Device for cleaning irrigation trays

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Abstract. In the following years, due to the sudden change of weather conditions from year to year, global warming, the need for water and its careful conservation, and informing everyone that water is not free, is becoming one of the important daily tasks. Especially in our country, solving these issues is the most important and responsible, which is reflected in a number of programs and decisions adopted in our country. This includes transferring existing inter-farm and intra-farm irrigation systems to a closed system as much as possible, using new innovative technologies, increasing the efficiency of irrigation systems in necessary areas, covering canals and ditches with the ecessary coatings, addition, measures for the implementation of cleaning works on the ground and cover irrigation systems, respectively, are being carried out on a regular basis, and the control work will be at a higher level. The article describes the conclusions on rational use of irrigation systems, increasing their efficiency, applying economical irrigation technologies, improving management and raising the technology of cleaning orks to a higher level, as well as the parameters of the proposed cleaning device.

1 Introduction

In addition to the improvement of land reclamation in our country, it is important to widely apply scientific and practical works such as rational use of all irrigation systems, increasing their useful work coefficient, improving management and raising the technology of the work to a high level. is given importance.

In the dialogues of the head of our country with the employees of agriculture and water management, the following important tasks were also pointed out, in addition to the wide introduction of water saving and the use of high water-saving technologies.

The first important task is to concrete canals and ditches. The second important task is to introduce water-saving technologies. The third important task is to reduce the cost of water delivery [1].

In the State Program adopted in our country, tasks such as the effective use and use of land reclamation techniques, work equipment and construction machines have also been specified. It is necessary to expand the operating range of the existing techniques and to constantly improve them. Of course, when hydromelioration works are carried out with

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machines, cost reduction and efficient use of machines are one of the main issues. For this purpose, it will be possible to improve the performance and technical level of machines only by fully meeting the constructive, technological operational, social and economic requirements of modern techniques [1, 2].

2 Materials and methods

The use of concrete-covered and newarkas, which are one of the domestic irrigation systems of the farm, shows that these networks are also polluted as a result of sedimentation, the growth of grass and plants, and in various cases, the installation of various barriers. Therefore, irrigation systems should be cleaned at least once every 2-3 years. is required. Taking into account the above-mentioned problems and tasks, more importance should be given to the issues of timely fulfillment of all the requirements by creating and implementing devices and machines with higher work efficiency for cleaning the gutters, which reduce the energy consumption in cleaning irrigation ditches (trays) is one of the important tasks. Land reclamation machines play an important role in improving the land reclamation of irrigated areas. Targeted use of existing and imported equipment in the Republic ensures their reliability and long-term operation.

One of the urgent issues of today is to create the necessary conditions for more stable development of agricultural production, improvement of land reclamation, increasing their productivity and, on this basis, increasing the yield of agricultural crops, as well as organizing reclamation works and improving the financing mechanism.

Currently, various irrigation systems are widely used. In particular, despite the widespread use of newar systems and concrete-lined ditches, the deposition of sediments in these systems, that is, they become muddy, causes a sharp decrease in water carrying capacity [3, 4].

Ditches are filled with muddy sediments for various reasons. First, the turbidity of the irrigation water can be below the ground level of the constructed irrigation systems and can be hakozos. Secondly, in these systems (especially in new ones) different barriers are made for different purposes and used for water intake, car washing and other purposes. Thirdly, as a result of wind erosion, sediment deposition is observed as a result of the flying of various migrating sands and soils. As a result, the seeds of various plants fall from it, which leads to the increase of weeds. These tools, in turn, lead to a decrease in the water permeability of the channels.

The results of the existing analyzes show that it is necessary to develop and implement special work equipment and equipment for cleaning these systems [5, 6, 7].

Taking into account the above, it is necessary to improve the quality of service in hydromelioration systems, which in turn leads to an increase in the efficiency of irrigation systems, that is, to a better implementation of water permeability and water supply.

3 Results and discussion

The scientists and specialists of our department, who have a scientific approach to the effective use of gutters in irrigation systems and their effective operation, are conducting observation and scientific research in this field.

On the basis of research, a patent № IAP 02658 was obtained for the invention on "Device for cleaning gutters" [8].

Many years of observations show that even if the gutters (trays) are built in accordance with all the rules, during their operation, various weeds grow inside the gutters, reducing their surface, which limits the full capacity of the gutters.

Such limitations cause deterioration of the high efficiency of the canals. In order to solve this problem, a device for cleaning gutters was developed.

(Fig. 1 and 2).

