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DETERMINATION OF STRENGTH CHARACTERISTICS OF ASTERISK THE LIFT GEAR BOX

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To maintain the vehicle fleet in a technically sound condition requires the use of sophisticated means of maintenance, improvement of technology and organization of work, a sharp increase in the productivity of repair workers. Damage to downtime of defective vehicles can be reduced by mechanization and automation of repair work, as well as by improving production management.

Well-organized maintenance, timely elimination of problems found in the units and systems of vehicles with highly skilled work can increase their durability, reduce downtime, increase the time intervals between repair runs. This can significantly reduce non-production costs and increase the profitability of operating vehicles.

The process of repairing gearboxes of cars consists of their removal, repair and installation of the repaired unit in its previous place. Currently, the gearbox removal is carried out by means of a device for removal and installation of a gearbox or by means of a crane for replacement of units.

The first – winch type. The worker installs the device in the cab of the car, then clings the chain to the check point with the help of a hook, climbs under the car and, disconnecting the box from other units of the car, climbs into the cockpit, lowers the box on the floor on a pre-delivered cart, detaches the hook of the device and tow PPC to the place of repair.

Even more complicated is the process of installing a gearbox on a car: repeating all the above operations in reverse order makes it very difficult and dangerous to fix the primary shaft of the unit with the centre of the crankshaft of the engine: it takes a lot of time and effort, and the work is done almost manually. A three hundred-kilogram swinging gearbox can injure your fingers.

The second type is used by pre-hanging the car on the hoist and supporting it with additional insurance racks. Fit the crane under the gearbox, set the rotary pickup under the unit, detach the box from the car and take out with the help of the crane from under the car. With the help of an electric hoist move the check point in the aggregate area. At least two workers are involved here: one precisely adjusts the crane and keeps it from self-extracting, and the other separates the gearbox from the vehicle. The process is safer, but no less time consuming.

All these disadvantages of using these devices make it necessary to maximize the mechanization of the process while minimizing its complexity. Therefore the authors [1] designed for the removal and installation of transmission units an electromechanical hoist, which can be used for work in both the ditch and floor type transmissions.

Hoist, moving along the ditch, allows you to move the device with the gearbox installed on it along the axis of motion of the car (fig. 1). Movement of the transmission in height is carried out by the mechanism of lifting. The transverse movement of the unit is done manually by rotating the flywheel of the carriage drive. Thus, it is possible to move the unit in three planes.

This not only moves the gearbox but also aligns the primary gearbox shaft with the crankshaft axis of the engine and then installs the gearbox. Moreover, when the repair post is equipped with a hoist for lifting cars, it is possible to move the unit outside the vehicle with subsequent transportation by electric hoist to the transmission unit repair section. The process is serviced by one person.

The technological process in the field of computer technology has significantly changed the views on setting and solving engineering problems. Recently, numerous methods of calculating complex physical systems using software complexes have become increasingly widespread.

SolidWorks has become particularly popular with both scientists and engineers [2]. This powerful design tool has significantly improved the engineering design standards and methodology of this process in many areas and allows you to build a precise part model and finite element method to determine the performance parameters (SolidWorks Simulation application [3]) that occur in it under specific operating conditions.

The authors of [1] carried out a static analysis of the most loaded part of the designed electromechanical lift – a power screw (fig. 1, item 1). In the analysis of the simulation results it is found that the maximum nodal stresses, displacements and deformations do not exceed the permissible values (minimum strength factor n = 2,99729, which is less than the permissible [n] = 1,5).

