Design and Development of Torsion Bar applied to the Elevation Mechanism for the Tracked Fighting Vehicle

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***Abstract*— Due to the restrictions space of cradle, Torsion Bar (TB) was applied to solve the constrain by relieving load acting elevation system.**

Here, we designed and developed the TB mechanism to enhance the elevation mechanism of the firing power system for the tracked fighting vehicles.

After improving tracked fighting vehicle, the test result showed that the gear force 30% decreased. The need of transmission and drivetrain power are then reduced.

***Keywords*— Torsion Bar, Torsion spring, Torsion beam, Suspension bar.**

I. INTRODUCTION

Type 85 tracked vehicle was developed in 1990 with air-cooled, turbocharged diesel engine sits to the right rear of the driver [1]. An intake is located on the top of the hull with an exhaust on the right hand side. The track is driven at the front by a drive sprocket and passes over five dual rubber-typed road wheels and three track-return rollers, then loops over an idler at the rear, before returning to the front again.

The vehicle is armed with 30-round 130 mm multiple rocket launcher mounted on top of the hull. A total of 60 rockets is carried on board with 6 crews. The rocket has maximum range of 10 km and maximum elevation of +55°, traverse is limited to 22.5° either side and have mechanical angle adjustment both transverse and elevation.

However, the 20-round 122 mm multiple rocket introduce the weight increase about 119%. The development of elevation mechanism for the firing power system for the tracked fighting vehicles is then challenged. To overcome the force generated during the elevation and assist the motor power. The concept of torsion bar is introduced.

Torsion bar acts as a torsional spring used in the suspensions of vehicles. It is commonly used in the car or truck [2]. As stated by Kumbar et al. [3], the torsion bar work by applying the torque resistance. One end of the torsion bar is affixed to an fixed object, while the other end

is twisted. Therefore, torque is developed. Kumbar et al. also noted that the effective spring rate of the bar is determined by the length, cross section, and shape, material and manufacturing process.

This paper is then focused on the application of the torsion bar to assist the rocket firing system. The Torsion Bar mechanism is designed and developed to enhance the elevation mechanism of the firing power system for the tracked fighting vehicles.

II. Design Analysis and Experiment

2.1 Load Estimation

Due to upgrading launcher to 122 mm, understanding of physical behavior of load acting on the vehicle is required. The weight is increased, therefore it can cause structural damage to the vehicle. In this work, there are static load and dynamic loads.

A static analysis calculates the effects of steady such as weight of cradle, pod and rockets on a structure, while ignoring inertia and damping effects.

The modified launcher has 1520 kg more than the original launcher where the overall weight is about 1280 kg.

Dynamic loads are used to determine the strength of a structure under the action of any time-dependent loads. In this case the time dependent load present the multiple rocket firing

2.2 Static Load (weight) and Force Analysis

In 2015, Defense Technology Institute (DTI) was initiated the Typ-85 tracked vehicle improvement and upgrading. One of the upgrading is equipping the 20-round 122 mm multiple rocket with maximum range of 40 km as shown in Fig.1 (b). By arming 20-round 122 mm, the total weight of the vehicle was increased about 119%.