

AGENCY SUSPENSIONS OF A BACK IDLER ON ANGULAR OSCILLATIONS OF A TRACTOR WITH THE TRIANGULAR CATERPILLAR CONTOUR

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Abstract

Main route of development of an agricultural tractor construction is raise of productivity of caterpillar at the expense of increase in working speeds and tractors and tool width. Such direction of development demands simultaneous development of running systems and suspensions of caterpillars. The analysis of possibility of application of running system with triangular caterpillar contour in farm tractors is in-process made. The mathematical model of the caterpillar has been developed for research conducting realised in the environment of SIMULINK. Within the limits of conducting of the analysis of a construction of running system with triangular caterpillar contour more effective construction of a suspension of a back idler in comparison with existing suspensions has been developed. On a designed construction of a suspension the patent is gained. The spent mathematical simulation of oscillations of a case of a tractor with various arrangements of running systems and at tractor operation on the most widespread regimes has displayed efficiency as designed circuit design of a tractor with triangular contour, and a designed construction of a suspension of a back idler. Working out of a technique of optimisation of a suspension bracket of the developed running system as a whole under concrete conditions of operation is necessary.

Keywords: triangular caterpillar contour, suspension, back idler, modelling

One of the basic tendencies in agricultural tractor industry throughout all period of its existence is productivity increase agricultural tractors. Such result is reached, basically, at the expense of increase in working speeds of a tractor and width of capture of the tool. The increase in weight of a tractor and capacity of the engine for possibility of realisation of higher traction effort and working speeds becomes a consequence. To realise such way of perfection of traction means is probably with simultaneous development of running systems and suspensions.

The running system of a caterpillar should provide effective realisation of traction effort which is reached, basically, at the expense of increase in the area of contact of a caterpillar with a ground and uniformity of distribution of pressure on all basic surface.

Historically, in agricultural tractors two configurations of running systems are applied:

- "Linear", when all wheels (including directing and conducting) lay on a basic surface;
- With raised directing and driving wheels.

Recently introduction attempts in agriculture of running system with the top arrangement of a driving wheel become, thus the form of caterpillar contour gets the triangular form (Fig. 1). It is necessary to carry to its basic advantages:

- Possibility of maintenance of the big traction efforts at smaller weight of a tractor;
- The raised longitudinal stability at the expense of the increased length of a basic surface;
- Decrease in dimensions of a tractor at the expense of features of configuration of running system;
- Possibility of maintenance of necessary displacement of the centre of gravity forward and increases mounted implement, etc.

