Chapter 6

Use of an Elastic–Damping Mechanism in the Tractor Transmission of a Small Class of Traction (14 kN): Theoretical and Experimental Substantiation

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ABSTRACT

Each modern tractor should be adapted to perform an increasing number of various traction, transportation, and other works. Therefore, their designs are becoming more complex. To improve tractor productivity, the power-to-weight ratio and the speed of its units are constantly increasing. This inevitably improves dynamic loading of the chassis and the transmission parts, the level of the generated oscillations, which increases the vibration load of the transmission. One of the promising ways to solve this problem is to introduce elastic links into the tractor transmission closer to an engine or a clutch. Installed closer to the engine, the elastic element in the transmission of the tractor absorbs the impact of the shocks, protecting the tractor engine from large dynamic loads. The material of the chapter contains studies confirming the efficiency of the use of an elastic mechanism (closer to the engine) in the tractor transmission of a small class of traction (14 kN).

DOI: 10.4018/978-1-5225-7573-3.ch006
INTRODUCTION

The universality of modern tractors is constantly increasing. Each tractor should be adapted to perform an increasing number of different traction, transport and other works, therefore their designs become more complex. To increase labor productivity, the power-to-weight ratio of tractors and speed of their units are increasing. But this leads to an increase in the dynamic loading of the chassis and transmission parts and to an increase in the level of generated oscillations, which increase the vibration load of the transmission.

Academician V.N. Boltinsky started the research work on the effect of unsteady loading conditions on the economic and operational performance of the tractor, and the engine in particular. Various studies have shown that the source of engine speed fluctuations is not only the oscillation of the traction resistance, but also the oscillations of the transmission elements. Therefore, it is necessary to increase the transmission compliance to reduce the dynamic loads on the engine.

But there is no consensus among the researchers on the installation location in the transmission of elastic elements. One of the ways to solve this problem is to introduce elastic links into the tractor transmission closer to the engine or clutch. Mounted closer to the engine, the elastic element in the tractor transmission absorbs the shocks impact, thereby protecting the tractor engine from large dynamic loads. The development of tractors with such more advanced transmissions acquires a high scientific and practical significance. Based on the above mentioned, we come to the conclusion that to increase the tractor operational efficiency it is necessary to install special devices damping the load and protecting the engine from fluctuations in the external traction load.

GENERAL CONTENTS

Theoretical Substantiation

Achievement of permanent growth of agricultural production, the population can be provided with food and agricultural raw materials due to the improvement of technical level, quality and durability of agricultural machinery and the widespread introduction of scientific and technological achievements aimed at increasing the efficiency of its use (Denisov, 2005; Nekhoroshev, 2014; Hansson, 2002). The improvement of mobile agricultural machinery, its efficiency, technological efficiency and reliability, the traction-dynamic and economic characteristics of machine-tractor units (MTAs) in their set-making and operation in production are of great importance in the solution of these problems (Iofinov & Mikuberg, 1971; Zoz & Grisso, 2003).

The most technological operations result in overexpenditure of fuel, energy and money costs per unit of received products and processed area. This occurs because of the inconsistency of traction characteristics of the tractor and the aggregated machines at operating speeds and, as a consequence, the lack of an optimum load of the engine by traction (Kutkov, 1980).

The introduction of the latest achievements of science, technology and advanced technologies is of great importance in the development of agricultural production efficiency. The main task in the development of a new system of machines for agricultural production is to increase their productivity, to reduce fuel consumption in various types of work, to decrease the negative consequences of the interaction of
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