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MOBILE MECHANICAL DEVICE FOR VINEYARD CARE AND PRELIMINARY SYNTHESIS OF ITS MAIN PARAMETERS

Iminov Bahramali Ikromzhanovich
Assistant, Andijan State Technical Institute
E-mail: iminov13q@gmail.com

Abstract

Purpose: In order to facilitate the process of caring for vineyards, to save the physical strength of gardeners, the authors offer gardeners a new "Mobile mechanical ladder" - a mobile device.

Methods: In the republic, horticulture and viticulture are engaged in breeding, new varieties of fruits and grapes, improving their technologies, intensive care of gardens, storage and processing of fruit and grape products, protection from diseases and pests, creation of new agricultural machines that workin gardens and vineyards that are carried out in the republic-the results of research are described.

Results: Since this mobile device consists only of mechanical transmissions, it does not cause any harm to nature during its operation. Its service life is long and reliable. Also, the practical use of the proposed device not only increases the volume and efficiency of work performed, but also has a positive effect on the quality of work. Because the gardener, working in his cabin, feels comfortable and has all the amenities.

Conclusion:

1. A kinematic scheme of a mobile mechanical device has been developed, which makes it possible to increase the labor efficiency and ease of operation of gardeners in the care of vineyards.
2. Based on the developed kinematic scheme, the main parameters of the device's movement mechanism are synthesized.
3. The preliminary synthesis carried out is the basis for the development of the technical design of the proposed device.

Keywords: vineyard, pantograph, lifting mechanism, cab, steering wheel, synthesis.

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Introduction

The thesis presents a kinematic diagram of a new portable mechanical device that can be widely used in the field of viticulture. The results of preliminary synthesis of the main parameters are also given.

Today, many organizational, theoretical, experimental and scientific-practical works are being carried out in our country in the field of viticulture development. And the results are applied in practice and their scale increases.

Methods

In the republic, horticulture and viticulture are engaged in breeding, new varieties of fruits and grapes, improving their technologies, intensive care of gardens, storage and processing of fruit and grape products, protection from diseases and pests, and the creation of new agricultural machines working in gardens and vineyards. they areproduced in the republic - the results of research are described.

It is known that the care of the vineyard lasts from early spring to late autumn, i.e. before the harvest. Currently, various types of portable ladders are used in the care of vineyardsлестниц. Moving heavy ladders from one place to another causes the gardener some physical strain. Especially in the care of grapes on high vines, it is necessary to use large and heavy ladders. Retired gardeners are also more affected by this problem.

In order to facilitate the process of caring for vineyards, to save the physical strength of gardeners, the authors offer gardeners a new "Mobile mechanical ladder" - a mobile device.

The proposed mobile device is driven by a simple pedal, controlled by the steering wheel and changes its height using a screw, that is, it adjusts to the desired size of the frame (vine). All mechanisms of the device consist of mechanical gears (Fig. 1).

This mobile device consists of a frame 1, a driving wheel 2 and 17 wheels controlled by it, and a cab 4that is liftedся usinga fixed pantograph 3.A rotating chair 5 is placed inside the cab around a fixed axis.

The movement mechanism of the mobile device consists of a chain 6, a drive 7 and a driven 8 sprockets, drivenby apedal 9. The sprockets 10 and a spring 11 are installed to hold the chain taut. One pair of sprockets is attached to the frame 1, and the other pair to the cab 4.

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The lifting mechanismof the cab consists of a pantograph 3, a gearbox 12 that movesit about the supports, and a screw 13. As a result of the rotational movement, we attachthe screw with our hand, the shaft with thread 18 rotates and moves the movable support 19 and changes the height of the cab [1,2].

The direction of movement of the mobile device is regulated by the steering wheel 14, the telescopic shaft 15 and the lever 16. For thispurpose, the axes of rotation of the front wheels 17 are placed on the levers 16.

On the frame 1, four telescopicracks are installed, which hold the cab 4 in a vertical position and force it to move vertically.

Results:

Since this mobile device consists only of mechanical transmissions, it does not cause any harm to nature during its operation. Its service life is long and reliable. Also, the practical use of the proposed device not only increases the volume and efficiency of work performed, but also has a positive effect on the quality of work. Because the gardener, working in his cabin, feels comfortable and has all the amenities.

To design the proposed device, it is necessary to conduct its initial synthesis of the main parameters.

One of the purposes of the initial calculations is to determine the dimensions of the movement mechanism in the device.

1. Consider the chain tensioning mechanism.

In this device, the drive mechanism operates by means of a chain drive, that is, the rotational movement from the screw 13 to the drive wheel 2 is carried out by means of a chain 6. The rotational movement of the drive wheel causes the frame (device) to move forward or backward.

