

The Maintenance Methods Research of the Armored Vehicle Mechanical Steering System

Baiyuan Gu^{1,a}, Yi Yao^{2,b}, Meng Zhang^{3,c}, Guibao Wang^{4,d}

^{1,2,3,4}Armor Technique Institute of PLA, Changchun, China

^a3063543236@qq.com, ^b3174296251@qq.com, ^{c,d}1441789825@qq.com

Keywords: Armored vehicles; Mechanical steering system; Maintenance Methods; Research

Abstract. Vehicle steering system is an important part of vehicle, once appear, fault creates a great potential safety hazard for the vehicle. Vehicle steering system general malfunction due to use of frequent wear and tear. The right to use the vehicle steering system, master the maintenance method can maximize reduce vehicle mechanical steering system failure. The author combine experience and the working principle of the steering system of the use and maintenance of the armored vehicle steering system carried on the thorough research.

1 Introduction

Mechanical steering system is currently the most widely used armored vehicles structure, mechanical steering system failure, mostly due to normal wear and tear in use, sometimes, regular check do not reach the designated position, or the lack of adjustment and the acceleration of lubrication can cause wear, if excessive wear, will reduce the armored vehicles operating flexibility, thus affecting the traffic safety. Therefore, pay attention to the maintenance of mechanical systems in the vehicle is of vital importance.

2 The working principle of the Armored Vehicle Mechanical Steering System

For the vehicle's performance requirements gradually increase with the development of vehicle technology, mechanical steering technology is the base of vehicle steering system, plays an important role. In order to better maintenance and use of mechanical steering system, must be the vehicle mechanical steering system structure and characteristics of understanding.

Mechanical steering system is through the use of steering, turned to the driver's power as energy, by the steering gear, steering transmission machinery and the operation system structure composed of three parts to work.

According to the different forms of mechanical steering, steering mechanism can be divided into worm pin type, circulating ball type, gear and rack type, worm wheel type, etc., which use frequency is highest is the gear rack type and circulating ball type. Circulating ball type steering gear in the form of the rolling friction, rotation with high efficiency, convenient operation, and the service life is long, often used in heavy duty vehicle. Circulating ball type steering, the output of the pitman arm swinging Angle and the input of the steering is direct ratio relation, the output and input of the steering rack displacement is in direct proportion to the number of turns. Compared with circulating ball type steering gear type redirector rigid bigger, weight is lighter, more compact structure, reaction of wheels can turn the steering wheel, on the reaction is keen, but, gear type redirector is easier to appear thugs and array of problems, and has some defects, the loading rate than the circulating ball type difference, therefore, steering gear type is mainly used in light vehicle.

3 The main points of using Mechanical Steering System

To extend the mechanical steering system of vehicle use fixed number of year, guarantee the safety of vehicle and requires the use of mechanical steering system according to the correct method to operate, in accordance with the specifications required to do the operation and maintenance work.

3.1 Using the Steering System Correct

When using mechanical steering system of a few points to note: generally speaking, in the vehicle is moving in a straight line don't sloshing around the steering wheel, which can cause the vehicle steering, steering system on the accord with too much. First, the driver on the steering wheel on the strength of the after rotation, will be many times more than the original strength; Second, the reaction of road to steering device also has a lot of wear and tear. In such a state, the friction between parts in the position of steering, ruined the original fit clearance, lead to deformation of the parts, steering frayed. Which affects the safety of driving, easy to cause serious traffic accident, so keep good technical state of steering is crucial.

3.2 Strengthen the Inspection and Maintenance

Vehicle mechanical steering system at the time of use, all aspects of the interaction force, the friction between parts, lead to the breakage of the parts, fasteners loose problem, make the quality of lubrication can not meet the expected. So, inspection and maintenance of steering device should be enhanced, to ensure the safety in the motion of the vehicle. To regularly check the steering shaft coupling and coupling nut connecting bolts, and connections to transmission of various parts of the plant also needs to be checked. Found a loose situation and needs in a timely manner tightened, in accordance with the requirements for fastening. Parts no longer closely under the condition of the activity, according to the situation for component replacement. And the leakage check and tighten nut and screw, in addition, also need regular inspection on the lubrication oil in the steering gear, in the case of insufficient oil for timely added.

4 The main points of maintenance Mechanical Steering System

4.1 Attention to check

In the daily use of the vehicle, the steering gear of distributing valve, power cylinder and oil pump regular inspections on the connection of the fixed condition, put an end to appear suddenly loose in the operation of the situation, which affect the safety. Oil capacity is also must pay attention to of place, at the time of oil shortage, need to add oil in time, in the oil added, must conform to the requirement of operation, can't add oil, must be conducted before adding filtration, oil shortage too much, need to empty air.

4.2 Pay Attention to the Free Clearance Adjustment

Steering wheel in the middle position, free to join the clearance is too large or too small, need to be sent the side cover steering lock nut screw, then turn to the right position adjustment, let the meshing clearance can be adjusted to achieve the required value after the lock.

