

A T3 CHRISTIE RUNS ON ITS WHEELS AT A DEMONSTRATION AT ABERDEEN PROVING GROUND IN 1932.

U.S. Army Tank Development – 1925-1940

by Konrad F. Schreier, Jr.

Current U.S. Army tanks are magnificent machines, but few realize how much they owe to developments from 1925 to 1940. Before 1925, designers continued to work on World War I developments, but then the entire tank development program was overhauled. Over the next 15 years, the Army developed many of the features that are a part of the tanks of today.

The program began with the T1 Medium, built by Rock Island Arsenal in 1922. This was a 22-ton machine, powered by a 200-horse-

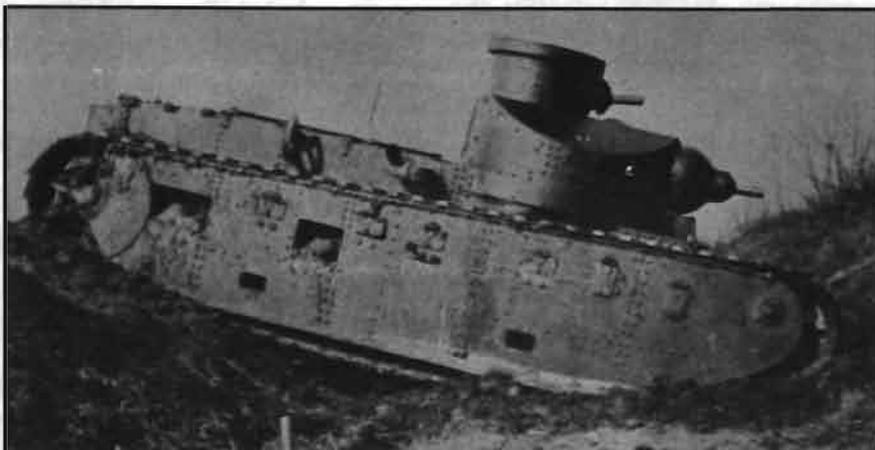
power engine, and it could run 22 miles per hour – very fast for its day. The turret mounted a medium-velocity 57-mm gun, with a cupola-mounted .30-caliber machine gun. The T1 Medium was the last tank with any World War I design heritage, but it was a vastly improved machine. After being used to try many modifications, it was retired about 1935.

The next model was built by the Cunningham, an automobile company. The T1 Light Tank of 1927 was a 7.5-ton vehicle powered by a

105-horsepower engine, giving it a speed of 20 miles per hour. The engine was in front, with the drive in the rear. Its turret mounted a .30 caliber machine gun. The turret and some of the armor was welded, rather than riveted. Three additional T1 chassis were built for self-propelled artillery, weapons carrier, and cargo vehicle experiments.

In 1928, Cunningham built four improved T1 Lights, called the T1E1. These weighed 8.9 tons, and their 132-horsepower engines gave them a speed of 22 miles per hour. Several additional T1E1 chassis were built for self-propelled artillery and other experiments. In 1929, a T1E2 Light incorporated additional changes, but it had the same power and speed as the T1E1. These T1s were all very similar, and they were used for many experiments well into the 1930s.

In 1930, Cunningham built one T2 Medium, basically an enlarged T1 Light that weighed 15 tons, had a 320-horsepower engine, and a top speed of 25 miles per hour. Many of



