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DESIGN OF A WASHING MACHINE WITH A SCREW ACTIVATOR

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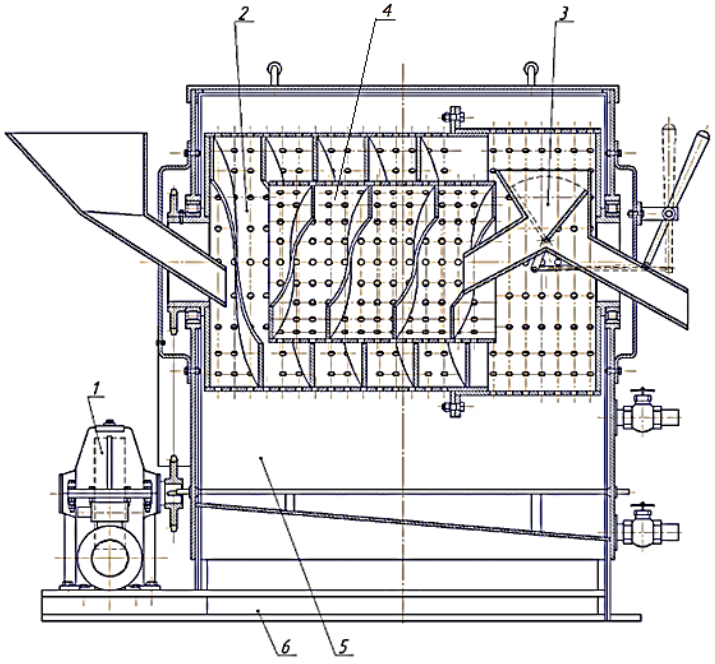
Technological equipment for washing and cleaning operations is important in the production process of machine repair. One of the methods of cleaning products is immersion in a washing solution, which involves a complex effect on contamination of physicochemical and mechanical factors. To intensify the cleaning process, activators are used, which can be hydraulic, pneumatic, vibrational and mechanical. In turn, machines equipped with mechanical activators are divided into rotary, screw and blade.

Screw washing machines are innovative equipment designed for effective cleaning of parts with complex surfaces or hard-to-reach areas. The principle of operation of such machines is based on the use of rotating screws capable of providing uniform and intensive mechanical impact on contaminated surfaces [1].

The washing machine consists of a frame, a drum and a drive (Fig. 1). The frame is a welded structure on which the bearing housings, the electric motor and the gearbox are bolted. The tank of the washing unit is also located on the frame, above which the drum is mounted.



1 – drive, 2 – outer drum, 3 – discharge chute, 4 – inner drum, 5 – tank, 6 – frame

Fig. 1. Submersible washing machine with auger activator

The drum is welded from sheet steel and consists of an inner and outer drum with coils placed between them. The rotation of the drum is transmitted from the electric motor through a clutch, a worm gear and a chain drive.

Parts are placed inside the machine, where a screw mechanism ensures their uniform movement through the cleaning solution. Screw machines are equipped with rotating screws that move, moving the parts along the entire length of the washing process. The screws provide intense mechanical impact on contaminated surfaces, effectively removing even persistent deposits and oil films.

To prevent the evaporation of the cleaning solution, the drum with the tank is closed with a lid. For better loading of parts, a loading tray is installed, through which the parts enter the outer drum. During the cleaning process, the parts from the outer drum are fed into the inner drum by means of coils. For better unloading of parts, an unloading tray is installed in the drum, inside of which a flap is placed. To unload parts from the drum, it must be opened.

As the parts move through the machine, a cleaning solution is used to increase cleaning efficiency. After the wash cycle is complete, the parts are rinsed to remove detergent residue and then dried.

The performance of a screw activator machine is determined by the formula [2]

$$П_M = \frac{pd^2}{4} \times S \times n \times r \times j \times C_a, \quad (1)$$

where d – auger diameter, m.d = 0,25…0,5 m;

S – screw pitch, m. S = (0,8…1,1) d;

n – screw rotation speed, min^{-1}. n = 50…70 min^{-1};

ρ – bulk density of cleaning objects;

φ – fill factor. φ = 0,13…0,16;

C_α – coefficient that depends on the angle of inclination α tangent of the cones to the axis of rotation of the screw. When $\alpha = 20^O$ C_α = 0,65.

The diameter of the screw should exceed the size of the objects being cleaned by 12…15 times.

The required power of the electric motor is determined as follows

$$N_M = П_M \times L \times k_Д \times g / h, \quad (2)$$

where L – auger length, m;

$k_Д$ – drag coefficient. $k_Д$ = 4…5;

g – acceleration due to gravity, m/s^2;

η – drive efficiency.

The advantages of machines with a screw activator are the efficiency of cleaning parts of various shapes and complexity; removal of various types of contamination; automation of the process, which reduces the need for manual labor.

Screw washing machines are modern equipment that provides a high level of cleanliness of complex parts, which makes the cleaning process more efficient and versatile.

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