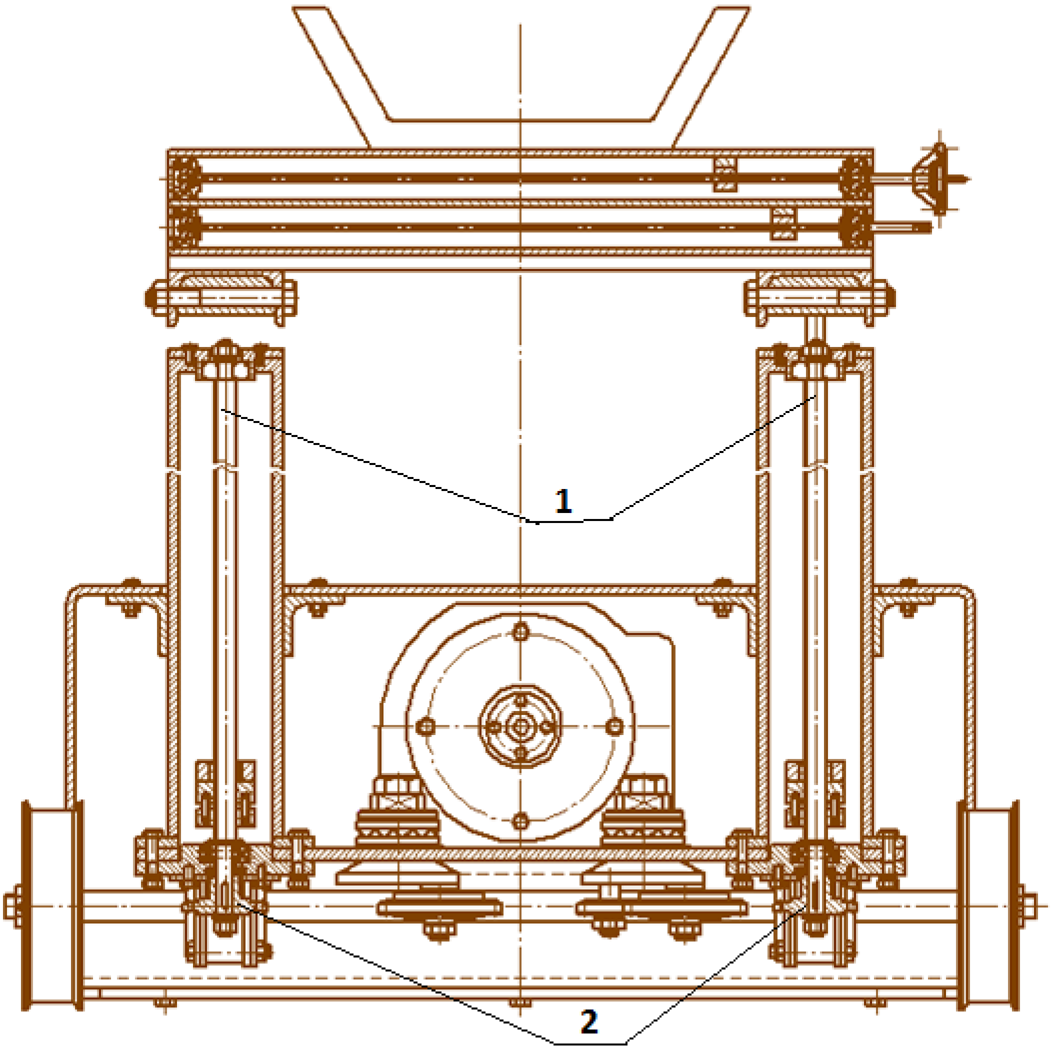


Fig. 1. Hoist for removal and installation of a gear box: 1 - power screws; 2 - asterisks

But often the reason for the destruction of the structure is not a violation of strength, but a loss of stability of the balance of its individual elements. Therefore, the following study of the power screw, which can prevent its destruction – the loss of stability (calculations of linear statics using finite element technique) was carried out by the authors [3]. It is established that the safety margin of the screw is n = 172,555, that is, its loss of stability does not occur.

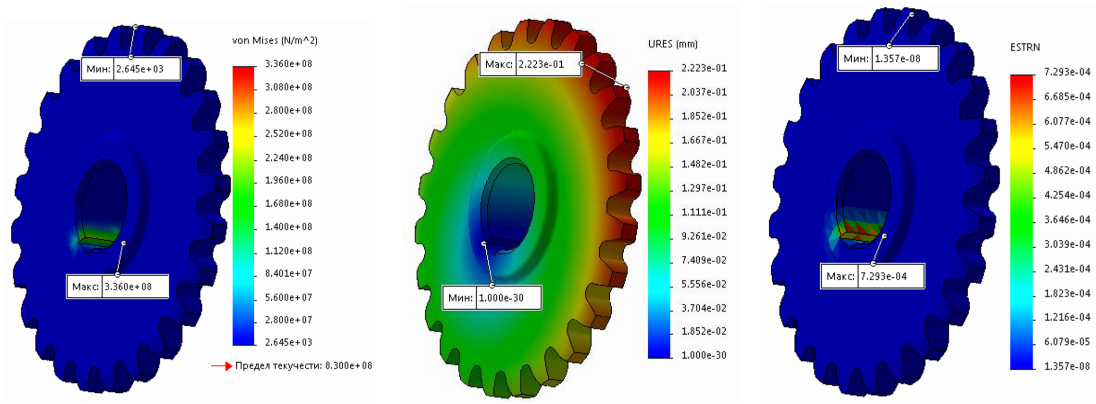
The purpose of these calculations – to continue the study of the ability of the lifter: to determine the strength characteristics of its asterisk (fig. 1, item 2). For this purpose, SolidWorks [3] created its model. The beginning of calculation of an asterisk – the choice of its material from the library SolidWorks Simulation: steel 45 GOST 535-88. This type of steel is the cheapest, heat-treatable. It is an excellent material for parts that require increased strength.

The following step – definition of a star support, application of loading and creation of a grid of a solid-state model (fig. 2).

a *b* *c*

Fig. 2. Definition of support (a), application of load (b) mesh solid-state model (c) sprocket

The results of the calculations are shown in fig. 3.



a *b* *c*

Fig. 3. Contour plots of total von Mises stresses (a), total displacements of URES (b), equivalent deformation (c) of an asterisk

Thus, the maximum nodal von Mises stresses occur at node 6683 and are 3.360e + 08 N / m ^ 2; the maximum resulting displacement of the asterisk URES is formed at node 654 and is 2.223e-01 mm; the maximum equivalent deformation of the ESTRN occurs in the element 5595 and is 7.293e-04; the minimum factor of safety margin of FOS is at node 6683 and is equal to k = 2.470e + 00, that is, the asterisk strength is guaranteed.

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