

# The Origins of Torsion Bar Tank Suspensions

## Did the U.S. just copy a German design?

by D. P. Dyer

Every effort to try and reduce the myths surrounding World War II American tanks, as in the article by Charles M. Baily ("Tank Myths," September-October 2001), is to be applauded. A follow-up letter in the November-December issue by George F. Hofmann, however, promotes another myth itself, albeit an official U.S. Army Ordnance Department one. (*Editor's Note:* Dr. Hofmann stated, "In fact, it was the Ordnance Department that developed the torsion bar suspension for Army tanks during World War II...")

No torsion bar development program has been uncovered as being proposed, recommended, financed, or approved by the U.S. Ordnance Department.

The development histories on the medium tank T20 and light tank T24 merely refer respectively to their torsion bar suspension as being a modification or similar to that designed originally for the M18 Gun Motor Carriage (GMC). One must therefore look to the purpose-designed tracked tank destroyer that evolved for its development. It doesn't help.

It having been decided to utilize the light tank T9 chassis for a proposed 37mm GMC T42, the original layout drawings were modified in October 1941 to specify individually sprung wheels (Fig. 1). Later proposal drawings, dated 29 December 1941 and 5 January 1942, show the Ordnance department modified Christie suspension developed for the Combat Car T4 (Fig. 2).

With the decision to fit a more powerful gun, the designation 57mm GMC T49 was allocated for the two pilots that were authorized to be built by the Buick division of General Motors. Included in the list of recommendations dated April 1942 was independent suspension similar to the Christie type, or that used on the Combat Car T4.

What evolved and appeared in July 1942 on the first pilot T49 (USA 6029910) was trailing arm vertical coil

spring independent suspension adapted from Christie (Fig. 3).

While this was undergoing testing, it was decided to have the second pilot T49 fitted with the 75mm gun M3. As such, in October 1942 this vehicle was redesignated as 75mm GMC T67. The military characteristics merely specified it to be tracklaying with independent suspension. Typical characteristics in the historical record, however, have it defined more specifically as coil spring-individual wheel.

In December 1942, the Special Armored Vehicle Board (Palmer Board), in order to reduce the vast number of projects competing for contracts, stated that the 75mm Gun Motor Carriage T67 was capable of development as a satisfactory tank destroyer, but that the engines were unsatisfactory. It recommended suitable standard engines be provided and that other minor changes found necessary be made. No mention was made in the list of changes of any alternative suspension being required, this having been considered highly satisfactory.

Following the Palmer board report, it was decided to mount the new 76mm M1 gun in the tank destroyer. Approval was requested on the 4th of January

and given on the 27th to build six pilots to be designated 76mm GMC T70. (The photo below, taken 20 February 1943, shows the T67, but mounting the 75mm gun.) Although nothing is mentioned in the recorded discussion, quietly slipped into the military characteristics somehow was torsion bar independent suspension.

Quickly following in February were instructions to fit torsion bar suspension to the second pilot medium tank T20 and, in March, for it to be fitted to two pilots each of both the medium tank M4 and light tank T24.

The first pilot T70, complete with torsion bar suspension, was completed in early April 1943. For all of the necessary research, development, testing and manufacture of a radically different suspension system to have been completed in such a short time stretches credulity.

In July 1945, Captain Joseph E. Canning, the technical information officer from the Office of the Chief of Ordnance at Detroit (OCO), published an article in *Army Ordnance*, titled "Faster Combat Vehicles," about the new torsion bar suspension. It stated that in 1933 a torsion bar suspension was designed and patented by the Ordnance



Department, but limitations in funds made further development impossible. It went on to say that, "as soon as the initial pressure of arming ourselves and our allies was over and funds and engineering personnel were made available, work was renewed on torsion bar suspension development for high-speed vehicles." Early development tests were stated as being conducted on the medium tank M4E4 with the 76mm GMC M18 being the first production vehicle to be so equipped. As mentioned earlier, the M4 with torsion bar suspension wasn't even proposed until March 1943. (Studies of independent suspension for the medium M4 series were based firstly on the Ordnance modified Christie suspension, and later the Buick vertical coil spring suspension, thereby paralleling the tank destroyer development.)

Included in this article was a copy of the drawings from one of the Barnes/Preston patents, (although only quoting Maj. Gen. G.M. Barnes as the patentee) granted on November 10, 1936, of a design for a torsion bar suspension for cars.