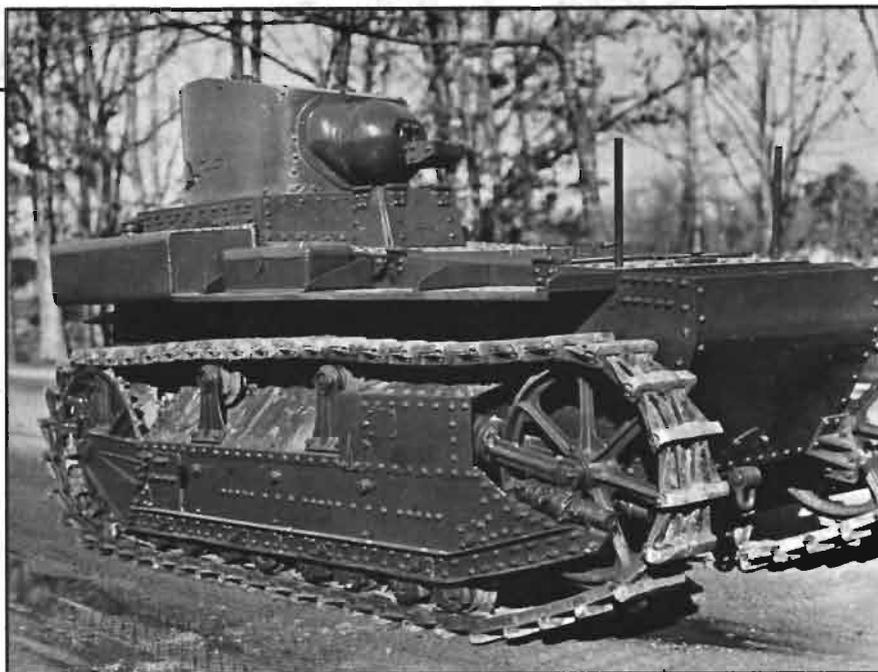
THE T1 MEDIUM UNDER TEST IN 1928.

its parts, including suspension and track assemblies, were the same as those on the T1 Light. The T2 Medium mounted an experimental, high-velocity 37-mm gun. Like all these machines, the T2 went through many experimental modifications until it was retired in the mid-1930s.

Beginning in 1930, several T1s were completely rebuilt into almost completely new machines. The T1 got a new power train and turret mounting the same 37-mm gun as the T1 Medium. In 1932, one was rebuilt as the T1E4 to test the British Vickers-Armstrong suspension. Another, the T1E5, was used to test other components. The last to be rebuilt, the T1E6, was used for engine tests.

While all the machines mentioned so far were considered successful, the Army wanted to test some European tanks. The Army borrowed from Vickers-Armstrong of England a "6-tonner" and a Carden Loyd Light. These were the first foreign tanks the Army tested since World War I, and while they had some good features, the Army found them unsuitable. In many respects, they were not as good as the Army's own experimental machines. In 1931, the Army purchased a group of tanks designed and built by the fabled J. Walter Christie. He was 66 years old at the time, and famous for his pre-World War I front-drive racing cars, front-drive conversions to motorize horse-drawn fire engines, and his World War I-era experimental tanks and self-propelled artillery designs.

Christie had developed his so-called "convertible tank," which could run on tracks or on its own road wheels, in 1928, but he called this remarkable innovation the "Model 1940" because he felt it was

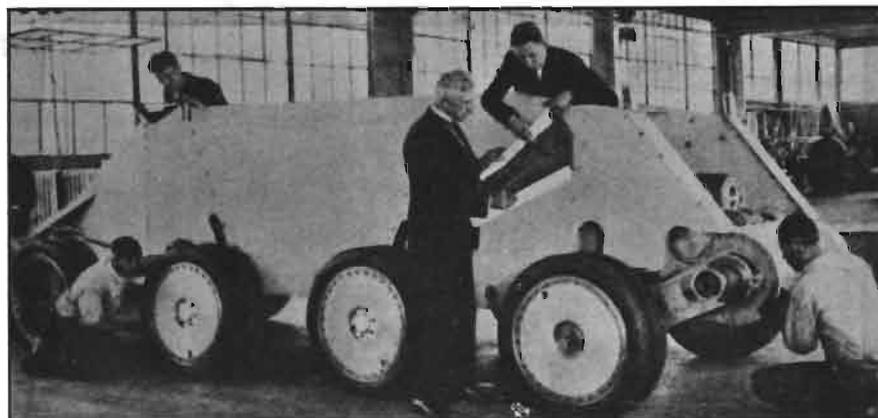


THE T1E1 LIGHT, USED AS AN ARMOR TESTBED IN THE 1930S.

