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TECHNICAL INFORMATION REPORT 3-1-2H4

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DEVELOPMENT OF 90-MM GUN TANK, T69 (U)

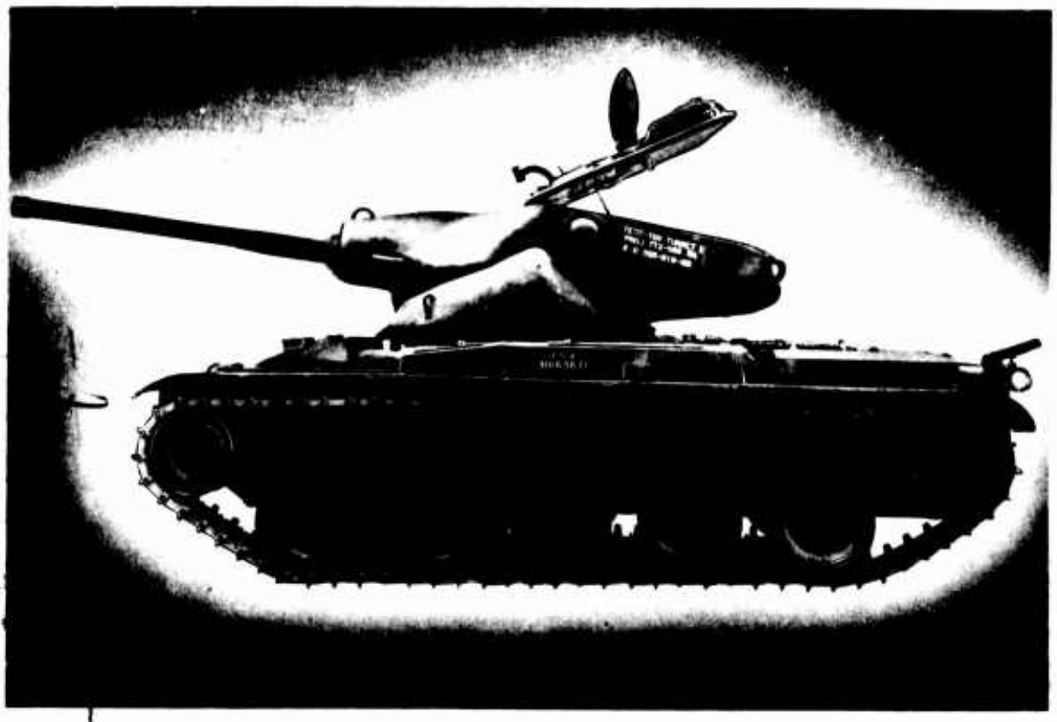
In the restricted space of a tank turret the manual loading of heavy rounds of ammunition becomes so difficult as to nullify the advantages of the employment of a rapid-fire high-velocity gun. One of the major problems of tank design, therefore, is the provision of an automatic loading mechanism for the tank gun. The need for this was recognized as early as May 1946, when a general development project for this type of equipment was initiated. When the development of the T42 90-mm gun tank, the first really new postwar medium gun tank, was approved in May 1949, automatic loading was included as a requirement to be met if possible.

Unfortunately, the design of an automatic loading mechanism suitable for installation in a conventional tank turret could not be carried out successfully. In part, this is because of the very circumstance that makes such a mechanism most desirable, namely, the limited space available in a tank turret, but it is also because in a conventional turret the position of the gun relative to the turret is constantly changing. In any event, the T42 tank was developed without the automatic loading feature. User-tested in 1952, it was considered by AFF to have several basic deficiencies, correction of which would have necessitated a fairly complete redesign. Partly for this reason and partly because the T48 (now the M48) 90-mm gun tank had meanwhile been developed and put into production, in October 1954 the T42 tank project was terminated.

During one of the discussions of the design of the T42 tank, it had been suggested that the problem of providing automatic loading for tank guns might be solved by development of a trunnion-mounted ball-type turret that could be elevated and depressed as well as traversed. In this type of construction, now generally called an oscillating turret, the gun could be rigidly fixed in position and, because there could be no movement as between the gun and the turret

RELATED TIR'S

5-54	TIR 3-1-2	Development of Medium Gun Tanks
4-54	TIR 3-1-2H1	90-mm Gun Tank, T49
____	TIR 3-1-2H3	90-mm Gun Tank, M48A2 (T48E2)
____	TIR 3-1-2H5	90-mm Gun Tank, T95
4-54	TIR 3-1-2J1	105-mm Gun Tanks of the T54 Series
____	TIR 3-1-2J2	105-mm Gun Tank, T96



90-MM GUN TANK, T69

(other than that of recoil and counterrecoil), the installation of an automatic loading device is greatly simplified.

In March 1951, accordingly, Ordnance initiated a project for the development of a trunnion-mounted turret with a 90-mm gun of the T139 (now the M41) type, automatic loading equipment, and simplified fire control, the entire assembly to be suitable for mounting on the hull of a T42 tank. The new turret was to be operable both by power and manually in such a way as to give the gun unlimited traverse and any elevation between 20° and -10°. In addition to the main armament, there was to be a coaxial machine gun and another machine gun on the turret roof. In October 1952 the vehicle to be developed was designated the T69 90-mm gun tank.

