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ҒЫЛЫМ ЖӘНЕ ЖОҒАРЫ БІЛІМ МИНИСТРЛІГІ

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«КӨЛІК ЖӘНЕ ЭНЕРГЕТИКАНЫҢ ӨЗЕКТІ МӘСЕЛЕЛЕРІ: ИННОВАЦИЯЛЫҚ ШЕШУ ТӘСІЛДЕРІ» XI ХАЛЫҚАРАЛЫҚ ҒЫЛЫМИ-ТӘЖІРИБЕЛІК КОНФЕРЕНЦИЯСЫНЫҢ БАЯНДАМАЛАР ЖИНАҒЫ

СБОРНИК МАТЕРИАЛОВ XI МЕЖДУНАРОДНОЙ НАУЧНО – ПРАКТИЧЕСКОЙ КОНФЕРЕНЦИИ: «АКТУАЛЬНЫЕ ПРОБЛЕМЫ ТРАНСПОРТА И ЭНЕРГЕТИКИ: ПУТИ ИХ ИННОВАЦИОННОГО РЕШЕНИЯ»

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В сборник включены материалы XI Международной научно – практической конференции на тему: «Актуальные проблемы транспорта и энергетики: пути их инновационного решения», проходившей в г. Астана 16 марта 2023 года.

Тематика статей и докладов участников конференции посвящена актуальным вопросам организации перевозок, движения и эксплуатации транспорта, стандартизации, метрологии и сертификации, транспорту, транспортной техники и технологии, теплоэнергетики и электроэнергетики.

Материалы конференции дают отражение научной деятельности ведущих ученых дальнего и ближнего зарубежья, Республики Казахстан и могут быть полезными для докторантов, магистрантов и студентов.

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қаңқаның жойылу ықтималдығы артады. Сондықтан шинаның ішіндегі температура оның жұмысын шектейтін фактор болып табылады. Шинаның қызып кетуі болмайтын жұмыс тәртібін анықтауға мүмкіндік беретін жалғыз құрал - ТКвЧ өнімділік көрсеткішін есептеу. Есептелген ТКвЧ индикаторы негізінде жұмыс жағдайлары мен режиміне сәйкес келетін шиналар таңдалады.

Қорытындылай келсек, шинаның жұмыс жағдайына тікелей тәуелді жүктеменің және қозғалыс жылдамдығының өзгеруімен шинаның төзімділігі көрсеткіштерінің өзгеру заңдылықтары талданды. Қарастырылған пайдалану факторлары бойынша ережелер мен ұсыныстарды сақтамау көліктік және технологиялық машиналармен орындалатын жұмыс құнының айтарлықтай өсуіне әкеп соғатын кез келген зақымдану нәтижесінде шинаның елеулі бұзылуына әкелуі мүмкін.

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THE USE OF A SPRING INSERT IN THE SHOCK ABSORBER AND THE CROSSPIECE OF THE DRIVESHAFT

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The analysis showed that bearings and shock absorbers are non-recoverable elements that perceive the greatest share of wear. Increasing their durability and cost-effectiveness of manufacturing is a significant and urgent task. In a car, various groups of parts and assemblies are not equally reliable, some of them serve the entire operational repair cycle, others part of it, and others work very little time compared to the service life of the car before major repairs. Functional tuning is designed to bring the reliability of various parts and assemblies, which is not provided at the design and manufacturing stage, equally.

The design of a sliding bearing for reciprocating motion is proposed, in which the conditions of activation of the working surface by plastic deformation and suppression of oxidative processes are fulfilled [1, 2, 3, 4, 5]. For this purpose, the bearing is equipped with a movable insert in the form of a helical cylindrical spring (an intermediate element), which in the oscillatory mode is forcibly rotated only in one direction and thus uniform wear and lubrication distribution is achieved. The spring tension required to achieve microplastic deformations is created by its preload. In the oscillatory mode, due to the twisting or unwinding of the spring liner, elastic tension occurs, respectively, on the inner or outer surface, and it is forcibly rotated in one direction (ratchet effect). Suppression of oxidative processes in the proposed design is easily achieved by an oil seal. A positive effect is also obtained by reducing the adhesive component of friction (rest friction) and partial implementation of the ideas of N.E. Zhukovsky's "on motion without friction" (rotation of an

intermediate support) without using an external energy source for this. Such a bearing (Fig. 1) can be widely used instead of needle bearings of the driveshaft, suspension silentblocks, steering hinges and other pivots operating in reciprocating mode.

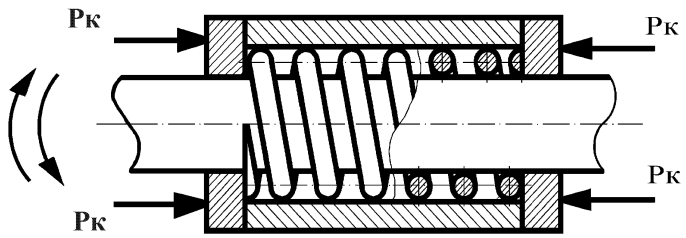

Figure 1. Scheme of a bearing with a movable spring insert

Examples of the implementation of some components of car units using a bearing of a new design are given below.