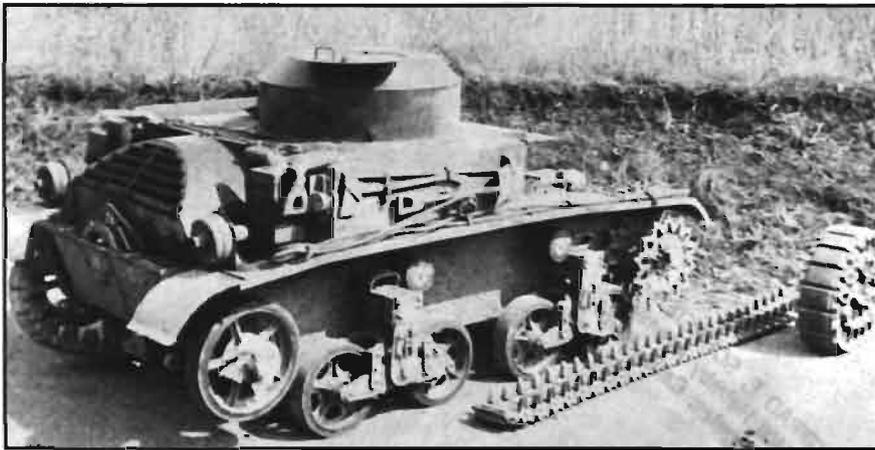
years ahead of its time. This was not a complete tank because it lacked any armament and had no turret, but it was an astounding machine that could run 45 miles per hour on its tracks, and 70 on its road wheels! This was possible because it only weighed 8.6 tons and it was powered by a 338-horsepower Liberty aircraft engine. Christie's Wheeled Track Layer Corp. only built one Model 1940, but it did so well in tests that the Army was determined to obtain a perfected version. The Army bought seven redesigned Christie tanks in 1931. To comply with federal law that limited tanks to the Infantry Branch, three were designated In-

fantry Medium Tanks T3 and the other four "Cavalry Combat Cars T1," but they were all practically identical. They weighed 10.5 tons and had the 338-horsepower Liberty engine. They incorporated the Christie convertible principle, and could run on either their road wheels or on tracks. They used Christie's unique coil-spring suspension. The Army had to build their turrets because Christie did not design ordnance systems.

The Christies proved only marginally satisfactory. The tank's complex dual-road-wheel-drive, steering-track system was troublesome. So was the chain final drive. With its



J. WALTER CHRISTIE GOES OVER BLUEPRINTS WITH HIS SON J. EDWARD, IN 1931-32.

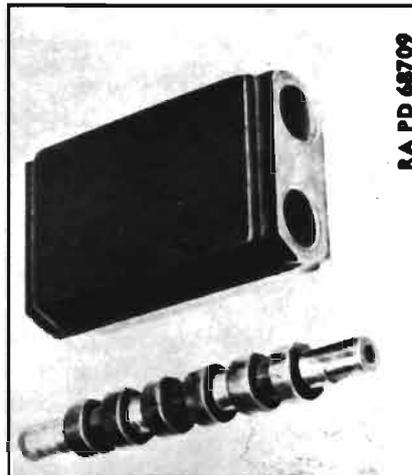


THE T2E1 LIGHT TANK, THE FIRST TO USE RUBBER-BUSHED TRACK.

suspension components, each Christie independent road wheel extended almost a foot out from either side of the hull, crowding the interior and making turret mounting difficult. The track life, like that of most tanks of the period, was poor — only some 500 miles. And the Christies tended to throw tracks in violent maneuvering.

Rock Island Arsenal used many of Christie's ideas in its 1931 T2 Combat Car. This 8.5-ton machine used a novel power plant: a 165-horsepower Continental radial air-cooled aircraft engine. Although this tank was extensively rebuilt as the T2E1 in 1933, it was an unsuccessful vehicle. A similar T3 Combat Car was designed in 1932 but never built because of the failure of the T2.

