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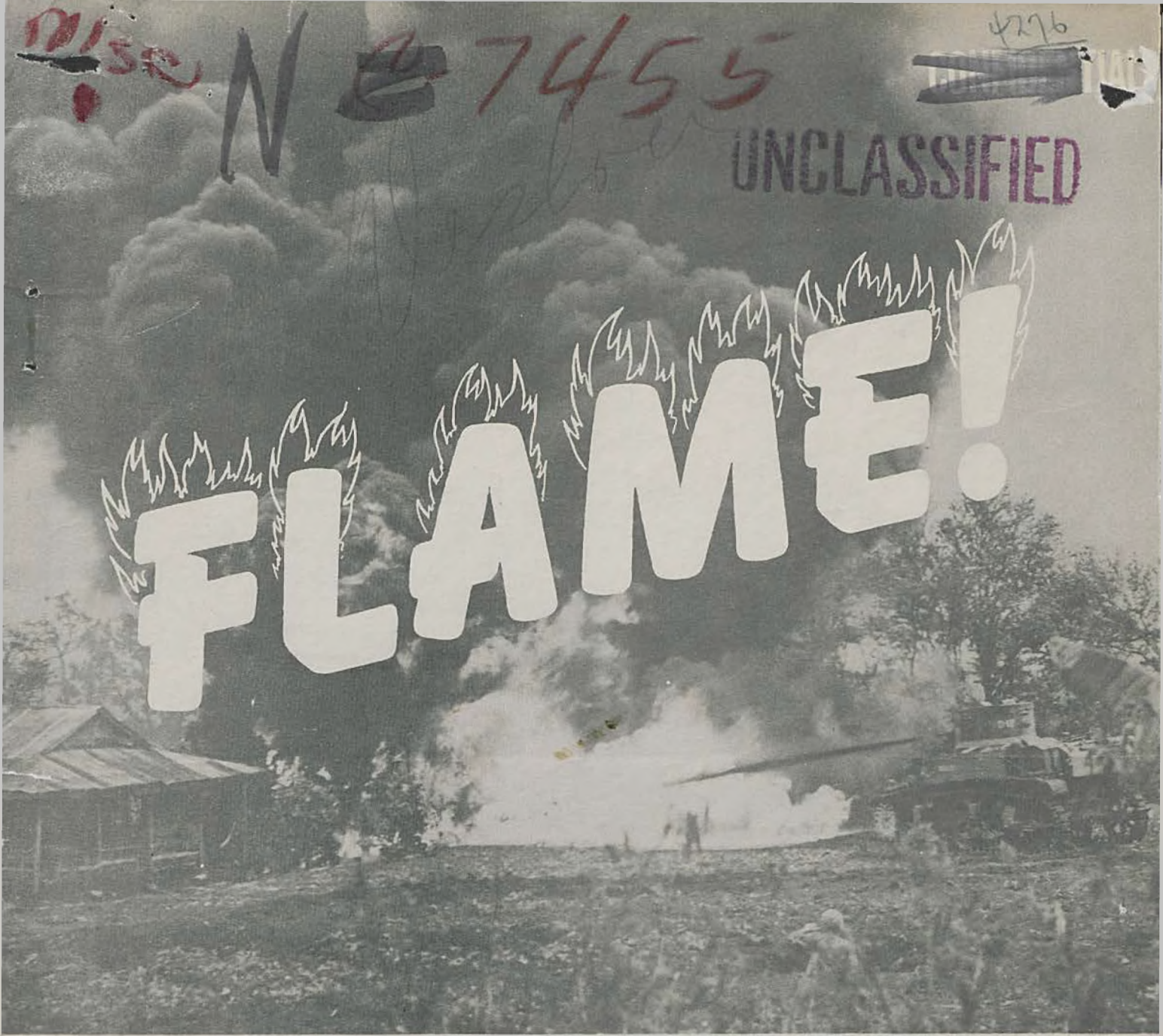


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 2 JUNE 1945



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4 Jun 45

MEMORANDUM FOR COL SCHMAHL:

Subject: ASF Special Technical  
Intelligence Bulletin No 9

I am inclosing herewith two copies of the above-mentioned publication dated 2 Jun 45 which is published by Office, Director of Intelligence, ASF.

W. H. VAN DINE  
Lt Col, QMC  
Dep Exec, C&GSS, Ln

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# FLAME!

IT PAYS DIVIDENDS IN  
DEAD JAPS - LIVE AMERICANS



*M1A1 flamethrower in action on 37th division perimeter on Bougainville. Japs are entrenched behind the log*

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“Flame”, a Marine veteran said after Saipan, “has been the only weapon that has ever made the Japs surrender in groups.”

The importance of flame, propelled from portable or mechanized flamethrowers or dropped from aircraft, cannot be overestimated in Pacific operations. Since it was first used on a large scale in 1943, it has proven one of the most effective of all the weapons marshalled against the Japanese. In New Guinea and New Georgia, New Britain and Bougainville, in the Gilberts, Marshalls, Marianas, Palaus, Philippines, Bonins and Ryukyus, flame has killed Japanese and saved American lives. Its importance is further enhanced as we find increasing numbers of heavily fortified caves and other underground defenses which would defy most other weapons.

In some of the only actions where the Japanese withdrew from prepared positions instead of dying in them, it was flame that made up their minds.

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Pacific - Bound Units  
Need Flame Training

Combat units headed for the Pacific will profit by a thorough investigation of the potentialities and limitations of flame warfare. Battle reports and observers' statements have continually emphasized not only the tactical value of flame weapons, but also the need for training of flame personnel before battle. Untrained flame teams are not only ineffective; they become casualties in short order.

Reports from both ETO and MTO indicate that comparatively few units now in those theaters have had much experience with flame. Some have had unfortunate experiences and as a result, may tend to distrust flame weapons.

In view of the rapidly increasing importance of flame in the Pacific, the following summary of flame developments, trends and tactical employment, assembled with the aid of Chemical Warfare Service and the Army Ground Forces, is presented for the information of appropriate Commanders.

Three Types of Flame Weapons  
Available to Ground Commanders

Ground commanders have three major types of flame weapons available to them -- the portable flamethrower for infantry use, the mechanized flamethrower for armored use, and the gelgas incendiary belly bomb dropped from fighter aircraft against tactical targets.

Each is a highly specialized weapon for use in special situations. Technical developments which are taking place swiftly in each field, are summarized herewith.

PORTABLE FLAMETHROWERS

Flamethrower Effectiveness  
Vastly Increased Since 1941

The effectiveness of the portable flamethrower has been tremendously increased since the United States entered the war. This is reflected by the fact that in early 1942, the infantry division carried only 24 portable flamethrowers in its combat engineer battalion while today the flamethrower is a Class IV item with Army Ground Forces requirements calling for 300 to 400 per division.

M1 Flamethrower  
Was Disliked by Troops

We entered the war with the M1 Portable Flamethrower as our standard flame weapon. It had an effective range of only 10-15 yards; misfires were frequent; maintenance and servicing was difficult. Combat troops disliked and distrusted the weapon, although it was equal or superior to anything used by the enemy.

Research and development brought a gradual increase in range but failed to overcome the one great limiting factor, namely, the burning time of the liquid gasoline used as fuel.

New Fuel First Step  
In Flamethrower Improvement

Liquid gasoline burned so fast that it was entirely consumed only a short distance from the nozzle. Besides, it tended to roll off the target.