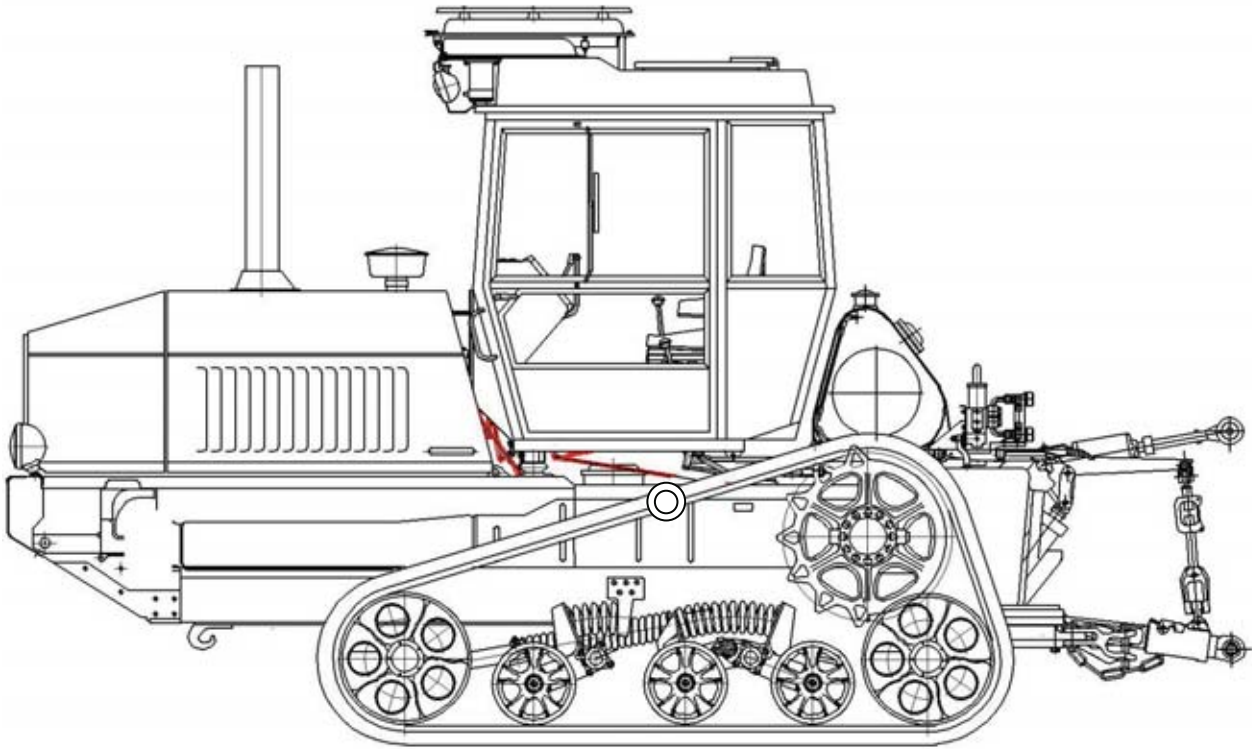


Fig. 1. Developed configuration of a tractor with TCC

Successful realisation of the scheme with triangular caterpillar contour (TCC) is accompanied by working out of a new design of knots of running system. In particular it concerns a suspension bracket of a back idler (BI) which is subject to the raised loadings from a tangent of force of the draught operating in a caterpillar and also because it is taken out back and at tractor turn makes the maximum work.

The scheme of a tractor has been developed for the configuration analysis with TCC, on the basis of serial sample BT-100 (Fig. 1). It meets the requirements of unification, to pressure decrease on a ground and to an optimum arrangement of the centre of gravity.

The basic lack of existing designs BI suspension (TCC-O) (Fig. 2.a), it is necessary to note necessity of maintenance of high resulted rigidity C_p for preservation of the set course of a skating rink at work with high hook loadings since at a deviation of the balance weight from a bisector, created a basic surface and a leading branch, moment M_{PKI} formed by a total tangent by force of draught Q_{pki} and the deviated balance weight, in addition draws in an elastic element of suspension bracket BI.

The design of a suspension bracket with a "return" arrangement of the balance weight (TCC-N) (Fig. 2.b) in which at its deviation from a bisector moment M_{PKI} the turning balance weight aside to return its turn is created has been offered. Thanks to such design the additional effect of change of rigidity of suspension bracket BI depending on a tractor operating mode is reached.

Work of a suspension bracket and its efficiency were checked on mathematical model of a tractor. It provides modelling of a wide spectrum of parameters of designs of running systems of caterpillars, research of spatial fluctuations of the basic knots of a tractor and their influence on a tractor as a whole, possibility of the task of a wide range of types of basic surfaces taking into account influence of their properties on behaviour of a tractor.

Researches were spent for the serial sample of tractor BT-100 and the developed scheme of a tractor with TCC. Comparison of running system VT-100 with the developed configuration was the Primary goal of research. The additional problem put comparison of the classical and developed schemes of suspension brackets BI in running system with TCC.

