UDC 629.114.2

INCREASE OF OPERATIONAL RELIABILITY OF TRACTORS HYDROSYSTEMS

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Reserves of reliability increase of tractor hydrosystems without essential change of their designs are revealed, that allows to exclude direct contact of a working liquid to an atmosphere.

Key words: hydrosystem, hydropump, liquid, oil, operation

Introduction. Faultless work of the hydraulic system of tractor, its normal functioning depends on many factors in particular operating (work, degree of muddiness of working liquid, loading that arise up in exploitation et cetera).

Problem. Analysis of the tests taken from the capacities of hydrosystems, showed that content of mechanical admixtures in oil rose by 0,01...0,03% each 100 motohours of tractors work at initial contamination of working liquid 0,012... 0,015% . For example, for 240 motohours of tractor ХТЗ-221 work on ploughing with the plough ПЛН- 5-35 content of mechanical admixtures in oil increased from 0,013 to 0,020% due to their hitting in a hydraulic reservoir through sapyn. In the real exploitation middle muddiness of oil in hydrosystems can rise to 0,12%.

Analysis of the last researches and publications. By reserve of increase of the hydraulic systems adjustment to the external environments there can be realization of works on the further pressurizing of elements of their constructions. The exception of contact of internal cavities with an environment prevents a hit in the working liquid of abrasive particles, that is sucked in from an atmosphere that positively affects tenure of employment to the working liquid and capacity of hydrosystems [1,2,3,4].

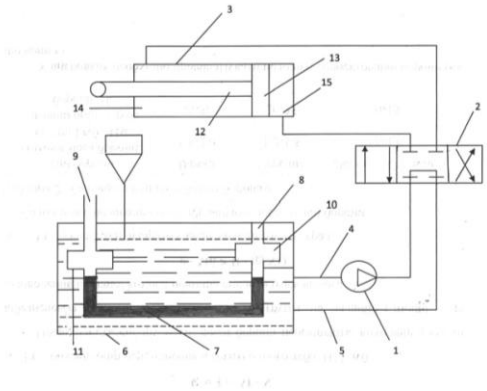
The purposes of researches: Aim of carrying out tests is development of chart of hydrosystems that eliminates a hit of abrasive particles with air from an atmosphere, research of dynamics of mechanical admixtures change in serial and experience hydrosystems from runtime.

Results of researches. The chart of the hydraulic system, where it is eliminated a hit in oil of abrasive particles with air from an atmosphere to the hydraulic reservoir (fig.1а, б), is worked out. Hydrosystem contains a hydraulic pump 1, distributor 2 and executive aggregate 3, that is connected by pipelines 4 and 5 with a tank 6 (fig.1а). In a tank U a vivid compensative tube 7 is submerged, the end of that is shown out above the mirror of liquid in a tank 6. Compensative pipe 7 from the side of free ends 8 and 9 has expansion 10 and 11, its free end 9 is turned into an atmosphere. An executing aggregate has rod 12 and piston 13, creating accordingly rod 14 and piston 15 cavities. At advancement of rod 12 from the

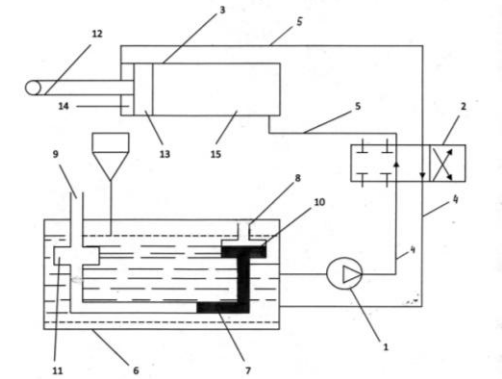
different volumes of piston 15 and rod 14 cavities level of liquid in a tank 6 goes down. Because of dilution that appears, liquid in a compensative pipe 7 moves toward expansion 10, freeing part of compensative pipe 7 from the side of expansion 2 for atmospheric air. Dilution in a tank does not appear here, as a general volume of tank does not change. In case if after advancement of rod 12 its involvement follows, the level of liquid in a tank will rise due to forcing out of executive mechanism 3 of greater amount of liquid. The increase of level of liquid is caused by the increase of pressure in a tank and liquid in a compensative tube 7 begins to move towards expansion 11. If the technology of implementation of agr work does not envisage moving of executive aggregate 3 in initial position during great while and rod 12 is, for example, in the pulled out position, then liquid in a compensate tube 7 occupies initial position because of possible uncloseness in connections and distributor 2. In this case at including of distributor 2 in position at that rod 12 is pulled in, that will promote the level of liquid in a tank 6 it will cause transferring of liquid to the compensative pipe 7 toward expansion 11. Thus, a working liquid in the tank of hydrosystems does not have a direct contact with air from an atmosphere that eliminates the hit of abrasive particles in an internal cavity to the hydraulic reservoir. After work the liquid cools down and volume diminishes. These overfalls of volume are perceived by a scray. Also in a primary period of work of hydrosystems and during work of hydrosystems of steering management there is making foam of oil. It results in the increase of pressure in a tank. In the absence of flowing the hydraulic system of the closed type will not require technical service to replacement of the working liquid. At the revision of pre-production models of hydrosystems with the aim of simplification of comfort of exploitation it was needed to change general arrangement of chart. The scray of volume of air, having regard to difficulty of its setting inwardly to the hydraulic reservoir, was mounted on a separate bracket outside of tank from two broadside sideburns interconnected by a tube. The internal cavity of one of sideburns is connected with an atmosphere, and other - with the internal cavity of hydraulic reservoir. The scray of volume is filled by oil, was set instead of sapyn, used in hydrosystems of tractor hitch of ХТЗ- 221of mass production [1,2,3,4]. The volume of scray is determined by a formula :

