

FEATURES OF APPLICATION THE ROTATIONAL CUTTING DEVICE FOR PROCESSING OF ROAD CARPETS

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An object of probe is the rotational cutting (RC) device. The RC device is intended for destruction of ice and solid formations on road coverings. The RC device is developed within the START-2010 program and its design is protected by No. 96875 patent Russian Federation.

The RC device contains a frame on wheels with bearings with a drove in the form of a cylinder. Satellites with cutting elements are installed on the cylinder. Satellites are located symmetrically with regard to their bearings of fixing. The driving engine is fixed on a frame. The cylinder is connected to the engine by means of a rotation shaft. The rotation axis of a shaft is located parallel to the base where there are frame wheels. Satellites are evenly distributed on the cylinder drove. The rotation axis of each satellite is deployed with the axis of the shaft drove to some non-zero α angle. Cutting elements on the satellite can be executed in the form of a coil.

The device works as follows. The cylinder drove is brought into rotation by means of the engine. During the rotation of a cylinder cutting elements of one of the satellites are in contact with the processed surface. By gravity devices cutting elements destroy a surface in a zone of contact piece and form satellite gearing with a surface. It is formed the instant center of speeds of the satellite in a zone of gearing. The rotation axis of the satellite moves with the forward speed equal to the corresponding district speed of the cylinder. Movement of the satellite shaft relative to the instant center of speeds causes an angular movement of the satellite as a solid. Complex angular movement of the satellite leads to shift of particles on a processed surface from a contact piece zone on all length of the satellite. The frame of the device moves progressively in the direction of destroyed ice and solid formations and provides a continuous process of processing of a road coverings.

The height of a processed layer is defined by satellite radius: the more the radius, the more depth of a processed layer. The loads on the bearing satellite increase when the depth of a processed layer increases. Satellites with cutting elements are symmetrized with regard to bearings of their fixing in an offered design. Therefore, their load capacity is higher than the console installation of bearings of the satellite. Consequently, the resource of the proposed RC device will be more.

The mathematical model of functioning of the RC device is created. The model describes the manual and automatic control modes with a horizontal and vertical shaft drove. The RC device automatic control system is developed. Probe of manual and automatic modes of behavior is executed. 3-D model of the RC device is developed. The RC device prototype with a horizontal shaft is made drove. Prototype test in laboratory and field conditions in manual control mode is made. Forces of cutting of various materials and geometrical characteristics of the processed surface are measured. Estimates of productivity of the RC device by results of laboratory and field researches are executed.

The operating sample of the RC device has the following characteristics: the maximum depth of milling is 20 mm; nominal width of a milled strip of 40 cm; speed of processing of asphalt to 360 meters per hour; weight is 40 kg; outline dimensions in the transport provision of 555*500*300 mm; drum drive gear – the petrol four cycle engine.

The considered RC device can be applied to service and repair of asphalt roads, sidewalks, domestic territories. Production and operation of the RC device is economically effective: it represents the inexpensive small-sized self-contained unit in comparison with road mills and milling cars.