Concentrated work on the T69 tank was begun in May 1951, but, partly because of delays in furnishing the contractor with equipment to be provided by the Government, it proceeded slowly. Six different turret designs were evaluated by APG and AFF before one was selected for development. Even then it was necessary to study in detail the ballistic protection afforded by this design; this was done by actually casting several ballistic turrets and shipping them to APG for tests. Only after these matters had been settled was the final assembly of a pilot model begun. This model, utilizing the hull of one of the six T42 tank pilot models, was completed at the beginning of 1955.

and shipped to APG for engineering tests, which began in May and are continuing.

The T69 90-mm gun tank, though mounting virtually the same armament as the recently-adopted M48A2, weighs only 76,000 pounds when combat loaded, which is 27% less than the weight of the M48A2. It is also somewhat smaller than the latter. The performance characteristics of the T69 tank have yet to be established, but it is driven by the same engine and transmission as the almost equally-heavy T42, which has approximately the same maximum speed and grade climbing ability as the standard 90-mm gun tank. Because of its smaller fuel tanks, however, the cruising range of the T42 is considerably less than that of the M48A2. One obvious disadvantage of the T69 is that it can stow only 38 rounds of 90-mm ammunition, as compared with the 64 that can be carried in the M48A2.

The T69 turret is basically a steel casting bearing on a turret ring 73 inches in diameter. The casting presents surfaces of high obliquity in order to deflect missiles and achieve a low silhouette. Mounted on trunnions, the turret is normally actuated by a hydraulically-powered traversing and elevating mechanism, but independent manual operation is available for use if the hydraulic system should fail. The turret is fitted with a platform, suspended from the turret ring, which affords storage space and contains part of the electrical and hydraulic apparatus. The top of the turret is covered by a large hinged access cover equipped with commander's and loader's escape hatches. This cover, which is raised and lowered hydraulically, not only affords quick exit in combat but also facilitates the loading of ammunition and supplies, the making of necessary repairs, and the installation of new parts; it also permits the automatic loading equipment to be installed or removed without disassembly. Seats for the commander, loader, and gunner are secured to the sides of the turret.

A T178 90-mm gun is mounted in the T69 turret in a conventional concentric recoil mechanism. It is a standard M41 tank gun with the breech modified to permit automatic loading. A caliber .30 machine gun is mounted coaxially with the 90-mm gun, and can be fired electrically by the same controls that fire the main armament. A caliber .50 machine gun, for either ground or antiaircraft use, is emplaced in a pintle mount on the access cover; it is controlled and fired manually. Provisions are also made for carrying a submachine gun, a carbine, and a grenade launcher in the tank.

The automatic ammunition-handling equipment is rigidly installed on the longitudinal center line of the turret and consists chiefly of a magazine and a loading mechanism, permanently interlocked. The magazine holds eight rounds of ammunition in a rotating spider and is so designed that the gunner can select any one of three types of round for loading. The loading mechanism, which is hydraulically driven, brings a rammer into position, pushes a round into the gun's chamber, and returns the rammer to the magazine before the latter is permitted to index the next round. An ejection chute is mounted above and in line with the loader, and cases are ejected through a hydraulically-operated door in the rear center of the bustle. The cyclical rate with this automatic loading equipment is 32 rounds a

minute. In an emergency, the loading operations can be performed manually.

The T42 tank hull, on which the T69 oscillating turret is mounted, is constructed in two sections. The forward of these, a homogeneous armor steel casting, houses the fighting and driving compartments, while the rear section, of welded armor plate, houses the engine compartment; the two sections are joined by a vertical weld.

The T69 tank is rear-sprocket driven with ten dual road wheels suspended by individual torsion bars. The T95 tracks with which it is fitted are steel-and-rubber single-pin tracks 24 inches in width, designed to accommodate detachable rubber pads. The vehicle is powered by a 6-cylinder air-cooled gasoline engine directly connected to a cross-drive transmission. The engine, Continental Model AOS-895-3, is supercharged and develops 500 horsepower. The Model CD-500-3 cross-drive transmission is a combined hydraulic torque converter, steering, and braking unit.

The primary fire control system for the T69 tank consists of equipment at two different stations. A T46E2 range finder and a T33 range drive are located at the commander's station, and an M20 (T35) periscope, a T184E3 periscope mount, and a T32 range drive are at the gunner's station. The T46E2 range finder, which is a 10-power binocular instrument employing the stereoscopic ranging principle, is used to determine the range to the target, while the T33 range drive enables the required superelevation to be introduced into the range finder. The T32 range drive, on the other hand, provides a means for introducing superelevation into the M20 periscope, which is used for observation and, in conjunction with the T32 range drive, to lay the gun. This periscope has two built-in optical systems, one 6-power, the other unity-power. The T184E3 periscope mount holds the periscope and the range drive to the turret. Because the fire control equipment, mounted on the turret, moves with the gun tube and the turret, the linkages normally needed to transmit gun elevation to the fire control equipment are unnecessary; the gun elevation is automatically introduced when the gun is layed.