In 1932, there was a track development that went unnoticed at the time, but revolutionized tank track performance ever since. This was the rubber-bushed track. Since the first tanks were built, they had used "dry pin" tracks, invented for use on tractors of the "caterpillar" type. Dry-pin track had a very short life — never more than 500 miles — because dirt got into the track pin bushings and wore the pins out. The T1 rubber-bushed track, developed in 1932 by the Army and the Timken Bearing Co., used flexible rubber bushings to replace dry track pins. Even the first rubber-bushed



THE RUBBER-BUSHED TRACK, DEVELOPED AROUND 1932, INCREASED TRACK LIFE FROM 500 TO 5,000 MILES.

tracks ran a thousand or more miles. They are still a basic element in U.S. Army tank track design.

The second tank innovation introduced in 1932 was the volute spring suspension. This is a bar coiled on edge like a clock spring. One end is the inner coil, the other the outer. Its big advantage is that it is very rugged and it is the most powerful compact spring there is, so it took up the least possible space in a tank suspension system, a fraction of what a leaf, coil, or torsion bar spring requires.

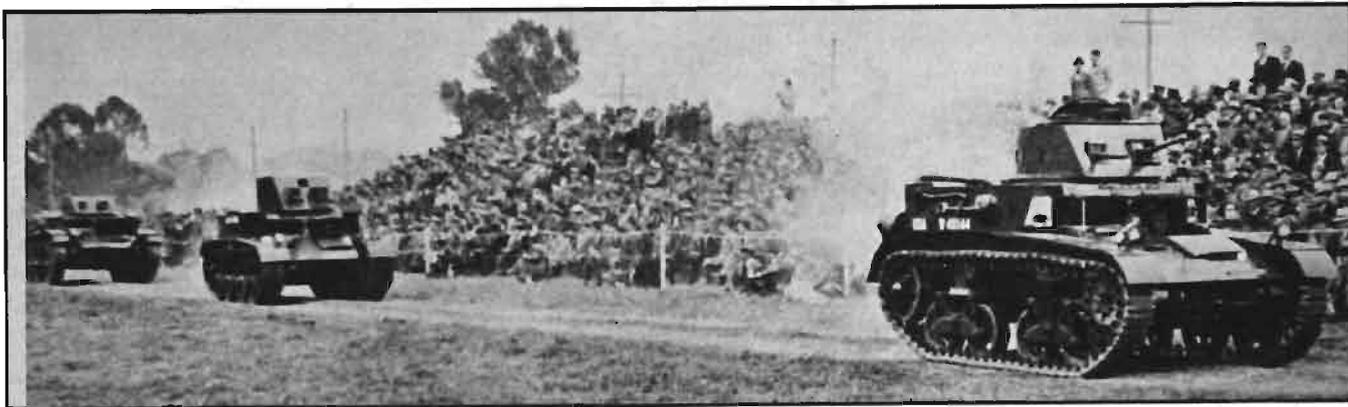
While the new components were undergoing test and development, the Army was also pursuing Christie's designs. In 1933, Rock Island Arsenal redesigned the T1 Combat Car/T3 Medium. The Army

believed Christie's ideas had merit, but his designs were far from perfect. The Army decided to pursue several other lines of development besides Christie's because of these problems. This turned out to be a very far-sighted decision, in light of the problems both the British and Russians experienced with their Christies in World War II.

At about this time, Gladeon M. Barnes, later an Ordnance Department major general, patented the torsion bar suspension. The torsion bar suspension takes up room in the bottom of the tank hull, instead of along its side. In 1934, the Army redesigned the Christie and had American-LaFrance — the fire truck manufacturer — build one T3E4 Medium. While it was a vast improvement, it was not as good as other experimental tanks built about the same time. Shortly after this project was underway, Rock Island Arsenal built a T4 Medium, a 13-tonner which was supposed to be the T4 Combat Car, but weighed more than the regulations allowed a combat car to weigh. The T4 medium was later rebuilt as the T4E1 to try out a special casemate top hull, but neither T4E1 or the T3E4 Medium Christie were considered very successful.