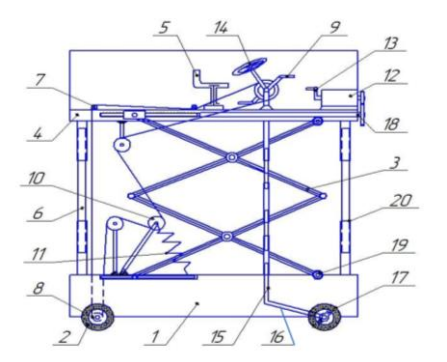

Figure 1. Kinematic diagram of a mobile mechanical device

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According to the task of the device, the height of the cab must change by at least 1.5 meters, and this requirement must be incorporated into the design of the device. Regardless of the change in the height of the device, this chain must ensurethat the sprockets rotate.

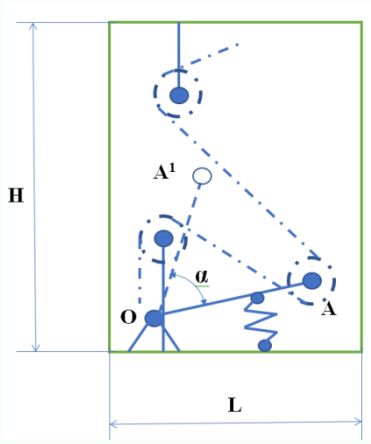

Fig. 2. Diagram of the device chain tensioning mechanism

When changing the height of the cab, the drive chain 6 should change in length, theoretically. In other words, the tension of the drive chain must be maintained during its movement. This requires the installation of a chain tensioner in the lifting mechanism (Fig. 2).

According to the technical specifications, the height of the device must vary within the following limits:заданием высота устройства должна изменяться в следующем пределе:

$$H = 2.00..... 3.5 \text{ m.}$$

So, the change in the height of the device *is* $HN = 1.5$ meters.

As can be seen from Figure 2, the point A of the tensioning mechanism must be moved at least 0.8 meters, that is, it will be necessary to provide $AA^1 = 0.8$ meters.

To do this, we write down the following crelation:

$$AA^1 = OA * \alpha \qquad (1)$$

where α is the angle of rotation of the rocker *arm* OA, its value is taken from a constructive point of view and is assumed to be approximately 60^0. This corresponds to 1.05 radians.

So, $OA = AA^1 / \alpha = 0.8$ (m) / 1.05 =0.76 m.

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We conclude that the length of the rocker arm is almost 80 cm. Since *OA* = 80 cm, the length of the device is much smaller *than L* and it can be easily placed in this frame (*L* = 1.5 m).

Let's look at the tension of the tension spring. If the upper end of this spring is connected to the middle of the OA rod, then its deformation, that is, elongation, will be almost half the displacement of point *A*.This is about 40 centimeters. From a design point of view, if you take a 1 meter long spring, it can be stretched by 40 centimeters, and it can be easily placed on the frame.

2. We determine theточtransmission number of the chain transmission.

The number of chain gears can be determined as follows [3,4,4]:

$$i_{total} = wn_n / wk_к =_n nn /_к \quad \text{nk} \quad (2)$$

where wn_n, n_n, nn are the angular velocity (rad / s) and the number of revolutions per minute (rpm) of the pedal shaft;

ω_k, n_k - angular velocity (rad / s) and number of revolutions per minute (rpm) of the wheel shaft;

Given the physical ability of a person n, we assume that n_n = 60 rpm.

If we take the speed of movement of the device (frame) *as Vp*= 0.1 m / s and the wheel radius R_k = 0.15 meters, then the value of the angular velocity of the wheel shaft is calculated as follows.

$$\omega k = vp / Rk = 0.1 / 0.15 = 0.67\ (rad / sec).{}_к = V_p / R_к = 0{,}1 / 0{,}15 = 0{,}67(\text{рад/сек}).$$

And the number of revolutions per minute of the wheel shaft is equal to

$$n_k = 30 * \omega_k / \pi = 30 * 0{,}67 / 3{,}14 \rightleftarrows 6.4\ (\text{оборотгрм}).$$

Hence, the total gear ratio in a chain transmission is found from expression (2).

$$i_{total} = n_n / n_k = 60 / 9{,}5 = 9{,}4.$$

It can be seen that to ensure such a large number of transmissions, it is desirable that the transmission consists of two steps, i.e.

$$i_{общ} = i_1 * i_2\ , \quad (3)$$

where $i1_{1,i2}$ - respectively, the number of gears of the gear and chain stages, which must be provided for in the design of the device. For example, we ccan take the number of transfers as follows according to the expression:

$$i_{total} = 6 * 1.6 = 9.6.$$

The resulting dimensions practically satisfy the requirement. Their values will be further refined in subsequent design processes.

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