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Modern Technology of High-Speed Spraying

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Abstract: *As a result of the wear of some parts, agricultural machines change their main effective indicators. Therefore, worn parts must be restored or strengthened, and in extreme cases replaced with new ones. The article presents information about the method of restoring the working bodies of agricultural machinery by high-speed spraying.*

Keywords: *plows, harrows, huskers, cultivators, wear of parts, high-speed spraying technology, combustion chamber, coatings, durability of parts.*

In agricultural production, a large number of agricultural tillage machines are used, such as plows, harrows, cultivators, cultivators and others.

As a result of the wear of some parts (ploughshares, disc knives, harrow teeth, paws and razors, as well as cultivator hillers), agricultural machines change their main effective indicators. Therefore, worn parts must be restored or strengthened, in extreme cases, replaced with new ones. [7,8]

The nature and amount of wear of parts is essential when choosing a restoration method and its parameters.

An analysis of the literature data showed that the wear of various structurally similar groups of agricultural machine parts ranges from 0.3 to 10 mm. The greatest number of parts has wear up to 2 mm.

High-speed spraying technologies are considered to be the most modern gas-thermal methods.

Fundamentally, these methods are no different from gas-flame methods, however, due to the design features of the burner, very high spray rates are achieved in them (Fig. 1).

There are various implementations of the idea of high-speed deposition. For example, one of the options includes a combustion chamber and a long cylindrical nozzle, cooled by water. Oxygen and combustible gas are blown into the chamber under high pressure. Strictly along the axis of the burner, the powder of the sprayed material is fed. A mixture of molten powder particles and gas combustion products, passing through the nozzle, accelerates to supersonic speed and flies out in the direction of the substrate. In the systems of high-speed spraying of the first generation, the pressure in the combustion chamber was 0.3-0.5 MPa, the particle escape velocity reached 450 m/s. To further accelerate the emitted particles, the pressure in the chamber is increased to 1-1.5 MPa, a nozzle is introduced into the gun design. The particle escape velocities in this case exceed 1000 m/s.

Coatings obtained by the high-speed method are characterized by density values reaching 99% of the density of a compact material and a low level of residual stresses. Since the presence of the

latter is the main factor limiting the thickness of the coating, high-speed spraying makes it possible to obtain coatings of much greater thickness compared to flame spraying.

High speed deposition technologies are unsurpassed for restoring and extending part life.

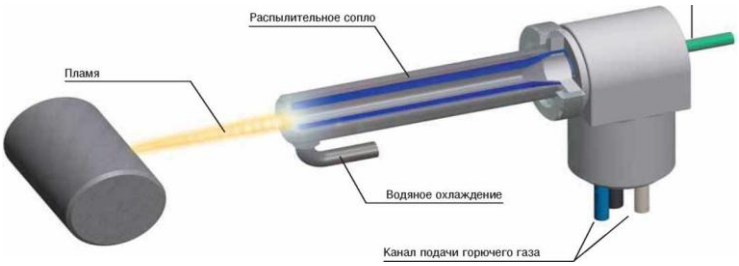

Fig.1- Scheme of high-speed flame spraying

In developed countries, high-speed deposition has almost completely replaced the methods of vacuum and some other types of deposition and made it possible to abandon extremely unfriendly galvanic coatings.

Given the greatest interest of agricultural producers in the repair and strengthening of parts of the working bodies of cultivators, in our research, experiments were mainly carried out to restore the paws of cultivators and some other parts.

In the existing technology, in order to give the cultivator's paw the effect of self-sharpening, a layer of hard alloy Sormite-1 with a thickness of 0.7 ... Application time is up to 8 minutes. The deposited blade is sharpened on a peeling and grinding machine from the front side at an angle of 8...10° (chamfer width 6...7 mm). [7,9].

The proposed technology of high-speed flame spraying of cultivators' legs is carried out as follows.

Curly and flat parts are sprayed manually or using a copier, while the layer thickness in one pass can be from 0.1 mm to 2.0 mm. The part is preheated with a torch with an excess of acetylene in order to counteract surface oxidation.

When spraying sections of considerable length after the first pass, stop the powder supply and start the process from the cooled end of the part. The main layer is applied in several passes; the thickness of the coating should be no more than 2.0 mm per side. The spraying time of one foot of the cultivator does not exceed 1 min. The sprayed layer is even, the processing allowance is 0.1 ... 0.3 mm. A soft local source of heating - a gas flame - practically eliminates the deformation of the cultivator's paw, [9,10].

Using the advantages of high-speed flame spraying of powders, it is possible to eliminate a number of disadvantages of previously used technologies.

To reduce the cost of the spraying process, the effect of various powder mixtures was studied. As a result, a mixture of Sormite-1 powders with PG-KhN80SR4 powder was developed in a ratio of 82%, 18% by weight, which gave good results. The specified alloy, sprayed on the paws of cultivators, increases their durability by 2...5 times more**.**

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