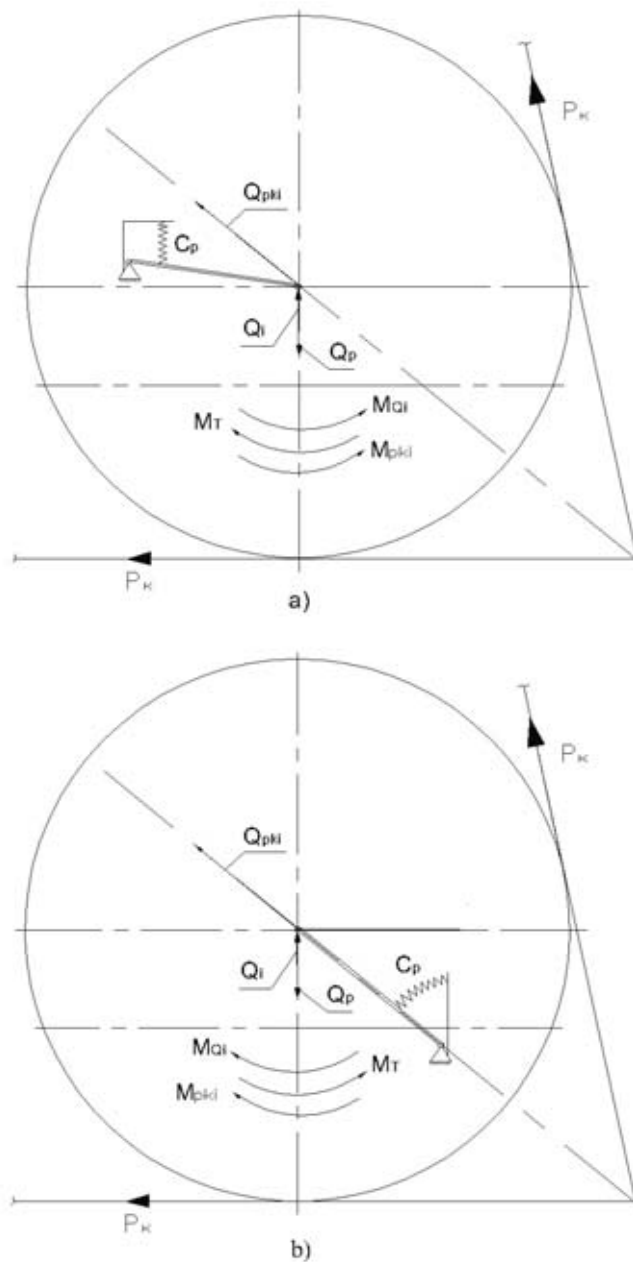


Fig. 2. Schemes of suspension brackets BI

At tractor movement on soil road with the tool in transport position and work on stubble with drawbar pull following indicators were estimated:

- Angular moving and case acceleration at turn round a cross-section axis;
- Vertical moving on sitting of the driver;
- Vertical acceleration on sitting of the driver.

From the analysis of the schedules presented on Fig. 3, 4 it is visible, that the increase in longitudinal base of a tractor has led to increase in angular rigidity of a suspension bracket, a consequence is decrease in amplitude of angular fluctuations of a tractor with TCC. Effective work of developed suspension bracket BI it is visible on Fig. 4. Root-mean-square value angular moving of a case of a tractor with a new suspension bracket more lowly, than at running system with the most widespread suspension bracket BI.