Prior to even the application for this patent being submitted, *The Automobile Engineer* had published a series of articles titled "Modern Suspension." Part V, in September 1934, was titled "Independent Suspension on Private Cars," and included in great detail all of the variations, formula, illustrative drawings, and photographs of the many car torsion bar suspension systems in use up to that date. These included Porsche, Rohr, Mathis and Citroen.

The possible original feature with the Barnes/Preston patents, was that their torsion bars described the tube-over-bar (TOB) suspension contemplated for an improved MBT M60A1 35 years later. On this, an outer torsion tube is fitted to the side of the hull nearest the wheel. An inner solid torsion bar runs through this being connected at the far end, thereby doubling the effective length available.

In the official history "The Ordnance Department Planning Munitions For War," it simply states that, in 1942, torsion bar suspension was developed to a point where it could be used in combat vehicles." The footnote refers to the same patent mentioned previ-

Fig. 1

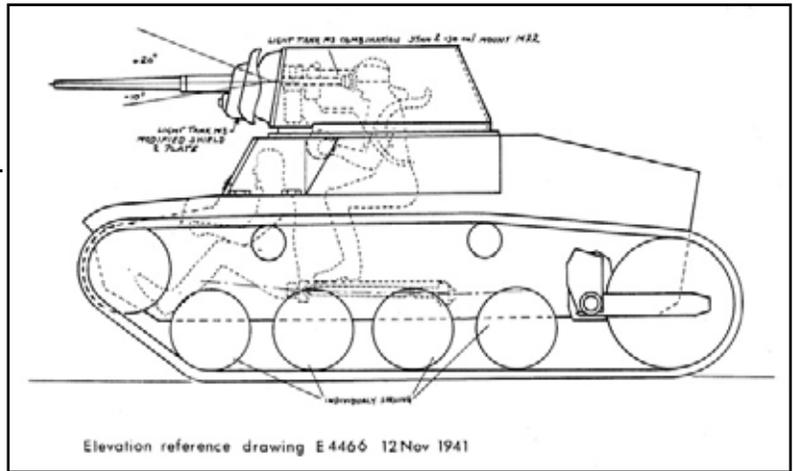
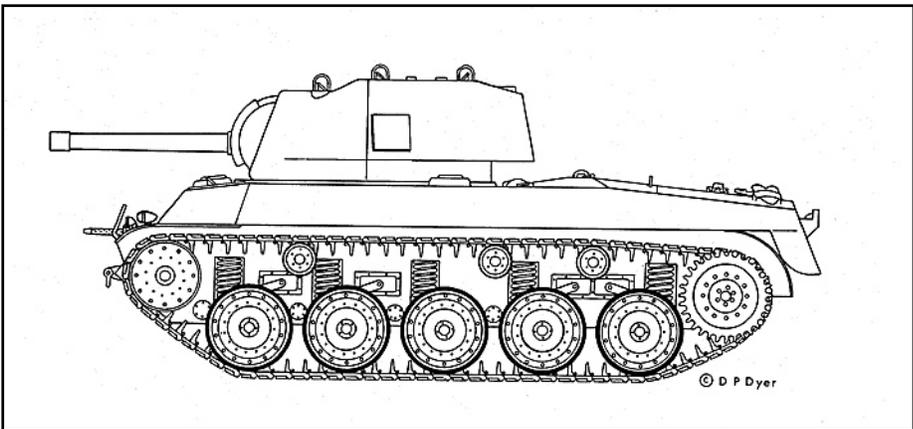
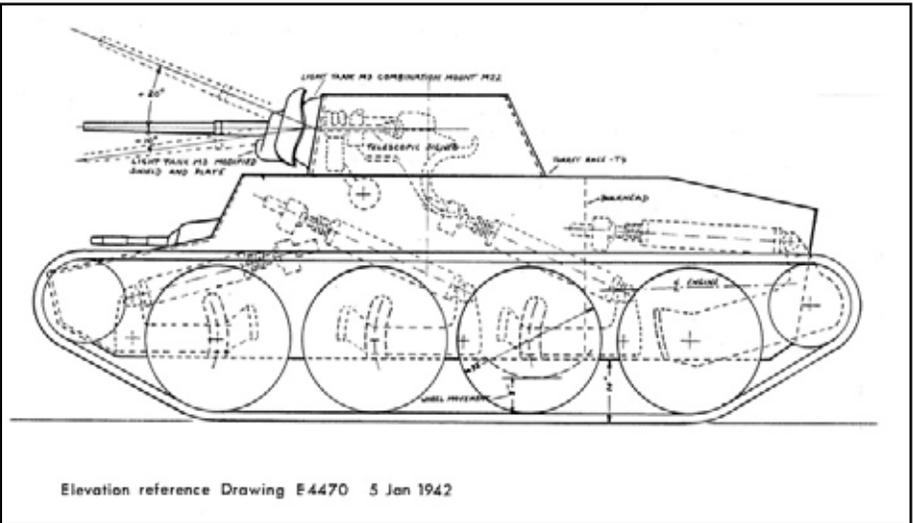