Benefitting by experience with incendiary oil bombs, the National Defense Research

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Committee and CWS scientists began work on a slower burning fuel in 1941 and found that gasoline, thickened by adding a metallic soap produced a fuel which almost doubled the maximum range of the standard flamethrower.

#### Thickened Fuels vs. Unthickened Fuels

The thickened fuel is ejected as a rod which clings together and reaches the target relatively unconsumed. Range and operator safety is increased by the rod of flame, and much of the effectiveness of the fuel is retained after it strikes the target. It clings to the walls, embrasures and clothing, burning for several minutes.

Under some conditions, however, liquid fuel is still preferred to thickened fuel, because it provides a more spectacular display of fireworks and thus has more demoralization and shock value. It also provides an excellent smoke screen. Decision as to which fuel to use depends entirely on the situation.

#### Early Thickened Fuels Variable in Operation

The first thickened fuels developed were relatively unsatisfactory. Although increased range was attained, the fuels were inconsistent in performance and difficult to store. Not until the standardization of Napalm, an aluminum soap, was a satisfactory fuel thickener developed. Napalm, mixed with gasoline in proportions varying from three to eight percent represents the greatest single contribution to flamethrower effectiveness.

#### M1A1 Designed to Use Napalm - Thickened Fuel

In 1942 the M1A1, an M1 modified to use thickened fuels, was standardized and issued in quantity. It remains perhaps the most familiar U.S. portable flame weapon, and with it the early flame successes in the Pacific were scored.

Weighing 68 pounds filled, M1A1 consists of a fuel unit, a pressure unit using com-



*The M1A1 portable proved a valuable weapon, though the need for improvements quickly became apparent. It was therefore followed soon after by the M2-2, shown in the accompanying picture in action against the Japanese in SWPA*

pressed air, nitrogen, or inert gas, and a flamegun. The fuel unit holds four gallons, and is capable of firing several bursts with a total burning time of 10 seconds. The fuel is ignited at

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the nozzle by a hydrogen-fed "pilot-light", which ejects hydrogen when the trigger safety key is pressed, and which is ignited simultaneously by an electrical spark. The flaming hydrogen in turn ignites the gasoline as it passes through the nozzle.

M1A1 is a modification of M1, and many of the same problems remained after it was standardized -- difficulty of servicing and maintenance, weight, and tendency of the ignition system to fail under humid jungle conditions.

M2-2 Flamethrower Solved  
Some of Existing Problems

Although M1A1 made history in the Pacific, it was not altogether satisfactory. It was superseded last summer by the standardization of M2-2.

The hydrogen-electrical ignition system of M1 and M1A1 was replaced by a simple, reliable ignition cylinder or cartridge holding five incendiary matches. The cartridge not only proved more reliable under all conditions but eliminated the hydrogen unit on the fuel tank. The maintenance and service problem was greatly reduced through ease in changing pressure tanks and other improvements. Fuel capacity and range remained unchanged -- four gallons capacity and 40 yards effective range.

New Developments Point  
To Specialized Weapons, Light Weight

Because weight and high silhouette limit the use of this flamethrower in many situations, AGF have requested development of a lighter-weight weapon with approximately the same fuel capacity and range as the M2-2.

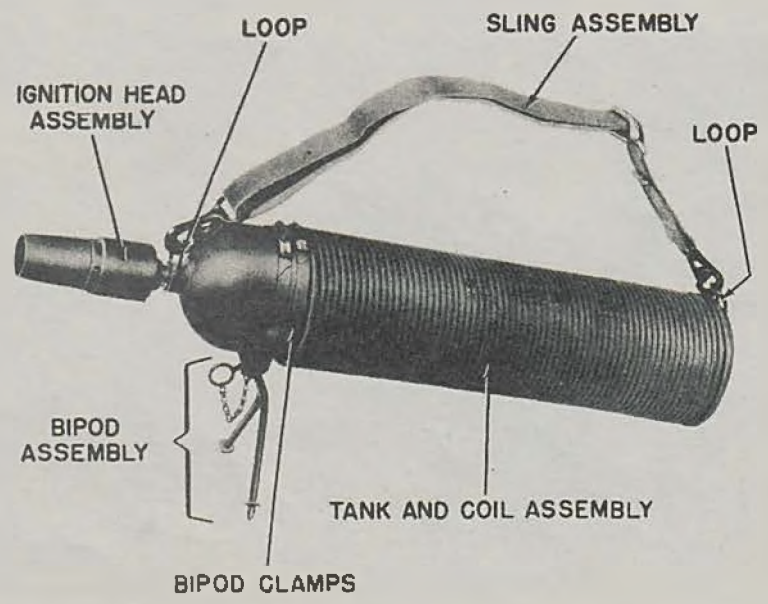
This development is following two principal lines -- the evolution of an expendable single-shot flamethrower and the redesign of the present weapon to reduce its weight.

Two Models of Single-Shot  
Flamethrower Being Tested

The Infantry Board at Fort Benning is now conducting tests on two models of the one-shot portable flamethrower, E15 and E16. E15 propels fuel from its 2-gallon tank by piston action powered by pressurized carbon dioxide. The fuel propellant mechanism of the E16 represents a new line of development--the use of the explosive action of cordite powder. The cordite charge explodes into a small pressure chamber, and the pressure in turn ejects the fuel.

Harnessing Force  
of Cordite

The use of cordite or some other explosive force may represent a big improvement, because it reduces the



Portable Single-shot flamethrower, E15.

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size of the pressure tank and thus cuts weight.

E15 weighs 32 1/2 pounds complete with fuel, and fires a single 3 1/2 second burst to a maximum effective range of 40 yards.

E16 is carried and operated by one man; is also fitted with bipods to give stability and accuracy when such employment is feasible. It can be fired from a crouched or standing position; fire must be adjusted rapidly because only one burst is available.