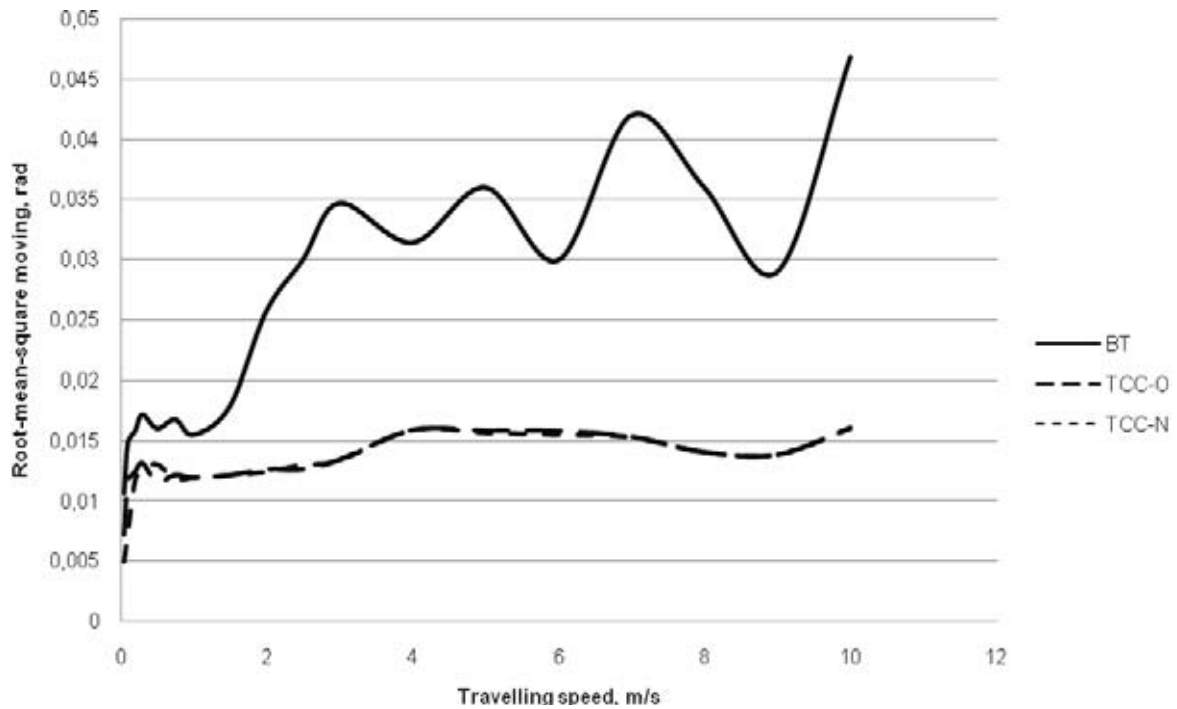


Fig. 3. Angular conveyance of a case at driving with the tool in a transport rule on the soil road

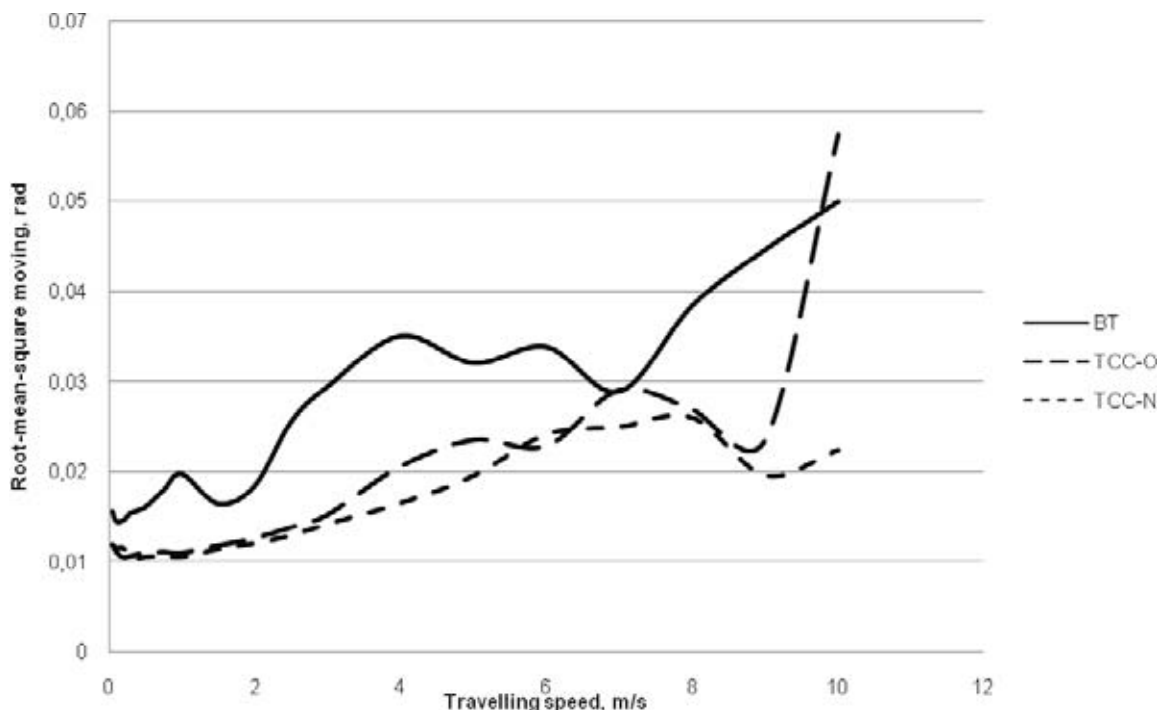


Fig. 4. Angular conveyance of a case at driving on an eddish with implement

Similarly the increase in longitudinal base of a tractor does running system less susceptible to asperity of a profile that reduces vertical moving of a case of a tractor and, as consequence, leads to decrease in vertical and angular moving on a case at transport operations (Fig. 5). At work with hook loading vertical accelerations and moving of a tractor with TCC increase, because of loading increase on suspension bracket BI and as consequences of increase in its rigidity. At work on such modes advantages of developed suspension bracket BI are shown - dynamically changing

depending on a skating rink course additional vertical force leads to decrease in the maximum amplitudes of angular fluctuations.