Fig. 2, above, and Fig. 3, below



ously, also giving the impression that this is what was the basis of development, although stating that French patents were of an earlier date. This could be referring to Dubonnet, who also utilized a combined torsion bar and tube layout.

Brig. Gen. J.M. Colby, who as a colonel had been Chief of Development at

TAC during the period in question, was promoting himself in the seventies as having designed the first torsion bar suspension in 1933, but stated he was never in a position to get funds for its development until the winter of 1942-43.

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In his enlightening book, *The Business of Tanks*, Colonel, later Brigadier, G. MacLeod Ross refers to Robert Schilling of the Buick Division of GMC as the developer of the American tank torsion bar suspension. However, my view is that with there being so much in common with the PzKpfw III suspension (modified to include the angling of the torsion bars introduced by Porsche in the cars he designed) rather than that of the Barnes/Preston patent, it is apparent that this was the basis.

Relative to this, a highly detailed report had been published by AEC Ltd., in June 1942 for the British Directorate of Technical Development (DTD) on the PzKpw III. This included complete technical drawings, dimensions and material analysis of its torsion bar suspension.

One of the many relevant comments that Brigadier Ross quoted was that Ordnance was fundamentally opposed to accepting any design emanating from outside the U.S.A. Buick obviously wasn't so inhibited, being a commercial firm.

In view of the extremely fast introduction of torsion bar suspension following the request for same, it would appear that Buick had developed it previously on their own initiative and at their own expense, as an alternative to the Christie type, coil spring-based independent suspension.

Although it isn't known whether he may have had any influence, the civilian engineer consultant with the British Army Liaison Staff at the Tank Automotive Centre was Maurice Olley. His name struck a chord. In the mid '30s, while employed by Vauxhall Motors of England, he was behind the development resulting in converting their range of cars to using front wheel torsion bar suspension.

The draft of the Ordnance Department Historical Record for the T67 originally stated, "After work had been started on the new vehicle, the second pilot of the T67 was completed. This was sent to GM proving ground for testing of the track and suspension system. Results of these tests were so satisfactory that *this suspension system with a few modifications*, was adopted for the 76mm Gun Motor Carriage."

The words underlined were later crossed out and substituted by "*an individual sprung type of suspension sys-*

*tem with torsion bars substituted for coil springs.*" The reference to the pilot model being built by the Buick Motor Division of the General Motor Corporation was also deleted.

What is suspicious to start with is that no second T67 pilot had been authorized. As the track and suspension system of the T67 had already been proved on the T49, there should also have been no need to have it retested. If it was felt necessary to retest it on a vehicle mounting a 75mm gun and was then found to be so satisfactory, why would the suspension system then need to be changed? Even this change is then only made to sound as if the two types of springing were simply interchangeable.

While no dates are mentioned and no photographs of this vehicle have ever been uncovered, the best supposition is that this was Buick's alternative version of the T67 (most probably modified from the first pilot T57) and incorporating torsion bar suspension. This torsion bar suspension was no doubt considered superior to the coil spring suspension leading to it being slipped in the T70 authorization.

The Ordnance Department obviously wanted to take the credit of developing such a considered ideal tank suspension and at the same time divert attention away from any foreign connection; especially an enemy one. For both purposes the old Barnes/Preston patent made a convenient decoy. Its success is proven by how long it has survived and it will no doubt continue to do so, every repetition reinforcing the ploy. It isn't alone in this respect.

*(Editor's Note: Richard M. Ogorkiewicz's encyclopedic reference, *Technology of Tanks*, credits the Germans with the first torsion bar tank suspension on Model D versions of the PzKpw II, in 1938, and E versions of the PzKpw III.)*

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D.P. Dyer, who lives near Falmouth, England, has contributed articles, letters, and technical drawings to military publications and modeling magazines. *ARMOR* readers may be most familiar with his detailed line drawings of armored vehicles which helped illustrate Richard Hunnicutt's series of references on American armor.