower Vehicles

(Part One of a Three-Part Series)

By Captain John Ringquist

Early Flamethrower Vehicle Development

During World War II, flamethrowers were transformed from infantry equipment to armored vehicle-mounted weapons designed to improve combat efficiency and increase fuel-carrying capacity. Flamethrower vehicles were highly effective at producing personnel casualties and penetrating emplacements. The heat from the flames burnt, asphyxiated, and blinded personnel while the thickened fuel rounded corners, burnt combustibles, and forced enemy personnel to close gun apertures. Flamethrower vehicles also had superior range capability, increased armor defense protection, and improved mobility.

The need to develop a flamethrower tank came in 1942. The German success in capturing Fort Eben-Emael, Belgium, with infantry flamethrowers spurred the Chief of Engineers, General Julian Schley, to request the development of flamethrowers for his engineers.[1] Flamethrower tanks had become the standard for flamethrower vehicles; the Germans and Italians used mechanized flamethrowers—Germany in Europe and Italy in Ethiopia—as early as 1938, but U.S. Forces did not use flamethrower tanks in combat until 1943. Germany (using the SdKfz 122) and Italy (using the Carro d'Assalto [light tank]) regarded the flamethrower as a successful weapon.

The development of U.S. flamethrowers started from scratch. The first flamethrower, the M1, was constructed by the Kinkaid Company (a manufacturer of fire extinguishers) and commissioned by the Chemical Warfare Service. The M1 was initially designed for use by infantry and engineer units, with no vehicle platform envisaged. However, the extreme weight of fuel and propulsion systems led to new specifications by the U.S. Department of War. Flamethrowers had to—

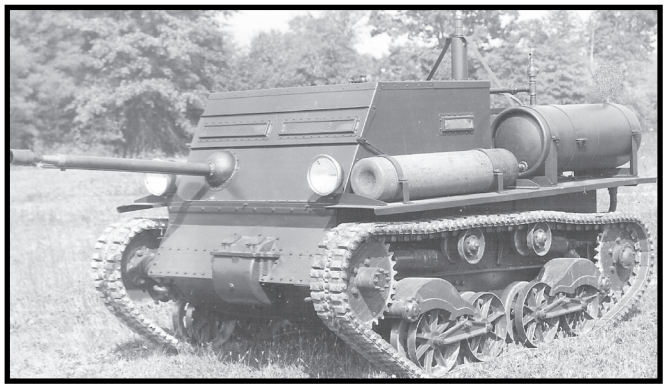
- Have a flame range of 50 yards.
- Be small enough to mount in a tank or combat car.[2]
- Use a slow-burning, hard-to-extinguish fuel that could be carried inside a vehicle or on a trailer armored to resist .30-caliber bullets.

The first mechanically transported flamethrower, the E1, was developed by the Munitions Development Division at Edgewood Arsenal, Maryland. The E1 consisted of—

- A flame gun.
- A fuel tank.
- A pressure tank.
- A regulation valve.
- An ignition device.
- An ignition fuel system (hot-wired to ignite pressurized propane that was projected by nitrogen pressure).

With a 1/2-inch nozzle and a fuel mixture (with equal parts of Number 6 fuel oil, kerosene, and gasoline), the E1 could project a 165-foot flame for 35 seconds.

Because the original flamethrowers did not have fuel tanks, the weapons were designed for transport on mortar carriers. In 1940, the E1 was paired with the Cunningham mortar carrier during testing at Edgewood Arsenal. But the carrier had no secondary armament and required an infantry escort. In June 1941, a prototype flamethrower

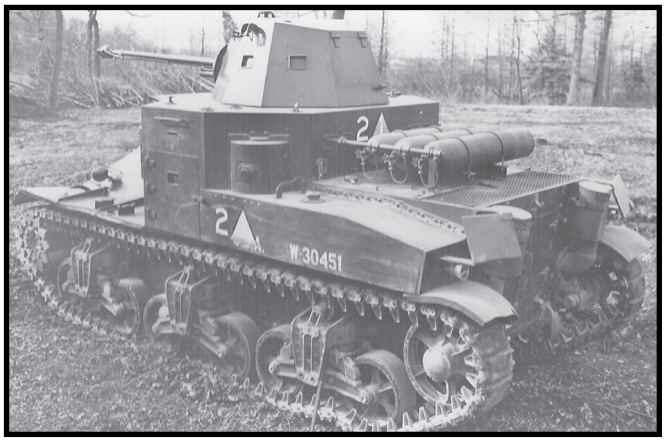


The E1 mounted on a Cunningham mortar carrier

was tested, but the results were less than impressive and the transport shortcomings were immediately obvious.[3] Apart from the dismal test performance, the lack of armored protection for the fuel and pressure tanks and the possibility of a catastrophic explosion remained serious concerns. While the initial pairing of the E1 and the Cunningham mortar carrier was not further developed, the knowledge gained was valuable as a starting point for U.S. flamethrower efforts.

