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IMPROVED TEMPORARY DITCH DIGGING MACHINE

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Annotation: The article describes research on improving the temporary ditch digging device. In order to reduce the traction resistance of the trencher and dig a high-quality trench, flat discs are installed in front of the trencher at a distance of 18-20 cm from each other. During excavation, the slope of the temporary ditch was maintained at the required level due to the partial disintegration of the soil layer due to the rotational movement of the disk, and the issue of maintaining the uniformity of the side walls of the temporary ditch was addressed.

Keywords: Irrigation, temporary ditch, disk, trencher, deformation, overturning, plow, skid steer.

Today, special attention is paid in our Republic to further improving the reclamation of irrigated lands, developing the network of irrigation facilities, and widely introducing intensive methods into agricultural production, and, above all, modern techniques and technologies that save water and resources. In this regard, the use of modern water-saving technologies, the constant maintenance of irrigation networks, and the creation and application of energy-saving equipment and technologies in production are of great importance.

It is known that improving the land reclamation condition and increasing crop productivity depend on irrigation. Irrigation networks are used to irrigate agricultural crops. Irrigation networks are divided into permanent and temporary networks according to their duration of use. Temporary irrigation networks are removed at the beginning of the irrigation season and leveled at the end of the irrigation season. To dig temporary networks, levelers are used: they are selected taking into account the ability of the ditch to pass water from 20 - 40 1/sec. to 100 - 200 1/sec.

In irrigated agriculture of our republic, KOP-500A, KZU-0.5, KPU-2000A, KBN-0.35, KZU-0.3 ditch diggers are used to create temporary irrigation networks for irrigation of crops. These trench diggers must perform the tasks of excavating the soil, lifting the excavated soil, placing it on one or both sides of the canal bank, and pushing it, as well as leveling and smoothing its surface, as well as ensuring its slope. The main disadvantage of this trencher is that it requires a lot of energy to dig trenches in hard areas, in areas with low humidity, the amount of large lumps increases, resulting in a decrease in the quality of the loosening, and due to excessive deformation, the geometric shape of the working columns is lost. These include the

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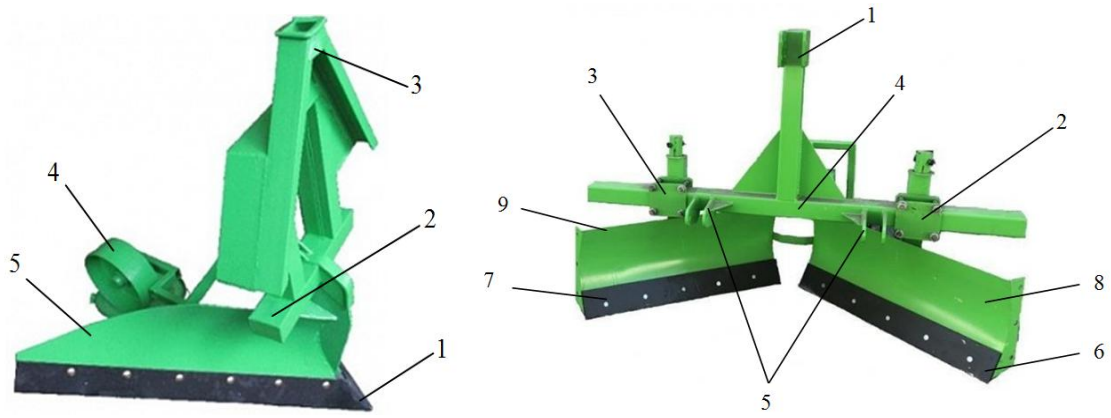
large amount of force required to pull the working equipment during the trench digging process, high soil resistance, and high water absorption due to insufficient compaction of the trench bottom.



a) **b)**

a) trencher. 1 – ploughshare; 2 – main frame; 3 – hanging device; 4 – support wheel; 5 – working body; b) rectifier. 1, 5 – hanging device; 2, 3 – mechanism for changing the coverage width; 4 – main frame; 6, 7 – ploughshare; 8, 9 – right and left tilting surface working bodies

1 – picture. General view of the KBN-0.35 device

As you know, the main function of temporary ditches is to meet the water needs of crops in a timely manner. To do this, a requirement is set for the water required from the canal, for example, to a cotton field, to be delivered at a rate of 70...100 m^3 per hectare. In this case, we can determine the one-time irrigation consumption for 1 ha of land required by plants using the irrigation rate (m^3 /ha) as follows:

$$Q = \frac{1000\ m}{86400\ t} \quad \text{(ha)} \quad \text{l/sek}$$

Where – m is the irrigation rate m^3/ha; t – Irrigation frequency is daily.

If you pay attention to the formula, the irrigation rate takes into account the type of plant or the conditions of the soil where it is grown. However, our experiences show that, taking into account the climatic conditions and soil structure of the Bukhara oasis, it is not appropriate to regulate water in this way and select temporary canals to bring water to it. Therefore, in order to increase the efficiency of the temporary ditch digger, we have installed flat disks at a distance of 18-20 cm from each other in the front of the device, taking into account the above, to soften the soil, reduce resistance, and improve the soil fraction, and a roller with a radius of 20 cm and a coverage width of 30 cm was installed in order to compact the bottom of the dug temporary ditch.