Needle bearings do not rotate, but only oscillate with small amplitudes (within the contact zone) and actually perform the function of a clutch between shafts with variable misalignment. Under the influence of torques arising during transmission through them, high contact stresses, dents are formed on the working surfaces of the bearings, called "false brinelling", and the most loaded bearing is jammed. In a standard needle bearing, there is no inner ring, and the surface of the pin serves as a raceway for needles.

(Fig. 2) shows a photograph of the part of the pin on which the bearing needles worked, with pronounced dents (false brinelling) formed during operation in severe road conditions.

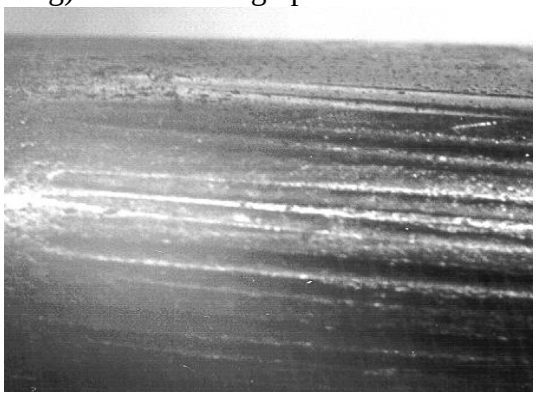

Figure 2. Sinks with traces of wear ("false brining")

In the crosspieces of the cardan joints, the same wear occurs as in the bearings of the pin suspension. For oscillatory movements with small amplitudes $\Delta\alpha$ (Fig.3) and large normal Rc loads, needle dents form on the working surfaces of the ring and the spike of the crosspiece, and further operation becomes impossible and dangerous.

The literature [8, 9, 10] also describes sliding supports containing fixed intermediate elements (inserts) in the form of cylindrical spiral springs with rigidly fixed coils, which could be used instead of needle bearings.

The necessary precision of manufacturing a traditional fit requires the use of high-precision equipment and expensive tools, which is economically unprofitable for the manufacture of a spring insert and parts mated with it. Therefore, it was proposed to make the spring insert conical, and the rest of the mating surfaces of the parts with it cylindrical.

Photos of worn parts of the bearing assembly of the crosspiece with traces of "false brining" are shown in (Fig. 3). The upgraded crosspiece of the VAZ Niva car is shown in (Fig. 4).

Figure 3. The appearance of worn parts ("false brining")
of the bearing assembly of the crosspiece
a) – bearing cage;
b) – the axle of the crosspiece


Figure 4. The upgraded crosspiece of the VAZ "Niva" car

Suppression of oxidative processes in the proposed design is easily achieved by an oil seal. A positive effect is also obtained by reducing the adhesive component of friction (rest friction) and partially implementing the ideas of N.E. Zhukovsky "on motion without friction" (rotation of the intermediate support) without using an external energy source for this. Such a bearing can be widely used instead of needle bearings of the driveshaft, suspension silentblocks, steering hinges and other pivots operating in reciprocating mode.

In this work, the object of the study was the rear shock absorber of the VAZ 2108 car, (Fig. 5).

Changes were made to the design of the shock absorber piston concerning the piston ring, made according to the type of helical cylindrical spring with preloaded coils. The material of such a ring is a square–section wire made of 65G copper-plated steel.

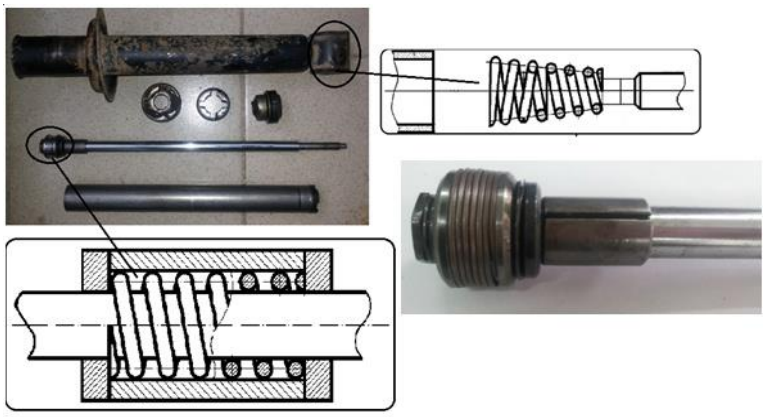

Figure 5. The rear shock absorber of the VAZ 2108 car:
the design of a piston with a seal made of a square-section helical cylindrical spring
with preloaded coils.

The proposed sliding bearings for reciprocating motion can be used in railway, automobile transport, suspension units, shock absorbers, steering, cardan gears, bearing units of aircraft, electrical contactors, sewing, mining, oil and gas production and processing industries and some others where traditional sliding and rolling bearings are used under heavy loads in the reciprocating-rotational mode [11].

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