In March 1941, development began on a flamethrower that could be mounted in an armored vehicle. The light tank, M2 was the first tank chassis chosen for modification. In place of a 37-millimeter gun in the turret, an E2 mechanical flamethrower was installed. The new design changes in the E2 flamethrower included—

- A nitrogen pressure cylinder.
- A pressure regulation valve.
- An electrical ignition system.

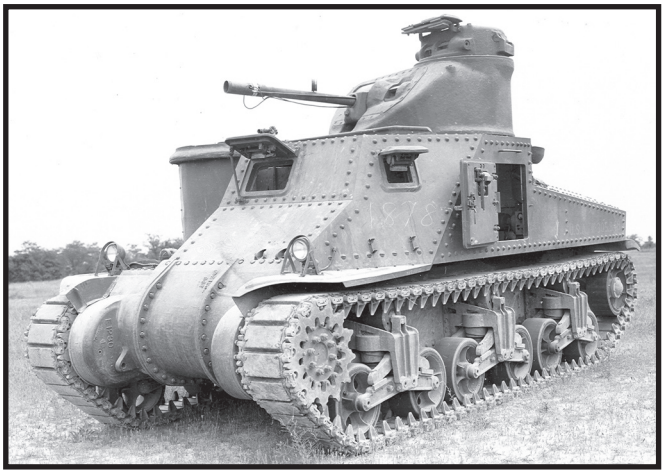


The E2 mounted on an M2

Nozzles of different sizes determined the pressure and range of the E2. With a 1/2-inch nozzle, the E2 projected a 150- to 165-foot flame for 65 seconds; with a 5/8-inch nozzle, the flamethrower projected a 186- to 210-foot flame for 42 seconds. Similar to the E1 flamethrower, the fuel and ignition system on the E2 was external and vulnerable to enemy fire. But despite system shortcomings, the E2 was influential to flamethrower development because it used an electrical ignition system and directed the flame from a turret that could be maneuvered to engage targets. However, in September 1941, field testing of the E2 revealed that seals and fuel lines were highly prone to breakdown and, as a result, the Armored Force Test Board recommended that the weapon be rejected and the expenditure of man-hours and funds be discontinued. This recommendation ended further research into flamethrower tanks until combat and demands from the field provided a new urgency for flamethrower development.

In January 1942, the Munitions Development Division began work on a main armament flamethrower vehicle. While interest in flame weapons was minor at this stage of the war, the medium tank, M3 was selected as the platform for the E3 mechanized flamethrower. The guns were removed from the tank, and the 37-millimeter gun in the turret was replaced with an E3. The 75-millimeter gun mounted on the right sponson was removed, the hole was sealed, and the space was allotted for internal storage of the 425 gallons of fuel required to operate the flamethrower. Unthickened fuels used with the E3 yielded a satisfactory 135-foot range (with a mixture of 50 percent Number 6 fuel oil, 25 percent kerosene, and 25 percent gasoline). Thickened fuels such as napalm yielded less promising results with the E3 and, as a result, the use of the mechanized flamethrower was discontinued.

Although armored flamethrower development continued at a reduced pace through World War II, combat against Japanese emplacements and fortifications in the Pacific moved the program to the forefront again. Several flamethrower designs were developed to increase fuel capacity and improve flame tank performance, leading to some unusual pairings with light tanks. The light tank, M5 was developed in conjunction with an armored trailer for use as a transport system for the E9-9 flamethrower. The trailer could transport 1,200 gallons of fuel and used a flexible connection to provide fuel for the flame gun. However, the development of this system was terminated when an explosion during testing destroyed the prototype. As a result, U.S. tanks, unlike their British Crocodile counterparts, did not use a trailer fuel system, but rather carried their fuel internally. In retrospect, the combination of the light tank, flamethrower gun, and 1,200 gallon