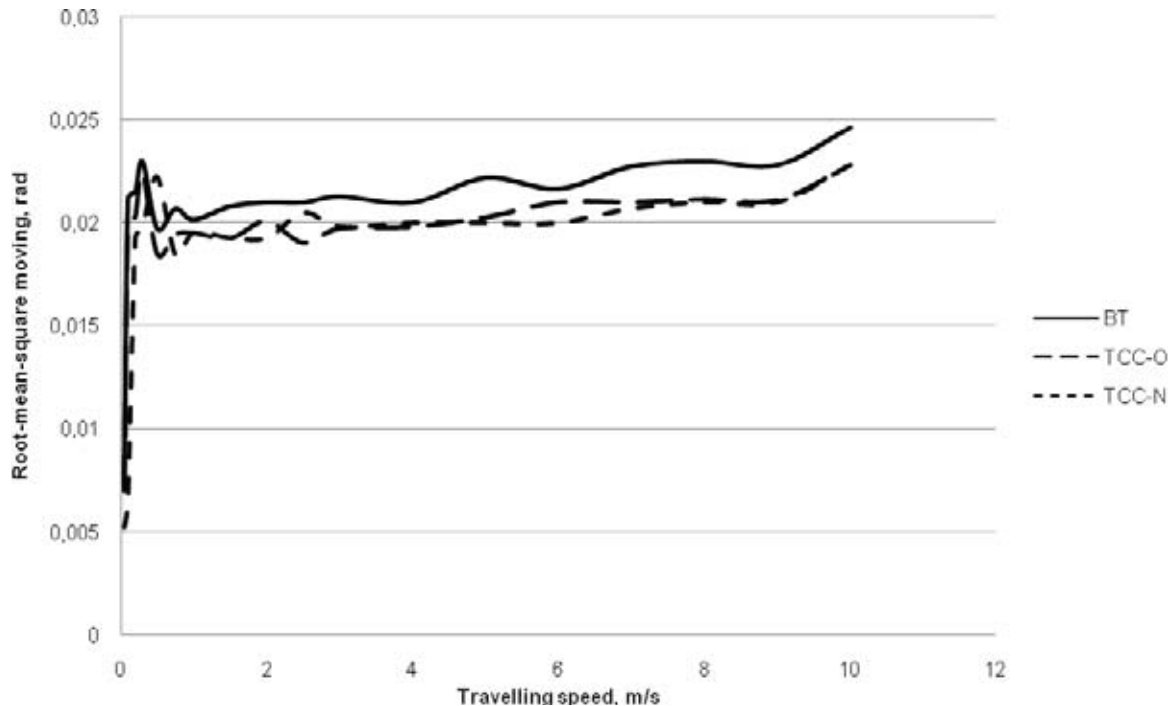


Fig. 5 Vertical conveyance of a case at driving with the tool in a transport rule on the soil road

Thus, the analysis of angular and vertical fluctuations of a case of a tractor with TCC and the offered scheme of suspension a back basic skating rink has shown, that such contour is comprehensible and to agricultural caterpillars. The basic application substantiated as updating of a serial tractor for work with heavy hinged tools.

Despite efficiency of the developed configuration with triangular caterpillar contour and suspension brackets BI is necessary to continue works on optimisation of the characteristic of a suspension bracket. As a first approximation there was a task in view of working out of running system with TCC applying serial knots of a suspension bracket of a tractor and a substantiation of possibility of application of the received system. The received results confirm validity of a direction of work. A following stage of work is carrying out of researches of influence of developed suspension bracket BI on smoothness of a course of a tractor on various operating modes. Also working out of a technique of optimisation of a suspension bracket of the developed running system as a whole under concrete conditions of operation is necessary.

References

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