$$V = 2\pi R2\ L\ [1+ \lambda(t -15) - \beta(P-12)] \quad (1)$$

where R is a radius of rod (piston) of m; L is length of rod (piston), m; λ – factor of temperature expansion; β it is a coefficient of compressibility. As working liquids for a scray there were used mineral oils with a closeness ρ = 0,86...0,92 kg/of m3 at t = 20... 70°C. Coefficient of temperature expansion and compressibility for these oils: λ =7x 10-4 and β = 73 x of 10-7 1/MPa. Volume of scray in this case for hydrosystems of tractor hitch ХТЗ- 221 makes a 526 cm 3. Scraies with such volumes were set in the hydraulic systems of tractors of Т-І50к, ХТЗ- 221 for passing performance tests.



а)



б)

Fig.1. Chart of the hydraulic system that eliminates a hit in oil of abrasive particles with air from an atmosphere.

At the same time, in equal terms, the tractors of T-I50к ХТЗ- 221 were tested with serial hydrosystems [8]. Concentration of dust in the hydraulic reservoir of tractor at implementation of different agric. works was within the limits of a 145...272 mg/of m3. In the process of researches we determined the functional indexes of hydrosystems, indexes of the modes of loading at implementation of different types of works, condition of exploitation (including a temperature condition, dust of environment, physical and chemical analysis of soils), dynamics of contamination of working liquid (mechanical admixtures, foods of wear), dynamics of physical and chemical properties of working liquid in the process of exploitation, and also wear of details of aggregates improved and serial hydrosystems. On fig.2. the dynamics of change of mechanical admixtures in serial and improved hydrosystems bed from runtime is given . A chart shows, that an angle of slope is to abscise axis of curve that characterizes content of mechanical admixtures in hydrosystems with the scray of volume does not increase, in the same the time in serial hydrotrailed percent content of mechanical admixtures in oil grows sharply. The analysis of results of comparative tests of the serial hydrotrailed systems of tractors and hydrosystems equipped by scraies showed that wear of surfaces of hydroelectric generators that work in serial hydrosystems is considerably higher. Maximal wear of external diameter of the spreader slide-valves that work in hydrosystems with the scray of volume

(improved) made 2 мкм. A wear of external diameter of slide-valves of spreader that works in serial hydrosystems was within the limits of 10...20 мкм. A few greater wear also for distributors that work in serial hydrosystems (gaps in connections a slide-valve frame and valve- frame). A considerable difference on a wear is got at measuring of details of hydraulic pumps that work in serial and improved hydrosystems. For example, wear of leading and slave cog-wheels at the tops of teeth, and also pins of leading cog-wheel for hydraulic pumps that work in improved hydrosystems, practically was not perceptible, while for pumps that work in serial hydrosystems, was within the limits of 60...200 мкм.

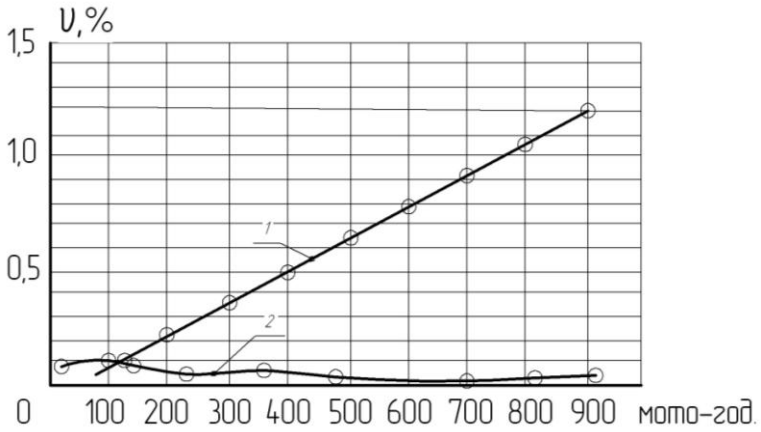


Fig.2. Dynamics of measuring of mechanical admixtures amount depending on operating time of hydrosystems: 1 - serial, 2 - improved.

Conclusions. There has been disclosed reserves of increase of hydrosystems reliability without the substantial change of their constructions due to application the scray of volume, that allows to eliminate the direct contact of working liquid with an atmosphere. In addition, the labour intensiveness of hydrosystems maintenance equipped by scraies went down by 1,5 times due to the exception of operations on washing of filters and sapyn and increase periodicity term of oil replacement at TO. These operations can be conducted only at seasonal service.

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ПОВЫШЕНИЕ ЭКСПЛУАТАЦИОННОЙ НАДЕЖНОСТИ ГИДРОСИСТЕМ ТРАКТОРОВ

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Ключевые слова: гидросистема, гидронасос, жидкость, масло, эксплуатация.

Резюме

Выявлены резервы повышения надежности гидросистем тракторов без существенного изменения их конструкций, что позволяет исключить непосредственный контакт рабочей жидкости с атмосферой.

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Summary

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