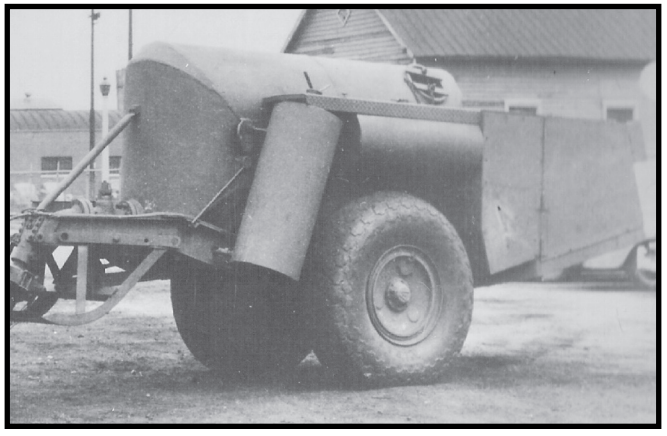
The medium tank, M3

trailer would have been unsuitable for use in the Pacific. During battles on Iwo Jima and Okinawa, Japanese attacks against the heavier armor of the medium tank, M4 were continuous. It is easy to imagine that if an E9-9 flamethrower system had been fielded, infantry personnel escorting the vehicle would have chosen to remain at a distance after witnessing its powerful explosion probability, especially against magnetic mines, satchel charges, and artillery fire.

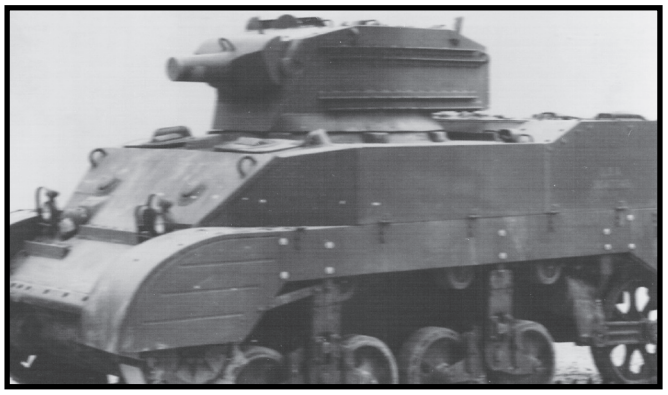
Another design that showed promise was the Q model E7-7 flamethrower (developed by Standard Oil Company in 1943). This model was designed to operate as a special-purpose main armament weapon (replacing the 37-millimeter gun) on the M5. Initial performance was promising at ranges of 120 yards (using a 1/2-inch nozzle and 7 percent napalm fuel); however, major concerns were raised about the armor shortfalls of the tank.[4] The M5 was approved for combat testing but, due to its thin armor protection, faced delays in fielding. The tank (with the E7-7 flamethrower) did not see combat until January 1945, where it was successfully employed on Luzon Island by the 6th Army.

The armored flamethrower was used heavily in the latter stages of the war in the Pacific where combat conditions were very different from those in Europe. Flamethrower tanks considered obsolete in the European theater of operations due to thin armor or small guns were employed in the Pacific.[5] In Europe, German tanks and guns destroyed Allied armored vehicles in large numbers, but the Japanese lacked offensive vehicles and weapons of the same magnitude. In the Pacific, flamethrower weapons were adapted by U.S. Forces, modified time and again, and used to destroy Japanese fortifications. U.S. armored flamethrower vehicles became the dominant flamethrower weapons in the Pacific. In contrast, Japanese efforts were few.

In 1945, Japanese flame tanks were found on Luzon. These tanks were equipped with three flamethrowers



The E9-9 armored trailer



The M5 with the Q model E7-7 flamethrower

(with the ability to project a flame 100–150 feet) and a 133-gallon fuel capacity. The Japanese used flamethrowers against U.S. Forces in 1942, but there is no evidence that these more advanced flame tanks were used in the fall of Corregidor Island in Manila Bay in 1942. U.S. Forces, lacking antiarmor weapons, would have faced a formidable threat had this tank been used against their defenses.[6, 7] However, by 1945, the armor and armament on the Japanese flame tanks were obsolete.

The flamethrower was an outstanding weapon! Few other weapons in the Pacific theater of operations were credited with saving American lives. The development of flamethrower tanks continued into 1943 and 1944, with the M4 becoming the platform of choice in the European and Pacific theaters of operation. The next development was a test in battle of a most unlikely tank, named *Satan*, on Saipan.

The Satan and the Light Tank, M3

In 1944, the conversion process to create flamethrower tanks was urgently implemented at Schofield Barracks, Hawaii, to install the E3-3 flame gun on the obsolete light tank, M3. Soldiers and Seabees modified the tanks with locally produced fuel tanks capable of holding 170 gallons of unthickened fuel. The flame gun mount on the modified tanks offered a flame projection of 180–240 feet, depending on wind and atmosphere conditions.

Twenty-four of the modified Satans were used on Saipan (assigned to the 2d and 4th Marine Divisions). U.S. Marine Corps personnel were enthusiastic about operating the Satan. In one incidence, 200 Japanese were entrenched in a cave and holding up the Allied advance. A Satan was called up and, in conjunction with machine guns, flushed the Japanese from the cave, killing 150 enemy personnel and capturing 50.