In 1934, Rock Island Arsenal also built the T2 Light, a turreted design with a 37-mm gun, rear engine, and front drive. It weighed 6.5 tons, and its 120-hp engine gave it a speed of about 25 mph. It used a version of the suspension on the British Vickers-Armstrong 6-ton tank. It was a reasonably good vehicle, but not nearly as good as another design built at the same time.

Two experimental tanks built at Rock Island Arsenal in 1934 had a tremendous influence on the development of U.S. Army tanks used in World War II. One was the



At a 1938 demonstration at Aberdeen Proving Ground, three different tank suspensions were on display. Tank in the lead has the volute spring suspension widely used during the war. The second is the first U.S. experimental tank with torsion bar suspension. The last tank in the column is a late Christie convertible design.

T2E1 Light Tank, the other the practically identical T5 Combat Car. These machines combined for the first time the rear-mounted, air-cooled, radial aircraft engine with a front drive, a volute spring suspension, and a rubber-bushed, long-life track. They were a fantastic success! They could do 45 mph, which made the convertibility of the Christie design unnecessary. They had excellent mobility. Track life proved to be over 1,500 miles, and the tank did not throw tracks during violent maneuvering. Their overall performance was unheard of in any other tanks of their day.

In 1936, an improved twin-turret model of the T2E1 Light was standardized and put in production at Rock Island Arsenal as the M2 Light Tank. Along with it, a single-turret version was standardized and went in production as the M1 Combat Car. These tanks were identical,

except for the turret arrangements, and they were the first in the highly successful World War II light tank series. Until the the M2 Light and M1 Combat Car were standardized, the only standard tanks still listed in the Army's inventory were World War I types, the 6-ton Model 1917 of the French Renault design and the 40-ton Mark VIII of the British type. The Army was still using them, along with some of the earlier Army experimentals, to train and educate tank troops!

Another experimental tank, built at Rock Island Arsenal in 1934, shared the same new design features. Called the T3 Light, it was a turretless 3-ton machine which worked well, but it was never pursued because the Army had no requirement for it.

The Army still thought the Christie convertible idea had merit, so in

1936 one last model was designed, the T6 Combat Car. However, due to the success of the other new designs, it was not built. However, one last Christie was built. In 1936-1937, Rock Island Arsenal took an M1 Combat Car hull and mounted it on a Christie convertible suspension. This was the T7 Combat Car, but testing proved it inferior to the new production model tanks. In 1939, the U.S. Army discarded the Christie design in favor of the much better tanks it had in production.

The Army, having a standardized light tank and combat car, needed a medium tank, and in 1937, Rock Island Arsenal designed and produced the T5 Phase I Medium. Its powertrain was derived from the M2 Light and M1 Combat Car, with a rear engine, front drive, volute suspension and rubber-bushed track. In addition to a 37-mm gun in the turret, there were four corner



Three light tank designs at Aberdeen in 1940 included, from left, the 37-mm gun-armed M2A4, the twin-turreted, machine gun-armed M2A3, and the M1 Combat Car.

casemates mounting .30-caliber machine guns. It had a 350-horsepower radial air-cooled aircraft engine, and it could do over 26 miles per hour. Its suspension and track parts were the same as those on the new light tank and combat car. It was a success.

Later variants of the medium tank project included the T5 Phase II and T5 Phase III of 1938, the latter employing a wider, improved, volute suspension and rubber-bushed track. In 1939, this design was standardized and put in production as the M2 Medium.

In 1939, a production M2 Medium was used to test the Guiberson radial, air-cooled diesel engine as a power plant. This was called the T5E1.