British Ack-Pack Weapon  
Has Desirable Characteristics

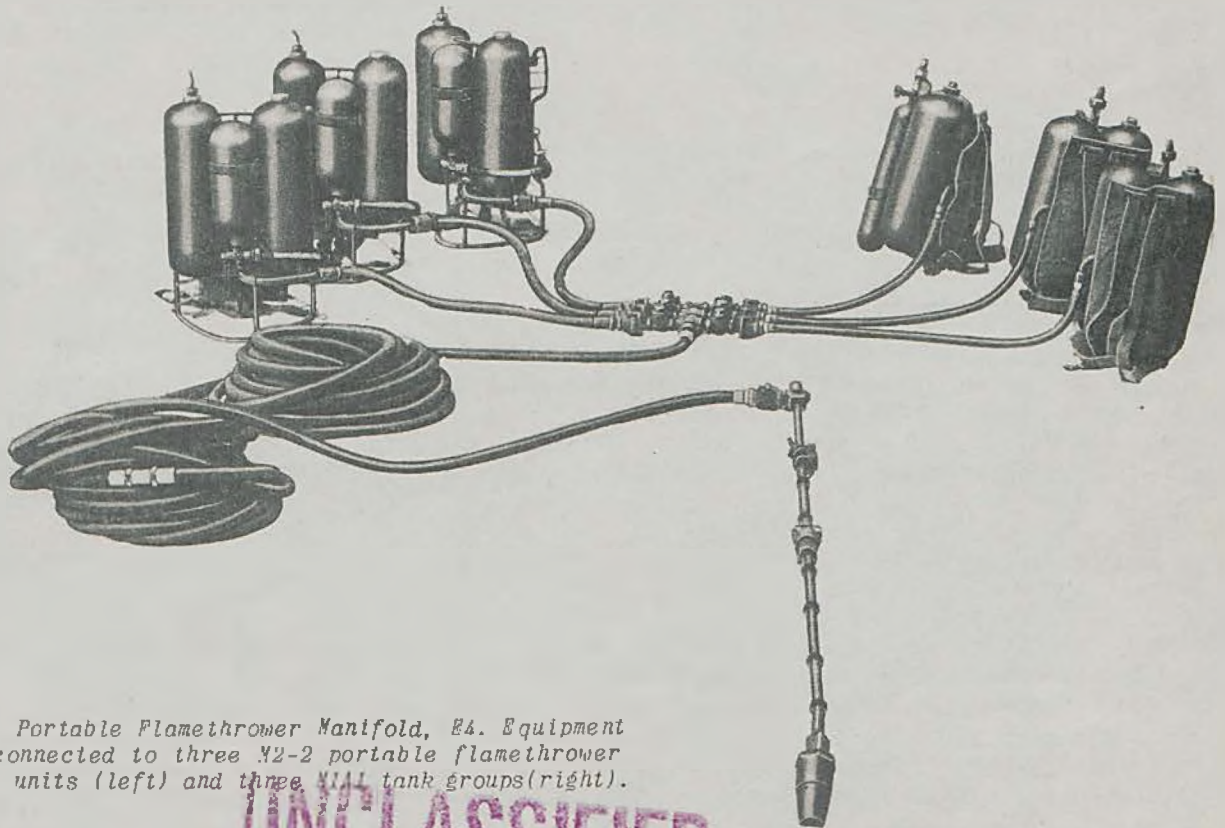
In the search for a lighter-weight standard portable flamethrower, CWS and AGF are now testing the new British Ack-Pack, which combines a range and fuel capacity similar to the M2-2 with a weight reduction of 18 pounds. Ack-Pack utilizes light alloys and sacrifices some safety features to reduce weight.

New Light Weight Flame  
Gun, M1T - E1R1, Developed

A new lightweight gun for use with the M2-2 tanks is also under development. Use of alloys cuts the gun weight to four pounds, half the weight of the standard M2-2 gun. The flame rod is of small diameter and unusually coherent, aiding greatly in penetrating target embrasures. Range is somewhat more than M2-2.

Manifold Flamethrower  
E4 is New Development

In the realm of specialized weapons is the new portable flamethrower manifold E4,



Portable Flamethrower Manifold, E4. Equipment is connected to three M2-2 portable flamethrower fuel units (left) and three M1 tank groups (right).

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which combines up to six standard 4-gallon fuel and pressure assemblies emptying into one flamethrower which can be carried up to 200 feet from the tank units.

Purpose of E4 is to provide a large-capacity, long-duration flamethrower for infantry use in a situation requiring a great volume of flame, and which at the same time does not expose a number of operators to enemy action.

A special portable manifold gun, E10-R1, is issued with the assembly, but either the M2-2 or M1-A1 guns may be used. The special gun is designed with its nozzle at a 30-degree angle, so that it may be fired from a crater or a protected angle.

#### Training is Vital To Flamethrower Success

The flamethrower operator and his assistant must be thoroughly trained in the operation and maintenance of his weapon, and must be fully aware of its capabilities and limitations. Moreover, other members of the unit must also be familiar with flame action, and officers must know in advance where and how to employ it.

Both AGF and CWS consider that comparative failure of flame in ETO and MTO was as much due to lack of training, and lack of understanding of its employment, as to terrain and technical difficulties. Heavy casualties among flamethrower operators in early Pacific operations may be traced directly to these factors.

Complicating flamethrower employment is the primary, natural fear of fire. The soldier instinctively fears the flamethrower; the first object of training must be overcome to his fear and give him and his comrades confidence in the ability of the weapon to destroy the enemy. In later Pacific campaigns, flamethrower operators suffered low casualties in proportion to the damage they caused. Present tactical doctrine calls for several members of each infantry rifle squad to be trained in flamethrower operation, gunnery and first echelon maintenance. The flamethrower is an auxiliary weapon to be used to supplement the basic weapons of the infantry team.

According to AGF's Tentative Redeployment Training Memorandum No. 1, "all infantry company officers in rifle companies, and at least four men per rifle squad, will be proficient in the care, operation and employment of the portable flamethrower, and all other infantry officers will be familiar with it.

#### Thorough Reconnaissance Necessary Before Assault

The flamethrower is limited in its ability to keep a target under fire; once the tank is empty, the operator must retire. Unless he knows the exact position of the target, and the exact location of the portion of the target he is to flame, he will only waste fuel and perhaps his life as well. It is the responsibility of those who have located the target to give full information to the flamethrower team. This is particularly true in the Pacific, where targets may not be seen from a few feet away.

#### Fire Support Is Third Requisite of Success

The third requisite of a successful flamethrower assault is continuous fire support. The defenders must be driven underground; fire may remove obstacles and rip away camouflage rendering the flamethrower's task that much easier. Support may come from the rifle and BAR fire of the assault squad itself; it may be HE and WP fire from infantry or chemical mortars; it may be infantry cannon, tank destroyer or howitzer fire, or it may even be from the air. Whatever its source, it must be maintained until the flamethrower team is in position. Once support

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fire ceases, and before the trigger is pressed, the flameman is a vulnerable and profitable target.

Pacific Incidents  
Describe Flame Warfare

The New Georgia campaign saw the first highly successful use of the portable flame-thrower. There Capt. James T. Olds, Jr., corps chemical officer, organized an impromptu flame-thrower squad of himself and five enlisted men, armed with three M1A1 flamethrowers. After



*Assault squad on Bougainville. Flameman protected by riflemen.*

a too-brief training period, he attacked a three-bunker Japanese position that had held up an entire regiment for almost two weeks. The three bunkers were flamed simultaneously after heavy fire had forced the defenders under cover, and the position was destroyed in a matter of seconds.

Flamethrower Important  
In Biak and Wakde Battles

Used sparingly and not too successfully in Guadalcanal and in early New Guinea operations, the flamethrower proved itself again in the operations in Biak and Wakde Islands.

One Biak pillbox was situated so that the infantry could not reach it with basic weapons. One flameman, covered by BARs, moved through heavy sniper fire to within 20 yards and opened fire. At the first burst, three blazing Japanese dashed from the position and were killed. At the second burst four more ran out, three of them on fire, and were shot down. The third burst slew the remaining defender at his gun.

Six Japs held a 30-foot tunnel-like cave in a coral cliff on Wakde, firing from behind a high stone parapet and could not be silenced. A flameman, covered by rifle fire, moved up and threw one long burst against the tunnel roof, so that the blazing fuel splashed out and down into the emplacement. One man ran screaming from the tunnel and was killed; the rest died in their positions.

