MULTI-FUNCTION DEVICE OF A CANAL CLEANER
FOR PERFORMING A COMPLETE CLEANING OF DRAINAGE CANALS

МНОГОФУНКЦИОНАЛЬНЫЙ РАБОЧИЙ ОРГАН КАНАЛООЧИСТИТЕЛЯ
ДЛЯ ВЫПОЛНЕНИЯ ПОЛНОГО ЦИКЛА ОПЕРАЦИЙ ПО ОЧИСТКЕ
МЕЛИОРАТИВНЫХ КАНАЛОВ

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Abstract: We offer a multi-functional operating element of rotary type for a channel cleaner, which is capable of performing the entire
cycle of cleaning household water reservoirs (ponds), in particular: 1. due to the compound rotor: 1.1. mow and chop the crop;
2. due to the implementation of detachable body: 2.1. mill and transport “dry” soils using a jet of air; 2.2. pump water; 2.3. extract and
transport the soil from under the water;
3. due to the installation of the teeth on the lower movable part of the body: 3.1. work as a clamp grapple to remove garbage from water
reservoirs (ponds).

The basis of multifunctionality of this invention is in the principle of implementation of the maximum number of hidden abilities of
the initial technical system, its rotor, framing, manipulator parts, which implies the subsequent creation of a reclamation robot.

Keywords: WATER RESERVOIRS, CLEANING, OPERATING ELEMENT (WORKING BODY), SOILS, MILLING CUTTER,
THROWER, PUMP, GRINDER, MULTIFUNCTIONALITY

1. Introduction

Care for water supply channels occupies a significant place in the
reclamation activities, because without proper maintenance these
facilities are non-functional. Cleaning of farm reservoirs includes
several operations:
- mowing, grinding and removal of vegetation;
- immediate removal of sandbar soils;
- removal of large inclusions.

The following operations should be performed:
- in dry soils;
- in waterlogged soils;
- under water.

For each operation, and for each option of soil conditions it is
required a special operating element (mower, milling cutter, pump
and so on. Thus, it is necessary to have a set of different devices,
and each time to install them on the base machine, using transport
and lifting equipment, time and manual labor.

To reduce the complexity of cleaning the channels by eliminating
secondary operations and by increasing the flexibility of the
cleaning process, we offer multi-functional device for the canal
cleaner, which can be adapted to various operations and ground
conditions.

2. The problem solution

It is able to:
- due to the compound rotor [1], (fig. 1):
  - mow and chop the crop (fig. 2);
- due to the implementation of detachable body[2], (fig. 3):
  - mill and transport “dry” soils using a jet of air (fig. 4);

fig. 1. Compound rotor multi-function device.

fig. 2. Scheme cutting vegetation in cross section a rotor blade.

Opposite rotating parts of the rotor have cutting edges which are formed
by H-shaped cut contour on the rotor blades. They grind up all kinds of
crop to the size to ensure its passage between the rotor blades. Later this
crop is removed along with the soil during the next operation.
**fig. 4.** Extract “dry” soils using a jet of air.

The lower half of body is transferred to the upper position and fixed releasing cutting edges of the rotor blades. As the rotor rotates, the ground is cut by end edges, shifted to the working surface of the blades, dispersed and ejected through the exhaust window to the desired distance from the channel.

--- pump water;

To perform this function the lower part of the body is transferred to the lower position, forming inner working volume of enclosure, its outlet is equipped with a pressure pipe (servo drive or manually) and the inlet – with a suction nozzle [3, 4, 5], (fig. 5).

**fig. 6.** Removal of water from household wooden

Spiral casing design with permanently installed pipe line is designed, manufactured and tested to reduce the difficulties for installation and removal of pipe, and to improve efficiency when operating as a pump[6], (Fig. 7).

**fig. 7.** Multi-function device with spiral casing and permanently installed pipeline

Testing the given device proved expediency of its use. Nozzles chance their functions by opening-closing the propellant tube.

--- extract and transport the soil from under the water (fig. 8);

As the rotor turns water in the working volume of the body is dispersed by the blades in the circumferential direction and due to centrifugal acceleration it rushes to the periphery, creating excessive pressure. Due to the pressure difference in the periphery of the body and in the pressure pipe outlet water (or water-soil mixture) is removed through the outlet and pipe from the enclosure at a desired distance (fig. 5). In the central part of the body a vacuum is formed, and the new amount of water is supplied from outside through the suction nozzle.
Experience has shown that under free water intake alluvial soils are not destroyed if to clean channels using the device discussed above. To intensify the cleaning of flooded channels, a combined hydro-loosening system in the form of two alternately working nozzles (fig. 9) which are controlled by a hydraulic drive of the base machine is mounted on the movable and detachable part of the body (housing).

Moreover, the pipes are installed in the abnormal portion of the body where the rate of water flow outpaces the circumferential velocity of the peripheral portion of the rotor and, therefore, the pressure on the loosening jets (20m) exceeds the pressure in the discharge line and is sufficient for loosening the soil.

Regime of shift work of nozzles is done by electronic hydrodistributor. This provides a highly efficient destruction of dense soil, bringing consistency of water soil mixture up to 40%.

Version of multifunctional working device with a vertical orientation of the axis of rotation is also designed, manufactured and tested, thus eliminating the suction pipe (nozzle) and mechanizing the process of changeover.

Unitization of this working body with rotary-screw propulsor (RSP) [7, 8, 9] makes its use in the intracanal version even more versatile since in addition to the obvious advantages of the RSP in working on liquid soils and its high maneuverability, it will be used for cutting soil.

3. Conclusion

The basis of multifunctionality of this invention is in the principle of implementation of the maximum number of hidden abilities of the initial technical system, its rotor, manipulator parts... This is consistent with the laws of development of technical systems and in the long term implies the creation of industrial ground robots that adapt to the technological requirements and various soil conditions. Creation of a reclamation robot will allow to complete the entire cycle of canal cleaning work daily, including weekends and holidays at maximum capacity, with only partial participation of an operator.

The device has been tested in the Nikolayev region of Ukraine and in the Nizhny Novgorod region of Russia.

4. Literature

2. Useful model patent №129492 RU, B65G31/04. Rotary thrower / E. G. Ivanov, V. N. Novichkov, P. V. Pchelnikov. – stated 05.02.13; published 27.06.13.