4.3 Power Plant must be Lubricated Periodically

For steering gear lubrication, can choose different brand of lubricating oil, add the pin of the power cylinder and the sockets of the ball head require periodic lubrication, also can be used after the cleaning of lubricating oil. Can not add do not conform to the requirements of the oil, when problems found lubricating oil must be timely replacement.

4.4 Regular Cleaning

Need to regular cleaning of pipe and filter, if necessary, can according to need to replace filter, in the process of cleaning need to check whether there is the joint of the oil pump and pipeline leak occurs, in daily use requires various components ensures good performance and reliable, screening and filter regularly do to repair the pipes. In the process of component dismantling need to pay attention to clean the element.

4.5 Keep the Steering System Cleaning

Steering system needs to be kept clean and clean, at the time of adding oil, must use clean containers; In the process of unpick and wash, don't allow casually throw, banning the use of cotton swab for parts; In addition, in the usual situation, will not be able to remove the pin and the valve core of the steering gear down, cooperate with each other using parts also can't replace or polishing.

5 The Common Fault Analysis of The Armored Vehicles Mechanical Steering System

Vehicles in the process of driving, steering system common fault is mainly the steering wheel rotation is too large and manipulation of the instability, the front wheel and steering heavy head, wandering. Common faults and processing methods mainly include the following points.

5.1 Much large and Unstable of The Wheel Rotation

The most common is the steering wheel rotation is too large and unstable. This will need to check the steering pump in the usual use ball head and the king pin and bushing, wheel bearing wear, if found in the inspection without excessive wear or clearance, repair should be mediated. But if after inspection found no excessive wear or clearance, you should check the status of steering turbine rod wear, and the gap is in accordance with the provisions; Second should check the wear condition of steering device connecting parts, check whether the adjustment too loose; The last check whether redirector installation parts become loose

5.2 The Heading of The Front Wheel

Front wheel pendulum is head basically has the head and the first two pendulum at low speed. If place head in high speed, you should check the wheel dynamic balancing, and tire assembly is reasonable, and check whether the tyre wear uniform, check if there is a deformation of the wheel rim, wheel deflection of whether there exists or wear and spring steel plate bolt for loose or damage, check the armored vehicles caster Angle is correct, tire pressure is correct.

If a low pressure head, besides should check the status of high-speed swings head appeared, also check the tire pressure is correct, whether to loosen steering knuckle bearing, steering linkage section horizontal, straight to see if there is loose, if there's any loose for steering gear assembly, spring steel plate is a participation or deformation.

5.3 Vehicle Running Deviation

When vehicle running deviation, you can check the tire pressure is equal to or tire diameter is equal, on both sides of the spring steel is elastic non-uniform or deformation, the vehicle's toe is not correct, camber Angle is equal, steering knuckle arm, steering knuckle is appeared or bending deformation, rear axle shaft tube is a bend and on both sides of the wheelbase is equal.

If two tyre pressure is consistent, you can pass road test method to test, waiting for the vehicle to run hot after parking, then check that the brake drum and wheel hub in your hand the temperature is beyond the normal temperature, if the temperature of the wheel is too high, is a sign of wheel hub bearing adjustment is too tight or wheel hub oil seal is too tight. If the temperature of the brake drum and wheel hub is normal, can further examine the wheelbase is equal on both sides of the frame. When wheelbase equal, we can use the ruler or general beam of steel tape test before the bunch of value is too small, or negative toe.

6 Conclusion

To sum up, the vehicle in the marching on the way to carry on the varying of the lane and turn depends on the vehicle steering system, so the steering system and the motion of the vehicle safety not only has the close relation, will directly affect the vehicle tire life, low fuel consumption, the extension of steering system is also on the efficiency of the driver and the intensity, steering portability and has great impact on the stability of the vehicle, it is not hard to find plays a indispensable role in the vehicle steering system. But, the wrong use of steering system and lack of maintenance at ordinary times will give the vehicle damage. This must be the vehicle for the correct use and maintenance of mechanical steering system, to ensure that in any way any speed of the vehicle can travel safely and reliably.

References

[1] A.T.Zaremba,R.I.Davis. Dynamic Analysis and Stability of a Power Assist Steering System[A].Seattle,Washington,1995.4253-4257.

- [2] Geng Ye, Jiajun Yang. Study of the steering feel of electric power steering system of automobile[J]. JOURNAL OF HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY(NATURE SCIENCE EDITION), 2002, 30(2).
- [3] Zhao Wanzhong, Shi Guobiao, Lin Yi. Road feeling of electric power steering system based on mixed control[J]. Journal of Mechanical Engineering, 2009, (04):142-146. doi:10.3901/JME.2009.04.142.
- [4] Patrick S. Numerical simulation of electric power steering (EPS) system[J]. KOYO Engineering Journal: English Edition, 2002, (16):52-56.
- [5] Kim J H, Song J B. Control logic for an electric power steering system using assist motor[J]. Mechatronics, 2002, (12):447-459.