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Another flamethrower operator wiped out a three-pillbox position on Wakde that had resisted a large combat patrol and tank fire. The tanks had sprayed the targets with both machine gun and 75mm fire, but withdrew after a sniper killed one of the tank commanders. While the patrol pointed out the camouflaged targets with tracers, the flaman crawled through dense underbrush and sent a two-second burst through a side port. It fell silent. He crawled to the center position and put a four-second burst into the front embrasure; it, too, was silenced. Although he had but a little fuel left, he crawled to within 10 yards of the remaining pillbox and pulled the trigger. His flame sputtered and fell short - but the single Jap machinegunner had not waited; he killed himself.

"No Further Resistance  
Encountered from the Position"

Perhaps the most common phrases anent flamethrower operations in the Pacific is this: "After a couple of bursts from the flamethrower, no further resistance or activity was encountered from that position."

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MECHANIZED FLAMETHROWERS

Development Started  
In Pacific Ocean Area

Although both the Germans and Russians had flame-throwing tanks early in the war, there was no apparent U.S. requirement for such a weapon and the first CWS efforts to develop a successful flamethrowing tank were not encouraged.

But after the Tarawa battle in 1943, it became apparent to Pacific commanders that new weapons and tactics would have to be devised if the losses in taking heavily fortified beach positions were to be cut. The success of the portable flamethrower at Tarawa and elsewhere fathered the idea of a larger flamethrower which protected the operator.

That thought in turn led to the development of an armored, mechanized flamethrower. Pacific research personnel knew only of Russian and German CWS experiments, but no information was available; even the portable flamethrower itself was relatively untried.

Early in 1944 Canadian Army personnel arrived in Hawaii with models of the Canadian Ronson flamethrower, a heavy-duty weapon which the Canadians had mounted on a Bren carrier. Since the Bren is unsuited for either jungle or amphibious warfare, the Ronsons were remounted in unarmored LVTs. Demonstrations proved, however, that while its 150-gallon tank and long range made the LVT-mounted flamethrower a dangerous weapon, it was at the same time highly vulnerable.

Ronsons Mounted  
On Obsolete Light Tanks

Col. George F. Unmacht, POA Chemical Officer, was made responsible for development of the new weapon, and marshalled a force of CWS personnel, Seabees, Marines, the Canadians and civilians. It was desired to mount the Ronson in a medium tank to gain the needed protection, but no mediums were available for the purpose, and finally an old M3 light tank was obtained.

The tank was stripped, the Ronson assembly modified, and on 15 April 1944 the new

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*Satan on Saipan*

weapon, dubbed "Satan", was demonstrated. The next day the V. Amphibious Corps requested 24 Satans for the forthcoming Marianas campaign.

By 17 May the last Satan was complete, test-fired, readjusted, waterproofed and combat-loaded. It carried 170 gallons of fuel with a maximum range with thickened fuel of 60-80 yards.

#### Other Pacific Developments

Shortly after work started on Satan, the Navy produced a very heavy (6400 pounds) flamethrower to be mounted in an LCVP. This Navy Mark I had a capacity of 300 gallons and a maximum effective range of 125 yards.

Six Navy Marks I's were mounted in LVT (4) tractors of the First Amphibian Tractor Battalion and used in the Peleliu operation. However, it was determined that the Mark I could not be mounted in an adequately-protected vehicle, and a short time later it was found that the preparatory fire on beaches is so heavy that there is no requirement for a landing-craft mount. Mark I was declared obsolete.

Theater CWS finally obtained an obsolete M3A5 medium tank and mounted a Mark I in the turret, replacing the 37mm gun. This weapon and Satan were demonstrated in August 1944, and it was then decided to carry out the medium tank development, using a modified Ronson flamethrower.

#### Medium Tank Flamethrower Design In Pacific

The improved Ronson was mounted in an M4 with its flamegun covered by a howitzer-like shroud, but Tenth Army rejected the weapon, requesting one which maintained the standard 75mm gun silhouette. A new flame gun, combining features of the Ronson and another flamethrower developed by the Operational Research Section of CWS, USAFPOA, was designed and produced virtually overnight. It fit into the 75mm gun tube, requiring only slight-modifications which did not alter the silhouette.

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*POA-CWS-H1 Tank firing 3 percent Napalm-thickened fuel from modified Ronson flamethrower in dummy 75mm gun tube.*

This weapon, designated POA-CWS-H1 Flamethrowing Tank, could be mounted in the M4, M4A1 and M4A3 mediums. It had a fuel capacity of 290 gallons located in tanks in the hull beneath the turret basket. Total firing time was 2 1/2 minutes, with an effective range of 60-80 yards with thickened fuel propelled by carbon dioxide. With the flame assembly installed, turret traverse was reduced to 270 degrees, and the total weight of the vehicle increased by 1500 pounds.

By February CWS, POA had turned out eight of the POA flame tanks for the Marines and 54 for the Tenth Army, which took them to Okinawa.

POA Mechanized Flamethrower  
Extension Flushes Out Caves

The POA-CWS-H1 is being put to another use. Frequently, Jap-held caves have been so large that normal flamethrowers have little effect, and it has been necessary to pump in large quantities of fuel and ignite it with incendiary grenades.

POA has developed a more satisfactory method than the field expedient of pumping gasoline from a truck or landing craft, both of which have been used. An M2 flamegun has been connected to the POA-CWS-H1 mechanized flamethrower fuel line, using 50-foot lengths of standard 1 1/2-inch rubber-lined fire hose. With 400 feet of hose leading from the tank up a 45-degree slope, a range of 40 yards was obtained with 4 percent Napalm. Total discharge time was 2 1/2 minutes. POA tests showed that two men were required to keep the gun, operating under 300 pounds per square inch pressure, under control.

Medium Tank Flamethrower  
Development in United States

Intensive development of main-armament flamethrowing tanks did not get under way in the U. S. until several months after a start had been made in the Pacific. In 1941, a pumped-fuel flamethrowing tank was built, but the thickened fuels of the period could not be pumped satisfactorily, so the experiment was dropped. Auxiliary flame mounts were already under way

in 1943, and in the summer of 1944, the bow machinegun flame mount was being produced in quantity. But not until August, 1944, were great strides made in development of main-armament flamethrowers.

CWS collaborated with NDRC to produce what is now considered the most effective tank-mounted main-armament flamethrower to date, 300-gallon -- capacity E12-7R1. It consists of the E7 R1 flamethrower mounted in a dummy 75mm gun tube, and the E12 pressure vessel system for storing fuel and propellant gas in the hull and turret of the M4A1 medium tank.

The flamethrower is provided with three interchangeable nozzles of 3/8-inch, 1/2-inch and 3/4-inch diameter, for use in different tactical situations, permitting variations in total firing time and effective range from 260 seconds and 95 yards for the smallest nozzle to 65 seconds and 140 yards for the largest.

The ignition system is novel. Atomized air and gasoline is released at the nozzle and ignited by dual spark plugs providing a nonluminous igniter flame. The flamethrower fuel is ejected by compressed air and is ignited as it passes through the ignition flame.

The gun can be traversed 360 degrees and has an elevation of 12 to 25 degrees. A .30 caliber machine gun is mounted coaxially with the flamethrower and can be operated at the same time.