By 1939, Rock Island Arsenal was producing the M2 Medium and working on the T2E2 Medium. The T2E2 used the lower hull and power train of the M2, but it had a unique new top hull with a machine gun turret on top, a 75-mm pack howitzer in the right front corner, and machine gun casemates on the rear corners. It was never intended to be anything but an experimental machine to test the mounting of a large-caliber cannon in the hull, and it proved to work well enough.

World War II began in September 1939, and gave the Army a whole new insight into its tank needs. Of course, the Army concentrated on producing and improving the new standardized models. By 1940, the Army concentrated on designing and specifying the combat tanks needed in the near future. As a result, the Army did an unprecedented thing: a new tank was placed in production without ever assigning it a "T" experimental number. These machines were the M3 Mediums ("Lee" or "Grant"), mounting a 75-mm gun at the right hand corner of



The M2A1 Medium was father to the M3 Grant-Lee and grandfather of the famous Sherman M4.

the hull and a 37-mm gun in a top turret. This tank was designed in 1940, and it was the first World War II Allied tank mounting a 75-mm gun.

When the British employed it in combat in North Africa, it proved

that the U.S. Army tank program had turned out to be outstanding.

Even as the M3 Medium was being rushed into production, the Army was working on the T6 Medium, using the lower hull,



General Barnes, at left, and General Christmas, right, are seen in this 1940 photo with the wooden mock-up of the M3 Medium that would later serve in North Africa.

power train, suspension, and tracks of the M3, but with a 75-mm main gun in a full turret. The T6, when standardized and ordered into production in 1941, became the famous M4 Medium "Sherman," and it is the only World War II tank still in service!

Another less successful development begun in 1940 was the T1 Heavy "supertank," a 60-ton monster even by present standards, mounting a 3-inch, high-velocity anti-aircraft gun in its turret. It had a 1,000 horsepower engine and a speed of 25 miles per hour.

Although it was standardized as the M6 Heavy in 1941 and production was begun, this most powerful tank of its day was never used in combat because of problems in shipping it and using it on the roads and bridges of Europe. In 1941, the Army also began production of its new M3 Light Tank, mounting a 37-mm gun in its turret. It was a better armored and armed version of the M2 Light.

One last non-convertible Christie was also built as the 57-mm Gun Motor Carriage T49, but it was not



The M18 "Hellcat" Tank Destroyer, its suspension based on research done in the 1930s, was the first U.S. production vehicle to use torsion bar suspension. This one is seen crossing the Moselle River in 1945.

successful. Based on designs begun in 1940, the 76-mm Gun Motor Carriage T67 was built in 1942. This was the first U.S. Army armored vehicle using a turret-mounted gun and the torsion bar suspension invented in 1933. It is sort of an interesting footnote that, while the the U.S. Army's volute suspension, introduced in 1934 and so successful that it is still used, takes up NO interior hull space, it was replaced by the torsion bar suspension which uses a good hunk of interior hull space.

The first production vehicle using torsion bars was the 76-mm Gun

Motor Carriage M18 ("Hellcat") introduced in 1943, and developed from the T67.

The torsion bar suspension was also used in the later M24 Light ("Chaffee") and the M26 Heavy (later M26 Medium "Pershing"). U.S. Army tanks through the M60 were developed directly from the M26 Pershing.

The rubber-bushed track, introduced in 1932, is still in use. As far back as World War II, sets ran as far as 5,000 miles before replacement, and as yet there is nothing better.



The M6 Heavy tank, at right, seen in comparison with the M3 Medium. Although a production tank, the M6 - at 60 tons - was thought to be too heavy for fighting in Europe and was never in combat.

Konrad F. Schreier, Jr. is a professional technological and military historian who served in the China-Burma-India Theater of WWII and later graduated from the U.S. Army Ordnance School at Aberdeen Proving Ground, Md. He was a civilian engineer from 1950 until 1967 when he became a full-time historian, specializing in U.S. Armed Forces history. He is a Fellow of the Company of Military Historians and a member of the U.S. Commission on Military History.