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PRINCIPLES OF DIAGNOSING OF DRIVE LINES OF TRANSPORT AND TECHNOLOGICAL MACHINES

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In material of article justification of the specifying additional parameter of diagnosing of drive lines of transport and technological machines on an axial clearance in cardan bearing mount assemblies of hinges is presented. On the basis of pilot studies, in particular, according to the analysis of wear, on repair and operational actions of increase in a resource of cardan hinges, taking into account the available experience of operational observations and prerepair diagnosing of drive lines of tractors, cars and farm vehicles, the basic principles of diagnosing of drive lines depending on differentiation of conditions of their loading with inertia forces on rotary speed are offered.

For the purpose of successful technological modernization of agricultural production in a prime order require a solution of the problem of formation of the park of transport and technological machines in branch, optimum on qualitative and quantitative structure [1]. The qualitative party is characterized by the solution of a problem of providing a high technical resource of the equipment in operation, and in the course of the solution of a question of optimum quantitative structure there is a problem of drop of a different brands of the purchased equipment. Thus, first of all it is necessary to provide operability of the existing park of transport and technological machines.

Considering complexity of modern domestic and foreign transport and technological machines it is necessary to pay a close attention to development and improvement of the stationary, mobile and built-in technical means of diagnosing of units of cars which correct application shows their high technical and economic efficiency, for example, drop of idle times of cars and the equipment is reached in 2…2,5 times, and reduction of number of their repairs — in 1,3…1,5 times [2].

For increase in efficiency of technical means of diagnosing it is necessary to prove the principles of technical preliminary treatment based on measurement and control of functional and load parameters of assembly units of units and systems of cars which will allow to obtain reliable information for a short period with a possibility of assessment, a flashback and forecasting of their working capacity.

In the field of reliability of transmissions of transport and technological machines the works of scientists and production workers directed to probes of functional and load parameters and processes of their development in joints, for example, of the prof. Degtyarev M. G. — about working off of technological and operational actions of increase in reliability of transmissions of tractors [3] are known; prof. Leonov O. A. — on probes of operability of sealing joints of mechanical units of combines [4]; prof. Groshev L. M. — on development of preventive actions and service regulations of farm vehicles [5], etc.

On the basis of experience of these works we will consider the possibility of extension of the list of diagnostic parameters on the example of drive lines of transmissions of cars.

The work purpose — justification of the basic principles of technical preliminary treatment on the example of drive lines of the transport and technological equipment.

For achievement of a goal it is necessary to solve problems:
1) analysis of the critical functional and load parameters;
2) identifications of uninvolved parameters;
3) realization of the offered parameter in diagnosing.

In the course of development of modes of maintenance operation and repair of drive lines of agricultural machinery selective actions taking into account the valid technical condition of critical friction pairs — joints a crosspiece thorn – a needle bearer were offered combined (contain consistently repair and serving influences) [6]. However these modes resolve an issue of restoration of work faces of the mentioned joints doubly: first, restoration only of a cylindrical part of a thorn with replacement of work faces by turning movement of a crosspiece with bearing mount assemblies (RU 2234008), and secondly, restoration and cylindrical and face surfaces of a thorn with replacement of work faces by turning movement of the barrel and bearings concerning a shaft of thorns (RU 2232309).

The operational basis of the offered actions was made by the analysis of wear of elements of cardan hinges, out of service, on the example of the IV standard size on RD 37.001.665-96 [7]. As a result of probes it is established that at wear of diameters of thorns, butts of thorns, bearings and needle rollers the share of the details having a residual resource makes – 72, 55, 61 and 60,5%, respectively, and a share demanding restoration – 28, 45, 39 and 39,5%. Besides, on the basis of the chart of defects of Pareto by types of refusals taking into account the accepted error it is determined that main types of defects are wear of butts of thorns, rollers and bearings (as the importance). Thus, the parameter which limits operability of cardan hinges is, first of all, wear of butts of opposite thorns of a crosspiece.

In this regard there is a question of control of this parameter in use, for example, by measurement and control of an axial clearance in joint a crosspiece thorn – a needle bearer.

In practice of operational and prerepair preliminary treatment of drive lines probes are known of the prof. V. Ya. Anilovich and doc. V.L. Litvinenko [8], the prof. M. G. Degtyarev and the prof. I. E. Ullman [9] in whom results of definition of extreme technical condition of drive lines on the example of the K-700 and T-150K tractors are reflected. In these works devices, techniques and results of measurement of a radial play in bearing mount assemblies of cardan hinges of tractors in operation for the purpose of establishment of optimum maintenance rate or repair are described. However the further review of works shows that the question of measurement and control of an axial clearance for the purpose of establishment of extreme technical condition by scientists wasn't considered.