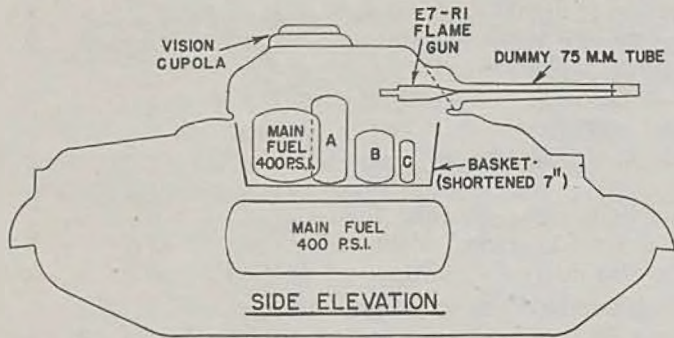
*The E12-7R1 firing 8 percent Napalm-thickened fuel at 65 yards.*

Range Data on Flame  
Tank E 12 - 7R1

Wind Velocity	Nozzle Dia.	Elevation	Range	Elevation	Range
Nil	3/8-in	10 degrees	78 yds.	20 degrees	95 yds.
Nil	1/2-in	10 degrees	95 yds.	20 degrees	105 yds.
Nil	3/4-in	10 degrees	113 yds.	20 degrees	140 yds.
5mph tail	3/8-in	10 degrees	88 yds.	20 degrees	106 yds.
5mph tail	1/2-in	10 degrees	103 yds.	20 degrees	121 yds.
5mph tail	3/4-in	10 degrees	125 yds.	20 degrees	154 yds.

"Sheath" of Flame Increased  
Flamethrower Effectiveness

The secondary fuel at the nozzle of the E7R1 flamethrower produces an interesting and highly effective result. Thickened fuel is normally projected in a rod from the flamethrower, but the addition of secondary fuel provides a "sheath" around the rod of unburned fuel. The sheath lubricates the rod of primary fuel and by rarefying the air through which its bushy flame passes, helps to increase range and assures that the rod is unburned as long as possible.



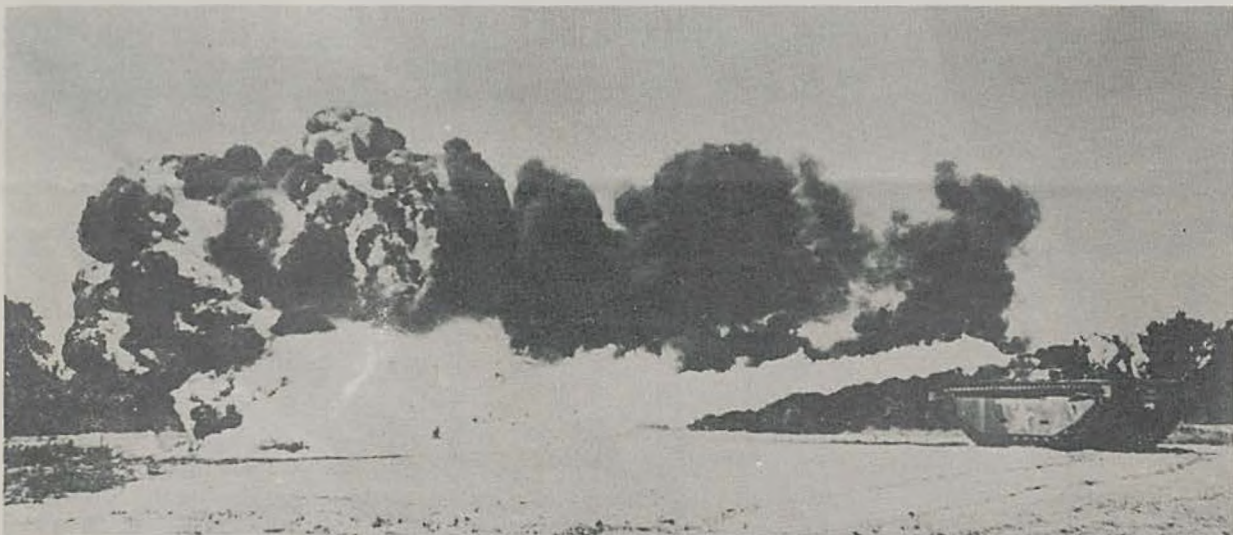
NOTE  
 (A = 2000 P.S.I. AIR FOR FLAME GUN AUXILIARIES IN BASKET  
 (B = SECONDARY FUEL FOR FLAME GUN  
 (C = ATOMIZER GASOLINE FOR IGNITER  
 (D = 2000 P.S.I. AIR CYLINDERS IN HULL OR SPONSONS

The accompanying drawing illustrates the manner in which the E7-R1 Flamethrower is mounted in the M-4 Tank. Note particularly the use of the dummy 75mm gun tube. See page 11 for details of this device

E7 Flamethrower  
In Amphibious Tank LVT-A1

Another main armament flamethrower is that mounted in the armored amphibious tank LVT-A1, replacing the 37mm turret gun. The external silhouette is that of a 75mm howitzer.

Developed last fall and summer, this weapon combined the large fuel capacity of the earlier LVT flame assemblies with the armor protection of the tank. The E7 flamegun has a



LVT (A) (1) firing liquid fuel from E-7 flamethrower. Note 75mm howitzer silhouette

nozzle diameter of 1/2-inch, an elevation of -10 degrees to +30 degrees, and a 240-degree traverse. Typical range data with 7 percent Napalm-thickened gasoline is 105-115 yards effective at 10 degrees elevation and with a 5-10 mph tail wind; 120-130 yards effective at 20 degrees.

The two fuel tanks carry a gross load of 210 gallons, discharging at the rate of 2.4 gallons per second for a total firing time of 80 seconds.

Gross weight of LVT-A1 after installation of the flame assembly, including fuel, crew and stowage, is 37,000 pounds. The crew of the weapon numbers six, including two in the turret.

Auxiliary Flame Weapons  
Mounted in Armored Carriers

So far as quantity is concerned, CWS production emphasis has been placed on auxil-

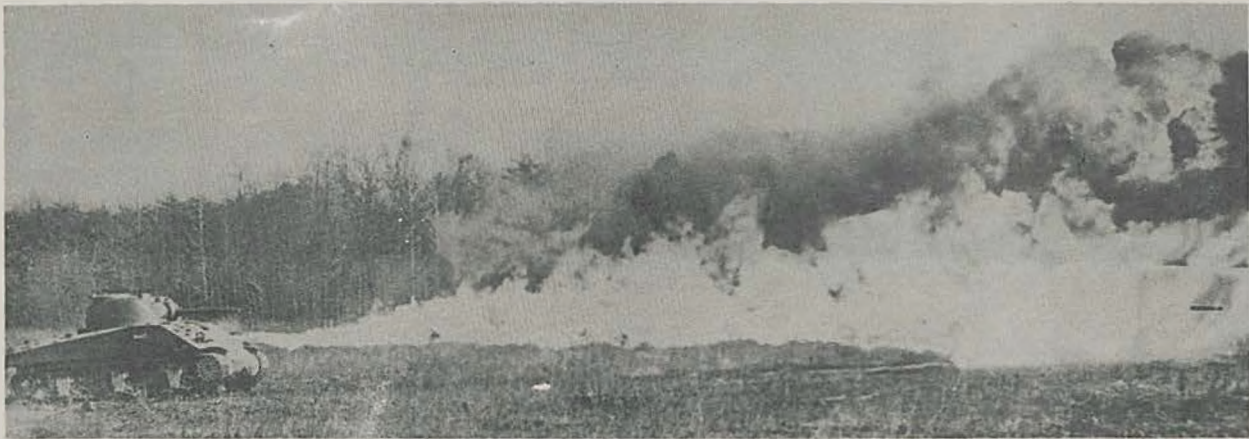
ary flame mounts rather than the main armament types described in the preceding paragraphs.