While formal modifications were being pursued in Hawaii by the Chemical Warfare Service and the Navy,

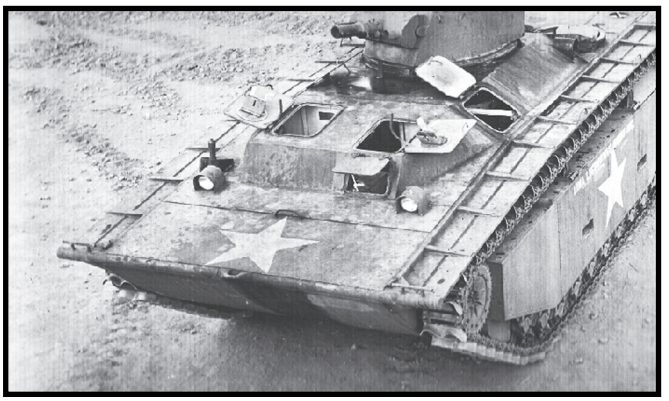
U.S. Forces in the field had a similar improvement idea: replace the .30-caliber machine gun on the bow of the light tank, M3 with an E3-3 flame gun. The Marines had experimented with the Canadian Ronson flamethrower on their amphibious vehicles, so modifying a tank with a flamethrower seemed like a logical next step. The war in the Pacific was marked by innovation, including the contributions made by U.S. Forces in the field. The flamethrower tank was very much a weapon improved by its operators.

The LVT A4 and the E7-7 Flamethrower

The successful demonstrations of the E7-7 flamethrower immediately interested the Navy and Marine Corps, who were looking to arm landing craft with flamethrowers to spray beach defenses and suppress or destroy enemy defenders. The earliest armament in the landing vehicle, tracked (LVT) series was heavy machine guns; the Mark 1 (LVT A1) and Mark 2 (LVT A2) models were equipped with 37-millimeter guns in an M5 tank turret. Some LVTs even had 75-millimeter Howitzer cannons. Flamethrower guns replaced standard guns in LVT, Mark 4 (LVT A4).

The LVT A1 had eight high-pressure gas cylinders to supply fuel to an improved spark plug ignition system. The LVT A4 could carry 220 gallons of fuel internally. When fuel left the fuel tanks (pressurized at 350 pounds per square inch), it was ignited by the spark plugs. The turret (which directed the flame and projected fire a distance of 330 feet) and a small flame gun barrel were improvements

The Satan



The LVT A4 flamethrower vehicle

over previous experimental Army flamethrower models developed in the early 1940s.

The baptism for LVT A4 flamethrower vehicles came shortly after their delivery to the Navy in September 1944, where they were used during fighting on Peleliu in the South Pacific and later at Ngesebus to destroy caves and bunkers (in conjunction with the 75-millimeter armed LVT A4s, tank dozers, and infantry support). In one instance, a Marine battalion was halted by enemy fire from an extremely large blockhouse. After personnel used a tank dozer to fill in an antitank ditch, an LVT A4 flamethrower vehicle closed in to the required range and fired, resulting in 60 enemy casualties. The 75-millimeter Howitzers often did not have enough firepower to completely destroy bunkers, but the flamethrower completed the mission. U.S. Forces later discovered in Peleliu that the Japanese moved their troops around underground to reopen blocked bunkers. The use of flamethrowers disrupted the Japanese tactical strategy.[8]

Endnotes:

[1]The Chemical Warfare Service had no flamethrowers in its inventory.

[2]In 1933, under orders from Army Chief of Staff, General Douglas MacArthur, the U.S. Cavalry began developing armored vehicles. Since the National Defense Act of 1920 directed that only infantry forces could have tanks, the cavalry vehicles were called combat cars, although they looked like tanks. MacArthur required that a tank function in the traditional cavalry role of quickly raiding behind enemy lines and rapidly supporting infantry forces. These missions demanded a light, fast tank, where speed and firepower were more important than armor protection.

[3]A fuel leak ignited a fire inside the turret. The hydrogen propellant leaked fuel, creating a dribble of flaming fuel from the flame gun that set fire to the rubber track treads.

[4]At this point during World War II, the M5 was considered inadequate for close combat operations.

[5]The light tank, M3 and the thin-skinned LVT A4 operated well in the Pacific.

[6]U.S. Forces stationed in the Philippines before the fall of Corregidor Island were not equipped with flamethrowers.

[7]U.S. Forces stationed in the Philippines following the attack on Pearl Harbor were the first forces to experience the effects of Japanese flame tanks.

[8]Six LVT A4 flamethrower vehicles were used on Peleliu. Enemy casualties during the battle totaled more than 300.

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