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RESOURCE-SAVING AND ENVIRONMENTALLY FRIENDLY TECHNOLOGY FOR APPLYING ANTI-FRICTION COATINGS

Today, issues of ecology, environmental protection are highlighted among the global priorities of human activity in all areas, including the operation of agricultural machinery (ACM). It has been proved [1] that the content and emission of harmful components increases sharply during the worn out engines operation of a mobile ACM, which leads to contamination of agricultural lands, a decrease in the quantity and quality of products and, in general, a deterioration in the environment. Consequently, the issues of quality improving of ACM friction parts and improving the ecology of the environment are both modern and urgent tasks.

The problem of increasing the ACM friction parts durability can be successfully solved by applying antifriction coatings (AC) [2]. In addition to its main functions of increasing the surface antifriction properties, AC can be used as restorative; running-in, solid lubricating and multifunctional coatings. Among the known schemes for applying AC [3], the simplest to implement and does not require the use of complex equipment is the method of finishing anti-friction non-abrasive treatment (FANT), the features of which include: low consumption of coating material and mechanical energy during rubbing, relatively short process duration when using automated equipment, high stability and quality of the coating, and most importantly - environmental friendliness. FANT allows: to reduce the running-in time of parts by 1.5 - 2 times, to eliminate scuffing of parts friction surfaces, to increase the bearing capacity of parts and joints, to protect the friction surface from hydrogen wear, to reduce the friction temperature and to extend the operating period of the friction unit when the lubricant supply is turned off, to reduce coefficient of friction and thereby reduce the consumption of ICE fuel and the emission of harmful substances into the atmosphere [4].

The feasibility of using FANT in relation to the ACM units is convincingly proved in the works [5, 6, etc.], which indicate a wide list of friction units for grain harvesters and other mobile agricultural machinery. At the same time, it should be noted that the existing FANT technologies are characterized by low productivity, uneven coating thickness, heavy loads on the tool and significant heat generation. So the current FANT process of cylinder liners does not provide sufficient hardening of the parts surface, and, therefore, wear resistance for a longer period.

To solve the problem of increasing the wear resistance and adhesion strength of the coating to the base, we propose the use of a combined processing method. The possibility of combining FANT with the methods of cold plastic deformation, in particular with deforming broaching, made it possible to increase the productivity of the process, as well as the quality of finishing processing of the sleeves holes [7].

The performed operational tests showed that the developed resource-saving and environmentally friendly technology of applying antifriction coatings FANT of cylinder liners using deforming broaching made it possible to reduce the wear of the part surface, reduce the cost of its restoration, and also increase the cylinder-piston group resource of mobile ACM engines during operation. The proposed technology of combining FANT and deforming broaching can be recommended in the manufacture and restoration of agricultural machines friction parts.

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RESEARCH ON A NEW TYPE OF CENTRIFUGAL LATHE FIXTURE

When machining small and medium-sized shaft parts on a lathe, the following problems are often encountered:

1. The center chuck of the three-jaw automatic positioning shaft is used to install the fixture on the ordinary lathe, and it needs to be started, closed and released repeatedly [1].

It is troublesome to lock the workpiece with a fixture. When used for multi-fixture assemblyor precision turning, the workpiece installation error is relatively large, the required time is long, and the labor intensity of the workers is high.

2. The use of centrifugal force lathe fixtures can greatly shorten the installation time. However, the centrifugal force fixture that usually uses three sets of counterweights and leversfor external automatic centering of the workpiece will produce larger axial positioning errors[2], and the centering accuracy is low.

3. The centrifugal force fixing device used to load and unload the workpiece with the opposite center and the center of the outward bending is easy to damage the end surface of theworkpiece.

4. Many existing lathe fixtures use electromagnetic or hydraulic devices to provide power [3], which consumes energy and easily causes environmental and safety issues.

A new type of centrifugal clamping device can be designed to make the lathe centrifugal clamping device work safely and reliably, and solve the problem of frequent opening and closing of the universal chuck. The traditional centrifugal clamping device cannot automatically determine the center of the spindle, and the centrifugal force disappears when it stops.

The main shaft drives the main body of the fixture to rotate, the counterweight generates centrifugal force [4], and the lever swings to make the claw clamp the workpiece radially. Atthe same time, the control rod drives the sliding block to move to the left, and the centering device eliminates the unbalance factor to ensure that the jaws automatically clamp the middleworkpiece.

The slider moves to the left. Under the action of the spring, the positioning rod is positioned and clamped [5] to ensure that the sliding rod will not be reset due to the loss of centrifugal force when stopping, thereby causing the workpiece to loosen.