The essence of the gutter cleaning device is that the device with higher efficiency for cleaning the gutters, which reduces the energy consumption of the cleaning work, includes a melter fixed to the frame. The softener is connected by a chain fixed on a flexible thread, and the rod is made in the form of a wire thorn located at the bottom of the ditch. The flexible thread, which drives the last drum with the possibility of pulling and winding, is attached to the rings connected to the drive shaft of the water roller with its free ends. The ground softening wire spikes are spaced at a distance that is less than the double eccentricity on the water wheel drive shaft.

The purpose of the Nov ditch cleaning device is to use it in reclamation works, which reduces the energy consumption of cleaning works.

The device includes a soil softener mounted on a frame. The soil softener is attached to a flexible string with a chain, and the rod is made in the form of a wire spike located at the bottom of the ditch. With the possibility of pulling and winding the last drum, the flexible rope is attached to the loops connected with the drive shaft of the water wheel with its free ends. The ground softening rollers are installed at a distance from each other that is less than the double eccentricity of the water wheel drive shaft.

The device works as follows. First, the device is fixed to the edges of the canal using clamps. Cleaning is carried out by adjusting blocks of softeners. Soil softeners installed on thin wires soften the sediments at the bottom of the canal as a result of the rotation of the water wheel. Softened sediments are carried away by the flow of small water in the canals. The work will continue in this manner. After a part of the canal is cleaned, the device is moved to the second place and the work is continued in this order. The operation of the trough is similar to that of chain conveyors. In addition, this device is universal, as it is suitable for gutters of different sizes.

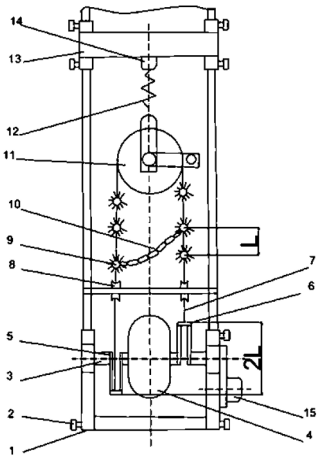

Fig. 1. Device for cleaning gutters (top view): 1-mounting frame; 2-clamp; 3-shaft; 4-water wheel;5-eccentric; portable wallpaper; 7-thin wire; 8-blocks; 9-softeners; 10-wheel; 11-drum; 12-spring; 13-frame; 14-mobile pin; 15-mechanical drive.

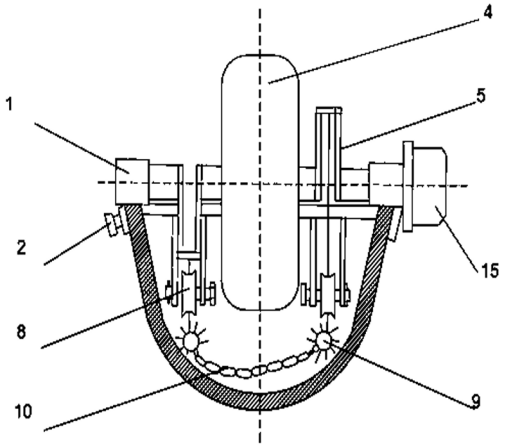

Fig. 2. Device for cleaning gutters (side view): 1-mounting frame; 2-clamp; 4-water wheel; 5-eccentric; 8-blocks; 9-softeners; 10-chain; 15-mechanical drive.

From the description of the device, we know that the device works similarly to chain conveyors. In addition, the fact that the movement of the ground softeners installed in it is taken as an example of a continuous chain is also the basis for performing calculations on the example of a chain conveyor.

The total breaking strength of the chains according to the strength reserve factor is selected from GOST by S(cut):

$$S_{(cut)} = S_{(job)} \cdot n, \quad N \tag{1}$$

where: S(job) – is the maximum tension force in the circuit of the device.

If a two-circuit device is used, then

$$S_{(job)} = (1.6...1.8) \cdot S_{(calc.)}, \quad N \tag{2}$$

where: S(calc.) – is the largest computational force in the chain.

The stability reserve depends on the level of responsibility of the device, the type of track, as well as the operating conditions. Usually, in less responsible and horizontal places n=6...7. For heavy-duty equipment and steep slopes n = 8...10.

The dynamic force in the device is determined as follows. The largest static force acting on the chain in the contour calculation method is the stretching force S(st). Dynamic force is added to this static force when the chains move unevenly. If the speed of the gusts is higher than 0.2 m/s, then it is necessary to determine the dynamic force. As a rule, the number of teeth of the sprockets is small, so that the drive is compact. Angular velocity of the stars, rotational speed of the tooth $\upsilon o = \omega \cdot R$ will be constant.