The possibilities of auxiliary flame weapons mounted in tanks are so great that the opinion of both CWS and AGF is that all tanks will be armed with flamerguns in the predictable future.

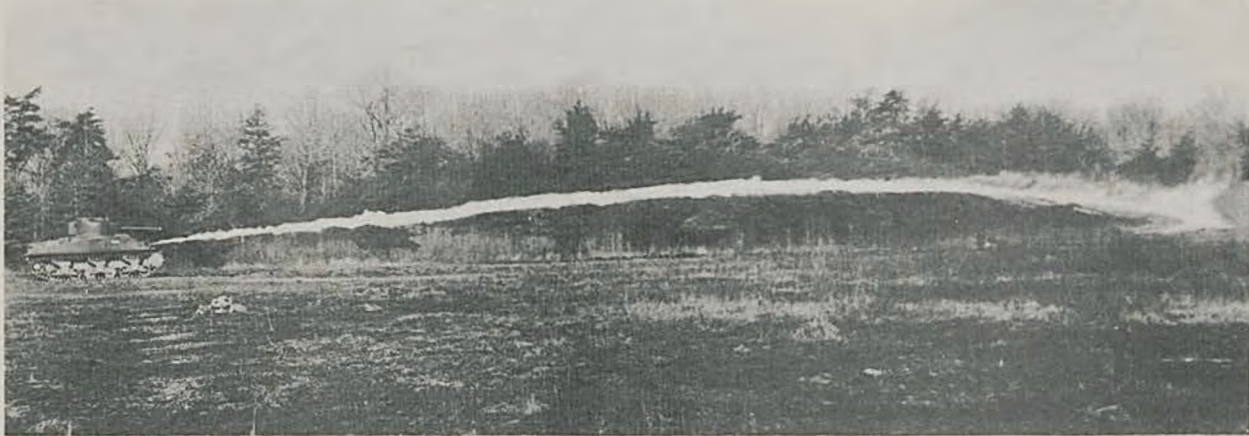
Two main types of auxiliary flamerguns are now in production -- bow-mounted and periscope-mounted. Both are considered a special-duty weapon to be used only when conditions require, supplementary to the main weapons and not affecting normal tactical employment of the vehicle.

Bow-Machinegun  
Mount E4-5

Perhaps the most familiar auxiliary tank-mounted flamethrower is the E4R3-5R1, consisting of a sponson-mounted fuel group, transmission fuel group and a flamergun which fires through the ball mount of the medium tank's bow .30 caliber machinegun. The flamergun and machinegun may be used alternately, but not simultaneously. Whichever gun is not in use is kept in an improvised sling beside the driver.



*M-4 medium tank firing liquid fuel from flamergun mounted in bow machinegun ball mount*



*M-4 tank firing thickened fuel from the same position*

More than 1000 of the E4-5 assemblies were sent to ETO, and many of them got into action.

Fuel capacity of each of the two fuel groups is 25 gallons. One or both of them may

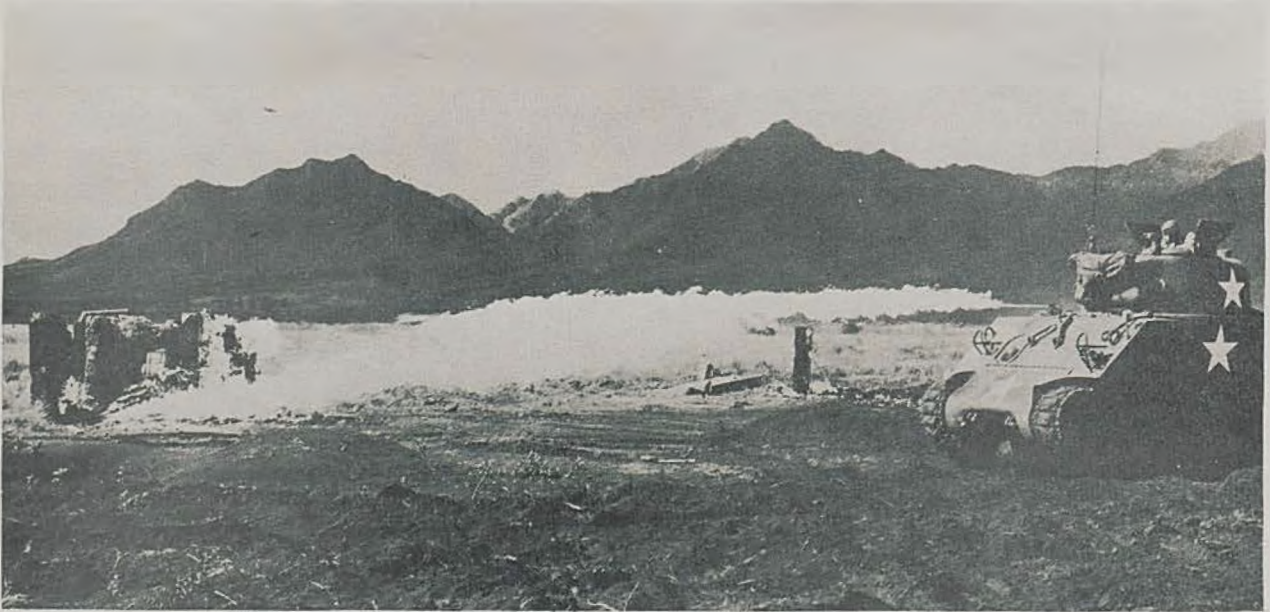
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be mounted in the tank. Rate of fire is one gallon per second, with a total duration of 25 seconds per fuel unit. Although best results are obtained at point blank ranges, the weapon may be used effectively at 50-70 yards with thickened fuel and 25-30 yards with liquid fuel. Range may be cut as much as 50 percent when firing through jungle or thick underbrush.

#### Periscope Mounting In Medium Tanks

The periscope-mounted E6R2 flamewgun has the advantage of retaining the bow machinegun. Attached to the same fuel assembly as the E4-5 weapon, the periscope flamewgun protrudes above the tank hull alongside the assistant driver's periscope, which has been slightly narrowed to accommodate the tube.



*Periscope-mounted auxiliary flamethrower.*

Range and other performance is similar to the bow mount flamewgun, but traverse is considerably wider, and care must be taken to avoid flaming accompanying friendly troops. Authorized production is 500, with the first 25 slated for completion 15 June.

#### Flamethrower Coaxially Mounted With Machinegun

Another attempt to retain all armament despite installation of a flamethrower is the flame gun E17 coaxially mounted with bow machinegun, both weapons protruding through the same ball mount. The E17 is used with the standard E4R2-4R-3 fuel assembly, with performance similar to the periscope and bow-mount weapons. Nine will be available for service tests 15 June, and although no additional procurement is now authorized, the interest of using services indicates further procurement.

#### No Satisfactory Method To Mount in Heavy Tank

Mounting a flamethrower in the T26 and other heavy tank models presents apparently insuperable obstacles, at least at this time. The heavy armor and crowded condition of the fighting compartment apparently bars installation of a flamethrower fuel and compression system large enough to be effective. Research is continuing.