At probes of the phenomena of a sidesway in cardan bearing mount assemblies by the author it is established that the choice of an axial clearance at a sidesway of elements of a bearing mount assembly happens for the reasons of twisting of eyelets of forks and existence of a radial play therefore existence of communication between a radial and axial clearance is confirmed [10].

In the course of work according to the analysis of accuracy of dimensional chains of radial, axial and district spacings (method of a maximum minimum and a probabilistic mode) in bearing mount assemblies of cardan hinges according to the manufacturing plants the author came to a conclusion that comparison of the settlement and allowed values of an axial clearance on standard sizes shows presence of significantly wider range of the first and a deviation in a tightness zone that doesn't conform to technical requirements [11].

In this regard at operation of transport and technological machines depending on the mode of loading of cardan hinges with forces of inertia at working rotary speed of an operating condition of needle bearers differ, and respectively and values of parameter of diagnosing on an axial clearance. For example, the mode of behavior of the drive line of the car is characterized by drive of values of torques at high rotary speed, and a mode of behavior in tractor transmission — more value of torques at a little low rotary speed whereas the two-level fixed rotary speed of shaft of takeoff of power of 500 and 1000 min^{-1}, which as a result of transformation in knots of a mechanical drive gear by drive to working body is depressed is characteristic of farm vehicles.

At department of technical mechanics and designing of machines of the Belgorod state agricultural university of V. Ya. Gorin the device is developed for simultaneous measurement of radial and axial spacings in bearing mount assemblies of cardan hinges, working documentation is prepared and the measurement technique

is developed [12]. Approbation of the device took place in operation on the example of cardan hinges of a drive gear of working bodies of a grinder of siderat IS-2.

Proceeding from the presented justification, it is necessary to mark out the basic principles of diagnosing of drive lines of transport and technological machines on the basis of the entered diagnostic parameter on an axial clearance:

– preliminary settlement estimate of loading of elements of cardan hinges with inertia forces on characteristic modes of behavior of cars;

– a formation of the factors influencing an axial clearance in bearing mount assemblies;

settlement quantitative assessment of an axial clearance;

– measurements by the device of radial and axial spacings with the fixed measuring effort;

– establishment of critical parameter of the limit state and its extreme value corresponding to refusal;

– operational character of diagnostic information.

The main result of such approach when diagnosing drive lines is the possibility of development of real practical recommendations about holding actions of constructive or operational character for the purpose of drop of size of an axial clearance and elimination of its influence on durability of drive lines.

On the basis of the material given above it is possible to make the following generalizations.

1. On the basis of the analysis of pilot studies in the field of preliminary treatment of drive lines the specified diagnostic parameter on an axial clearance taking into account the mode of their work on rotary speed is reasonable.

2. The given basic principles of diagnosing of drive lines of transport and technological machines are basis for the solution of problems of development of technical means and tool techniques of diagnosing.

3. The prospects of the real probes consist in development and realization of original techniques of diagnosing of drive lines of transmissions of the transport and technological machines in operation based on various physical effects, for example, thermo - and vibration diagnostics.

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Анотація

Принципи діагностування карданних передач транспортних і технологічних машин

Пастухов О.Г.

В матеріалі статті представлено обґрунтування уточнюючого додаткового параметра діагностування карданних передач транспортних і технологічних машин по осьовому зазору в карданних підшипникових вузлах шарнірів. На підставі експериментальних досліджень, зокрема, по аналізу зносу, по ремонтно-експлуатаційних заходах підвищення ресурсу карданних шарнірів, з урахуванням наявного досвіду експлуатаційних спостережень і передремонтного діагностування карданних передач тракторів, автомобілів і сільськогосподарських машин, запропоновані основні принципи діагностування карданних передач залежно від диференціації умов їх навантаженості інерції по частоті обертання

Аннотация

Принципы диагностирования карданных передач транспортных и технологических машин

Пастухов А.Г.

В материале статьи представлено обоснование уточняющего дополнительного параметра диагностирования карданных передач транспортных и технологических машин по осевому зазору в карданных подшипниковых узлах шарниров. На основании экспериментальных исследований, в частности, по анализу износов, по ремонтно-эксплуатационным мероприятиям повышения ресурса карданных шарниров, с учетом имеющегося опыта эксплуатационных наблюдений и предремонтного диагностирования карданных передач тракторов, автомобилей и сельскохозяйственных машин, предложены основные принципы диагностирования карданных передач в зависимости от дифференциации условий их нагруженности силами инерции по частоте вращения