UDC 631

ENHANCING THE TYPE-CONTAINING PROPERTIES OF THE BELARUS-1221 BY MODERNIZATION OF THE DIFFERENTIAL BLOCKING MECHANISM

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Differential is an integral part of the transmission of modern tractors. This knot cinematically connects the central and the final transmissions, ensuring the rotation of the drive shafts of the final transmission with different angular velocities, which is necessary when the tractor is rotated on the rotation and on the roughness of the soil. Therefore, it is one of the most loaded and, at present, one of the least durable nodes. The differential of the rear axle, which is currently used on Belarus-1221 tractors, was put into production in 1962 at the introduction of the MTZ-50 tractor. Over the past decades, the differential has not undergone fundamental changes, but it was systematically carried out in order to increase its reliability and resource.

This has improved its lubrication, increased purity of treatment and accuracy of its parts manufacturing, bronze bushings installed in the satellites, anti-friction coatings. Reliability and resource of the differentials were significantly increased and, nevertheless, numerous bench tests, as well as the examination of differentials in repair enterprises, show that the resource of the differential does not reach the required 10 thousand hours. The spent on the stand, as well as those arriving for repair differentials (usually after 5 ... 7 thousand hours) have significant losses in the vapors of the satellite-axle, at the ends of the satellites, as well as on the faces of the semi-gear wheels.

The most important indicator of a simple conical differential is the coefficient of efficiency (efficiency) of its mechanism. It is this coefficient that determines the reliability of the mechanism and its service life in the conditions of operation. The efficiency, in turn, depends on the frictional forces that arise in the mechanism with the relative rotation of its satellite elements and semi-gear wheels.

Tests of the tractor "Belarus-1221", conducted at the Minsk Tractor Plant, showed that the average value of the efficiency is $\eta = 0,6$, and the blocking factor of KB = 1,6. By comparing the efficiency and the KB of the GAZ-53 vehicle (as the same standard size) and the efficiency and the KB of the Belarus-1221 tractor, it becomes apparent that the Belarus-1221 differential has a lower efficiency (η) and, accordingly, a higher blocking factor (KB), with a difference of 30% [1].

The lower efficiency (η) of the tractor differential "Belarus-1221" in comparison with the car's differential (GAZ-53) is a consequence of the large losses of slip friction in the mechanism of the tractor differential.

In the mechanism of the considered differential, in addition to the eight pairs of gears, there are 10 friction pairs:

– 4 pairs of friction of satellites on the ends of the cross;

– 2 pairs of friction of the semi-manual gears with support washers;

– 4 pairs of friction satellites with support washers;

Given that the investigated differential ("Belarus-1221") η = 0,6, then, consequently, each pair of friction (on average) causes a loss of about 2-4% [2, 3].

Directions of perfection are selected installations of the forced system of lubrication of surfaces of the differential, which allows to reduce the losses of friction in pairs and increase the efficiency of the used differential.

The feature of the proposed mechanism is that in the cross-section of the differential there are axial and radial channels, as well as channels in the differential axis rigidly connected with the cross-section.

This allows the supply of lubricant from the pressure source to the inner cavity of the differential. When the lubricant is pumped through the oil channels, the lubricant of the friction pair is formed by the cross-satellite, the most loaded friction pair in the differential.

Further, the lubricating material under pressure flows through the gaps in the friction pair of the cross-satellite and enters the inner cavity of the differential, where lubrication of other friction pairs is carried out (satellite-case differential, gear-coupling satellite-solar gear, bearings).

One of the important problems is also to ensure the quality of the lubricant. The lubricant must not contain mechanical impurities, and also have low temperatures (for better cooling of the parts of the differential).

The lubricant is fed by a pump НШ16Г-3Л from the transmission, after which it is supplied to the purifier in a pressure filter 2ФГМ32Н-10 25К УХЛ4, where after cleaning at elevated temperature (and hence reduced viscosity, which provides improvement of the quality of cleaning) is fed to the radiator. After the radiator, the lubricant is fed into the feeder, which provides the lubricant feed into the rotary axle of the differential.

Thus, the tractor "Belarus-1221" with the modernized blocking mechanism of the differential can be successfully applied to work with agricultural machines that require the constant use of the blocking of the differential in agriculture.

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