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Pumped - Fuel  
Flamethrower Considered

Standardization of Napalm, which can be pumped successfully, has turned some attention back to the pumped-fuel idea. Use of pumps, rather than pressure vessels, to propel the fuel will mean a saving in space, since the pump can be designed to fit more crowded and irregularly-shaped than spherical pressure vessels. Research is under way on this.

Employment of  
Mechanized Flamethrowers

Principal mission of the mechanized flamethrower is the demoralization and destruction of enemy personnel and positions which cannot be satisfactorily attacked by other tank weapons. The tank flamethrower is primarily an antipersonnel weapon of limited range, particularly adapted to clearing the way for friendly infantry and to mop up in areas where enemy anti-tank weapons have been neutralized or are absent.

Tactical doctrine is prescribed in Training Circular No. 35, dated 8 May 1944. This circular is now being revised and considerably broadened by the Armored Board.

Use of Mechanized Flamethrowers  
in ETO Reduced by Lack of Training

The Mechanized flamethrower was introduced to American troops in ETO on the battlefield. There was virtually no time for crew training, and less for combined tank-infantry



*British Churchill "Crocodile" flamethrowing tank.*

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training. A few crews were able to pull back to learn the essentials of operation, but most of them went directly into action with very little training. Gunnery, which can only be learned by practice, was bad.

Moreover, lack of familiarity with the weapon led to unfounded fears on the part of tank crews, who protested against the inclusion of highly inflammable material within the tank compartment. The fear of flame, always present in a tanker's mind, was encouraged, although there is no definite indication of higher casualties among the flame-equipped tank than among other units. Indeed, several flame tanks took hits on their fuel assemblies without igniting.

Weather conditions, inhibiting the effectiveness of flame, and use of an unsatisfactory British fuel, combined with lack of training to produce a generally negative result in ETO. However, in a few instances, such as the Julich assault, flame played an important part in armored operations.

AGF recommends at least three full days per tank crew on flame-weapon training, with an additional two days' combined training with the infantry who will accompany the tanks, before going into action. The more actual practice under simulated battle conditions, against all types of targets likely to be encountered, the more effective the flame weapons will be.

#### Flame Tanks In the Pacific; Saipan

The field-expedient Satans taken into Saipan by the Marines gave an excellent account of themselves, and were acclaimed by both tankers and infantrymen.

The 2nd and 4th Marine Divisions used 12 Satans each, formed into a company of three platoons each of four Satans and one M5 command tank. The flame tanks remained in the rear and went forward as needed. They were generally assigned at the front on the basis of one platoon to a medium tank company; the reinforced company was attached to a Marine infantry regiment as regimental armored support.

When a Japanese position held up the infantry, and could not be reduced by normal armored fire, it was the practice to hold the position under 75mm and machinegun fire from two medium tanks while one of the M3 flame tanks burned it out. The flame weapons saw their major use in reducing cave positions and the interconnected machinegun-and-sniper positions that infested Saipan canefields. They were also used to burn away camouflage and heavy vegetation to clear fields of fire for other weapons.

One of the few recorded withdrawals of Japanese forces from prepared positions occurred on Saipan, in the face of advancing flame tanks.

#### Flame-Equipped Amphibious Tractors In Action; Peleliu

The LVTs with Navy Mark I's installed, assigned to the First Amphibious Tractor Battalion, were used with varying success on Peleliu in support of Army and Marine infantry.

The six flamethrowers were on the island 61 days -- a total of 366 operational days for the unit. But continual tractor breakdowns, resulting from use in rugged terrain not suited to LVT operation, brought a loss of 113 days spent in tractor repair and maintenance.

The first few days were virtually wasted. The landing forces had not been properly instructed in the use of the flame weapons, and some of the LVTs spent the initial portion of the operation on an AKA. Others landed and waited for orders from the infantry that never came.

But once the LVTs got into action, they proved themselves. They burned Japs from

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caves, pillboxes, from the reverse slopes of ridges, from dugouts -- they burned away cover and sprayed broken ground pitted with foxholes, During the operation the LVTs fired 50 full tank loads of fuel into 100 caves and 25 pillboxes, dugouts and blockhouses.

Okinawa and Iwo Jima  
Reports Not Available

Mechanized flamethrowers, as well as every other type of flame weapon, saw action on Iwo Jima against a deeply-entrenched foe, but final unit reports on that action are not yet available.

A full battalion of 54 of the POA flamethrowing M4s landed on Okinawa early in that operation, but not until the first week in May were they able to get into action. Jap minefields prevented virtually any armored operations until very recently, according to fragmentary reports, but the first use of the POA tanks was said to be successful.

DROPPABLE GASOLINE TANKS

Once an Encumbrance Extra  
Fuel Tanks now a Devastating Weapon

Extra fuel tanks were always an encumbrance, and when no longer needed were dropped with what fuel remained. Occasionally pilots dropped their tanks in the half-hearted hope of hitting something. Somewhat unexpected success -- one pilot hit an Italian warship -- led to full-fledged tests, in which it was learned that if the regular gasoline is mixed with thickener, the flame blast and the target is not expended in flash, but instead covers the area with blazing fuel. Pilots in all theaters began carrying extra tanks, not for fuel, but to drop on tactical targets.

They mixed the aviation gasoline not only with Napalm when available, but with cotton waste, crepe-rubber and smoked rubber strips. Sometimes crude oil with paraffin-asphalt-gasoline mixture was carried, sometimes motor transport fuel, sometimes white phosphorus.

P40s, P38s, P47s  
and Navy Planes Used

Dropable gasoline tanks have been used successfully against tactical targets in POA, ETO, MTO, and CBI. The P38s, P40s and P47s which have carried the belly-bomb have mounted one 165-gallon tank under the belly or one under each wing. The tank weighs about 1350 pounds filled.

Pilots prefer the 165-gallon tank to other tanks. It is sometimes given better ballistic qualities by attaching improvised fins. Either field expedient igniters or such as a WP Grenade igniter or standard belly tank igniters may be used.

P47s and P38s Attack  
Tactical Targets in ETO

Both P-47s and P-38s were used in ETO to drop Napalm-filled belly tanks against tactical targets. It was found that if the tank failed to explode, a strafing run usually served to set the gasoline-drenched area on fire.

Twenty-four P-38s dropped 24 belly tanks on a German supply concentration near Savigny which had been spotted by reconnaissance planes. Eighteen of the tanks struck the target area and exploded, destroying supplies and supply buildings in a great fire that covered virtually the entire area.

In another attack by 13 Lightnings, German motor positions were flamed with 26 gel-

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gas bombs. Sixteen hits were made in the area, leaving trucks and a large wooded area ablaze. A 9th Division surgeon who saw the site later said it was covered with wrecked vehicles and numerous enemy bodies virtually disintegrated by heat and flame. At Gisors, 12 P-38s attacked a concentration of 250 freight cars with 24 bombs, and left an estimated 150 cars on fire.

Gironde Estuary Sprayed  
With Napalm By Air Force

The recent ousting of the Nazi holdout forces from their positions along the Gironde Estuary near Bordeaux was the greatest display of droppable gasoline-tank bombing. An estimated 460,000 gallons of thickened gasoline, plus some 6000 other incendiary and 1000 explosive bombs, were dropped on German-held areas. The "area was one blazing inferno", pilots reported, and prisoners testified to the terrifying effect of the rain of flame, which penetrated trenches and foxholes.