The law of change of chain speed is approximately expressed by the following equation (Fig. 3):

$$\upsilon_o = \omega \cdot R \cdot \cos\varphi \tag{3}$$

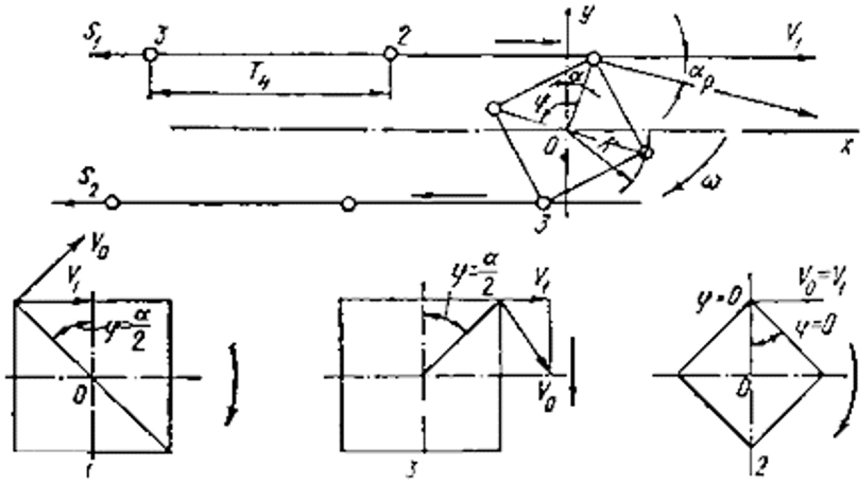

Fig. 3. Scheme of the chain movement along the star.

The period of the speed change is equal to the acceleration time of the star turning one tooth:

$$T = \frac{60}{n \cdot z}, s \quad (4)$$

where: n – is the number of rotations of the star in one minute;

z – is the number of teeth on the sprocket.

Chain acceleration:

$$a = \frac{dv}{dt} = -\omega \cdot R \cdot \sin\varphi \cdot \frac{d\varphi}{dt}, \ m/s^2 \quad (5)$$

where: $\frac{dv}{dt} = \omega$ and the acceleration is $d = -\omega^2 \cdot R \cdot sin\varphi$ will be.

$\varphi = \pm a_o/2$ the maximum acceleration is equal to:

$$a_{max} = \pm \omega^2 \cdot R \cdot Sin \ a_o/2 \ m/s^2 \quad (6)$$

If $\omega = \pm 2\pi/60$; $n = 60\upsilon/zt_3$; $\sin\alpha/2 = t_3/2R$ given that:

$$a_{max} = 2\pi^2 \frac{\upsilon^2}{z^2 t_3}, \ m/s^2 \quad (7)$$

where: υ – the average speed of the chain is m/s;

t3 – step of the traction chain.

If the chain engages only one tooth of the sprocket, ie t3 = 4.l2/(l+d) while for chains with welded arc links the maximum acceleration is equal to:

$$a = 2\pi \cdot \frac{\upsilon^2}{z^2} \cdot \frac{l+d}{4l^2}, \ m/s^2 \quad (8)$$

where: l – pitch of arc-link chains;

d – diameter of the arc steel wire.

For chains made up of two-dimensional (a and b) links:

$$a = 2\pi \cdot \frac{\upsilon^2}{z^2} \cdot \frac{a}{(a+b)^2}, \ m/s^2 \quad (9)$$

The total dinamic force is defined as:

$$S_{(din)} = 4t \cdot a_{max} — t\, a_{max} = 3t \cdot a_{max}.\ N \quad (10)$$

Full computational power:

$$S_{(calc.)} = S_{st} + 3t \cdot a_{max},\ N \quad (11)$$

Listed mass of chain devices

$$m = L \cdot (q_{load} + Cq_t),\ kg \quad (12)$$

where: L – conveyor length.
The general expression of the computational force is:

$$S_{(calc.)} = S_{kut} + 3\ (q_{load} + c \cdot q_T)\ L \cdot a_{max},\ N \quad (13)$$

where: c – quoted mass coefficient; this coefficient depends on the length of the device [6, 9, 10].

4 Conclusions

The proposed device is mainly recommended for the cleaning of LR-60, LR-80 and LR-100 rod gutters. In order for the device to work at high performance, it is necessary to pay special attention to the following:
1. categories of soil.
2. to the humidity of the ground being cleaned.
3. to the depth to be cleaned (that is, to the types of gutters).
4. it is necessary to have a certain amount of water flow in the system to be cleaned [7, 10].
Only if the above factors and other emerging situations are carefully considered, high productivity and high-quality cleaning work will be ensured. This is our ultimate goal.

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