In addition to the M20 periscope, periscopes of three other types are installed in the T69 tank. Six M26 (T25) periscopes are arranged around the commander's hatch to give 360° vision. Five M27 (T36) periscopes are supplied for the driver, and one M13 periscope serves for the loader.

In order that the tank may be used for artillery support, an M13 elevation quadrant and an M31 azimuth indicator are also provided for laying the gun for indirect fire.

The engineering tests of the T69 tank are expected to be completed by April 1956.

TENTATIVE PRINCIPAL CHARACTERISTICS

90-mm Tank Gun, T178

Caliber	90 mm
Length, over-all	193.21 in
Length of bore	50 cal
Travel of projectile in bore	156.4 in
Rifling	
Length	152.77 in
Number of grooves	32
Twist, uniform right-hand, one turn in	25 cal
Weight of tube	1,582 lb
Weight of breech mechanism	679 lb
Weight of complete gun	2,370 lb
Chamber capacity	300 cu in
Density of loading	0.83
Rated maximum chamber pressure	47,000 psi
Breechblock	vertical sliding
Breech mechanism	semiautomatic
Firing mechanism	electric
Ammunition, type	fixed
Performance	
Muzzle velocity (AP)	3,000 fps
Muzzle energy	1,503.6 ft/ton
Muzzle energy/weight ratio	0.637:1
Maximum effective range	2,000 yd
Perforation of homogeneous armor @ 0°	
AP shot @ 1,000 yd	6.2 in
AP shot @ 2,000 yd	5.9 in
HEAT shell	12 in
Spalling of homogeneous armor	
HEP shell	4 in
Rate of fire	30 rd/min

Combination Gun Mount

Weight	no information
Recoil mechanism	concentric hydrospring
Number of recoil cylinders	1
Recoil length	
Normal	no information
Maximum	no information
Equilibrator	no information
Elevating mechanism	hydraulic and manual
Maximum elevation	15°
Maximum depression	-9°
Traversing mechanism	hydraulic and manual
Maximum traverse, right or left	360°

Fire Control Equipment

Range finder	T46E2
Range drive	T33
Periscope	M20 (T35)
Periscope mount	T184E3
Range drive	T32
Elevation quadrant	M13
Azimuth indicator	M31

Periscope	M13
Periscopes (5)	M27 (T36)
Periscopes (6)	M26 (T25)

Ammunition Stowage

90-mm rounds	38

90-mm Gun Tank, T69

Length	
w/gun forward	323.75 in
w/gun to rear	280.375 in
Width	140.812 in
Height	112.875 in
Weight, over-all	76,000 lb (approx)
Ground clearance	17.125 in
Tread, from center to center of tracks	111 in
Length of ground contact	130 in (approx)
Ground pressure	12.2 psi
Turret	oscillating
Diameter of ring	73 in
Suspension	torsion bar
Wheels	26 in
Tires	26x6
Tracks	steel and rubber, T95
Width	24 in
Pitch	6
Number of shoes (both tracks)	152
Armor	
Hull	cast homogeneous
Front	
Upper	4 in @ 60°
Lower	4 to 2.5 in @ 54°
Side	
Upper	3 to 2.5 in @ 0°
Lower	1.5 in @ 0°
Rear	1 in @ 60° and 50°
Top	2 in
Floor	1 to 1.5 in
Turret	cast homogeneous
Front	4 in @ 60°
Side	no information
Rear	equivalent to 5.75 in @ 40°
Roof	no information
Gun shield	no information
Armament	
Main	90-mm gun, T178
Secondary	
Cal .30 MG, coaxial	M1919A4E1
Cal .50 MG, on turret roof	M2 HB
Cal .45 SMG	M3A1
Cal .30 carbine	M2

Grenade launcher	M8
Communications	
Radios	to be determined
Interphones (4)	AN/UIC-1
Engine	air-cooled gasoline
Make and model	Continental AOS-895-3
Cylinders	
Number	6
Bore	5.75 in
Piston stroke	5.75 in
Piston displacement	895 cu in
Arrangement	horizontal-opposed
Compression ratio	5.5:1
Horsepower	
Gross	500 @ 2,800 rpm
Net	370 @ 2,800 rpm
Horsepower/weight ratio	13.2:1
Torque	
Gross	985 lb-ft @ 2,400 rpm
Net	820 lb-ft @ 2,400 rpm
Oil capacity	52 qt
Electrical system	24-volt
Number of batteries	4
Transmission	cross-drive, CD-500-3
Drive ranges	low, high, and reverse
Range selector control box	mechanical
Linkage to transmission	mechanical
Torque converter	single-stage polyphase
Gearshift and steering mechanism	
Internal	hydraulic
External	mechanical
Fuel capacity	145 gal
Brakes	
Service	wet, multiple disk
Parking	lock on service brake
Crew	4
Air transportability	--
Performance	
Maximum speed on level	to be determined
Maximum grade climbing ability	to be determined
Maximum trench crossing ability	72 in
Height of obstacles that can be crossed	36 in
Fording depth	48 in
Turning radius	pivot
Cruising range	to be determined