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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...
(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 $20^\circ$ and $-10^\circ$. 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
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

- 4 -
90-MM GUN TANK, T69

Caliber
Length, over-all
Length of bore
Travel of projectile in bore
Rifling
Length
Number of grooves
Twist, uniform right-hand, one turn in
Weight of tube
Weight of breech mechanism
Weight of complete gun
Chamber capacity
Density of loading
Rated maximum chamber pressure
Breechblock
Breech mechanism
Firing mechanism
Ammunition, type
Performance
Muzzle velocity (AP)
Muzzle energy
Muzzle energy/weight ratio
Maximum effective range
Perforation of homogeneous armor @ 0°
   AP shot @ 1,000 yd
   AP shot @ 2,000 yd
   HEAT shell
Spalling of homogeneous armor
HEP shell
Rate of fire

Weight
Recoil mechanism
Number of recoil cylinders
Recoil length
Normal
Maximum
Equilibrator
Elevating mechanism
Maximum elevation
Maximum depression
Traversing mechanism
Maximum traverse, right or left

Combination Gun Mount

Fire Control Equipment

Range finder
Range drive
Periscope
Periscope mount
Range drive
Elevation quadrant
Azimuth indicator

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### Periscopes
- Periscopes (5)
- Periscopes (6)

### 90-mm Gun Tank, T69

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<th>Ground clearance</th>
<th>Tread, from center to center of tracks</th>
<th>Length of ground contact</th>
<th>Ground pressure</th>
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### Armament

- **Main**
  - 90-mm gun, T178

- **Secondary**
  - Cal .30 MG, coaxial
  - Cal .50 MG, on turret roof
  - Cal .45 SMG
  - Cal .30 carbine

### Armor

- **Hull**
  - 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
    - Front: 4 in @ 60°
    - Side: no information
    - Rear: equivalent to 5.75 in @ 40°
- **Roof**
  - Gun shield: no information
  - Armor: no information

### Ammunition Stowage

- 90-mm rounds: 38
Grenade launcher
Communications
   Radios
   Interphones (4)
Engine
   Make and model
   Cylinders
      Number
      Bore
      Piston stroke
      Piston displacement
      Arrangement
      Compression ratio
   Horsepower
      Gross
      Net
   Horsepower/weight ratio
   Torque
      Gross
      Net
   Oil capacity
Electrical system
   Number of batteries
   Transmission
      Drive ranges
      Range selector control box
      Linkage to transmission
      Torque converter
      Gearshift and steering mechanism
         Internal
         External
   Fuel capacity
   Brakes
      Service
      Parking
   Crew
   Air transportability
   Performance
      Maximum speed on level
      Maximum grade climbing ability
      Maximum trench crossing ability
      Height of obstacles that can be crossed
      Fording depth
      Turning radius
      Cruising range

M8
to be determined
AN/UIC-1
air-cooled gasoline
Continental AOS-895-3
6
5.75 in
5.75 in
895 cu in
horizontal-opposed
5.5:1
500 @ 2,800 rpm
370 @ 2,800 rpm
13.2:1
985 lb-ft @ 2,400 rpm
820 lb-ft @ 2,400 rpm
52 qt
24-volt
4
cross-drive, CD-500-3
low, high, and reverse mechanical
mechanical
single-stage polyphase
hydraulic
mechanical
145 gal
wet, multiple disk
lock on service brake
4
--
to be determined
to be determined
72 in
36 in
48 in
pivot
to be determined