Gelgas Bombs Proved  
Successful on Tinian

P-47s from Saipan flamed Tinian on many missions. The attacks were generally successful, although a lack of Napalm resulted in the use of a high proportion of liquid gasoline.

Thirty bombs were dropped in areas adjacent to the landing beaches before JIG-Day. It was hoped to burn off cover and flush the Japs from open trenches and dugouts known to be in the area. Well-placed hits burned off much of the underbrush, and the landing parties found charred Jap bodies in some of the trenches.

The P-47s dropped 120 bombs against Tinian, 25 of them Napalm-thickened. There were 14 duds, of which eight were set afire by subsequent strafing. The pilots strafed the area first, then dropped their tanks, then strafed again. The bombs proved highly effective against personnel in open foxholes and trenches, but the unthickened gasoline proved too volatile to seriously affect troops in covered positions.

Against canefields and wooded areas, the gelgas bombs were more effective than either the white phosphorus or thermite used heretofore, although an attempt to burn off a heavily-wooded cliff failed. It was found that the woods were largely of ironwood.

The tanks were dropped well in front of the targets, bursting open and spreading flaming fuel over an area 200-300 feet in length and 50-75 feet in width. Canefields were burnt in patches 250-300 feet long and 75 feet wide, but adjacent stands of cane were not seriously affected and were still able to provide good cover.

One bomb dropped on a village, whose houses were built on concrete foundations with adobe or corrugated iron walls, corrugated iron roofs, and wood floors and vertical members, burned out two great areas 150-200 feet in length.

Prisoners reported that the belly-bomb attacks were demoralizing when it was found that neither foxholes nor open trenches gave protection.

FLAMETHROWER SERVICING EQUIPMENT

Flexibility of Flame Weapons  
Depends on Servicing Units

The flexibility of flame weapons, whether portable or mechanized, is largely dependent upon the flexibility of the equipment designed to service them.

Heavy, over-complex servicing units result in fewer fuel-tank and pressure-tank refills and recharges; and thus in less use of the weapon. CWS has kept flame service equip-

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ment under constant research and development in an effort to produce the most flexible possible units.

7CFM M1 Air Compressor  
Most Familiar to Troops

The gasoline engine-driven air compressor 7CFM M1 is perhaps the most familiar to using troops. It consists of a compressor and engine mounted on the same frame, 33 inches high, 66 inches long, and weighing 820 pounds.

1000 New Portable Pressurizers  
Available about 1 July

A newly-developed portable hydrogen generator, the E5, is now in limited procurement and will be available starting 1 July.

Ninety-pound Portable  
Under Development

Development is under way on a light, man-carried portable compressor which will be able to fill three tanks in less than 10 minutes. Present weight of this unit is 90 pounds, but a weight reduction is expected.

Flamethrower fuel-filling kit E6, a 55-pound kit containing equipment for filling fuel tanks of either portable or mechanized weapons, is available.

Mechanized Service  
Equipment Developments

Filling of the large-capacity fuel and pressure tanks of mechanized flamethrowers, now a tedious process, will be speeded by the new E8 Mechanized Flamethrower Service Unit. Designed to provide compressed air at pressures up to 2250 pounds per square inch, and to manufacture and deliver thickened fuel, it is mounted on a 2 1/2-ton 6 x 6 LWB truck. E8 is used behind the lines where mobile flamethrowers are rendezvoused for servicing.

E8 can change the pressure tanks of the E12 300-gallon assembly in 23 minutes, and the fuel tanks in 25, allowing for all operations etc., one E12-7R1 flamethrowing-tank can be completely serviced in 30 minutes. Two men operate E8, and three handle gasoline, thickener and make connections.

Skid Mounted Service  
Unit to be Transported by LVT

A mobile servicing equipment, consisting of an air compressor and a mixer mounted separately on skids which can be transported by LVT-4s, has been designed to refill and recharge the flame assemblies mounted in the LVT (A) 1. Designated E14-7R2, 13 have been authorized for procurement. Production was slated to start in mid-May; they will be available 1 August.

Field Mixing  
of Thickened Fuels

One of the major obstacles in effective use of flame weapons has been the practical difficulty of mixing thickened fuels of uniform consistency and performance.

Under plant or laboratory conditions, uniform fuels may be continually prepared, but under field conditions it has been found that more than 30 per cent of a six per cent fuel had an

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effective consistency less than that of a properly-prepared three per cent fuel. Poor fuels, it was found, resulted almost entirely from contamination of either the fuel or the Napalm by water, and because of inadequate understanding and supervision by the personnel involved.

Objective of uniform fuels is operating efficiency; the operator must know, before firing an initial burst, what his fuel is going to do.

#### Tested Field Operating Procedures for Mixing Fuel

A comprehensive study of field operating procedures for mixing consistently uniform thickened fuels has been prepared by the 43rd Chemical Laboratory Company, and is distributed by Information Division, CWS Technical Command, Edgewood Arsenal, under the title of "Field Mixing of Uniform Napalm-Thickened Fuels."

Some of the recommendations made are:

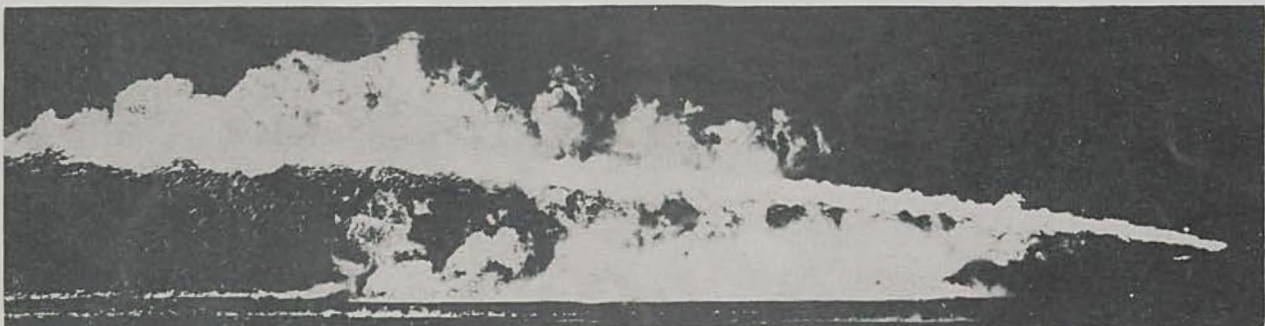
1. That Napalm containers not be opened until ready for use; unused contents should be discarded.
2. Every drum of gasoline should be inspected before use. Two or three ounces of water in a 50-gallon drum reduces the characteristics of a six per cent fuel to those of a four per cent fuel.
3. Water may be removed from the gasoline by use a modified aspirator, or by continuous filtration by a water segregation unit, standard equipment on the Type F-1A-Semi-trailer-Fuel Servicing Truck. Small batches of gasoline (55 gallon drums) may be filtered by use of a shelter half.

#### Fuel Mixing and Transfer Kit for Droppable Fuel Tanks

Newly developed is Kit E1R1 for mixing and transferring thickened fuel for jettisonable aircraft gasoline tanks. An air compressor is required for operation of the kit.

#### CWS Wants Data From Theaters

CWS feels that it can design and produce virtually any service unit desired in the field, and has requested units in the theaters to make their requirements known.



POA CWS-H1 firing thickened fuel at night, (See page 10).

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