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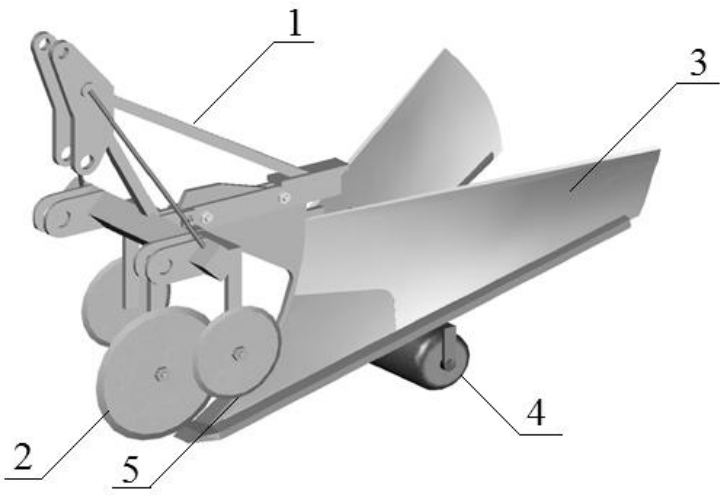

1- frame, 2, 5- central and adjacent discs, 3- overturner, 4- skein.

1 – picture. General view of the improved temporary ditch digging machine.

The improved trencher consists of a frame 1, a main working device 3 mounted on it, rotating disks 2, 5 mounted on its front, and a roller 4 installed to compact the trench bottom. Flat discs are mounted on a special bracket using a connecting rod - an axle. Instead of a sliding ski at the rear of the trencher, a spring-loaded roller is attached to the trencher frame using a screw nut and a specially welded handle.

When studying the canal digging process of a canal digger equipped with discs, it was found that the discs slide in the soil. The slip coefficient depends on the cutting depth, and as the discs get larger, the slip increases. However, when the discs move along the soil while sliding, the front part of the cutter, which is immersed in the soil, has a non-slip cutting area.

A study of the traction force and agronomic evaluation of the quality of work of disk devices showed that:

1. As the disk diameter increases, the drag force and the force per disk decrease;

2. As the mounting angle between the discs and the towline increases, the total force, the force per disc, and the coverage per unit increase.

3. In this case, the total force can be calculated using the following empirical relationship:

$$P^{/} = P_o^{/} + 10\alpha^{1,15},$$

here $P_o^{/}$ – $\alpha = 0$ gravitational force in the conditions;

α – the angle of installation of the discs relative to the line of traction;

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4. Increasing the angle of the discs relative to the traction line by more than 15 degrees does not significantly improve the level of cushioning, but it does lead to an increase in traction force, as well as an increase in the percentage of turf removal from the field surface;

5. As the distance between the disks increases, the drag per unit area decreases, while the drag per disk increases until each disk passes an independent path.

The test results of improved trench diggers without discs and with discs, with indicators in various soil conditions, are shown in Table 1.

Table 1

Soil	**Cutting force**	**Cutting depth with disc h, sm**			
		0 (without a knife)	**25**	**50**	**75**
Peaty	P, kg	7 450	6 650	6 120	6 075
	P, %	100	89	82	80.9
Medium loam soil, W=18%	P, kg	13 960	14 700	15 680	–
	P, %	100	105.2	112.2	–

The technological process of the improved trencher is as follows: during operation, the trencher is mounted on the back of the tractor and brought into working position. The forward movement of the tractor causes the working equipment to be lowered into the soil to a certain depth. During the temporary trench digging process, flat cutting discs placed at a certain distance from each other are immersed in the soil and, as a result of contact with the soil, rotate around their axis to cut the soil in front of the trencher at a specified depth. The cut soil layer is pushed to the side by the trencher, forming a channel. As a result, the pulling resistance force decreases during the operation of the unit. During the trench digging process, the slope and geometric shape of the trench side are uniform due to the cutting of the soil layer using discs, and a high-quality trench is formed as a result of the compaction of the trench bottom by the installed rollers.

Thus, an energy-efficient trencher equipped with the recommended discs can reduce fuel consumption by up to 15% and increase productivity by 1.5 times compared to the existing device when digging temporary ditches.

References:

1. Message of the President of the Republic of Uzbekistan to the Oliy Majlis dated December 29, 2020. Xalq so'zi, December 30, 2020, No. 276.

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 05,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

2. Z.A.Artukmetov, H.Sh.Sheraliyev. Fundamentals of crop irrigation. T. 2007.

3. S.T. Vafoyev. Land reclamation machines. T., “Science and Technology”, 2013.

4. A.Juraev et al. Utility model entitled “Improved ditch digging machine with discs”. Patent FAP 01573. 2020.

5. Imomov Sh., Jurayev A., Ruziqulov J., Kurbonboyev S., Ruziqulova D., Xusinov S., Madadkhonov T. (2022). THEORETICAL STUDIES ON THE DESIGN OF TRENCHER WORK EQUIPMENT. Eurasian Journal of Academic Research, 2(12), 989–996. https://www.in-academy.uz/index.php/ejar/article/view/6504

6. Sh.J.Imomov, J.U.Ruzikulov, S.S.Kurbanbayev, H.S.Safarov, K.S.Sobirov, and Z.Sh.Isakov “Technological process of provisional dig a ditch”, Proc. SPIE 12296, International Conference on Remote Sensing of the Earth: Geoinformatics, Cartography, Ecology, and Agriculture (RSE 2022), 122960O (6 July 2022); https://doi.org/10.1117/12.2642980

7. Energy-saving device for temporary ditch digging I.S.Hasanov1, J.U. Ruzikulov, F.A.Ergashov1, M.J.Toshmurodova and M.R.Sotlikova1 Published under licence by IOP Publishing Ltd IOP Conference Series: Earth and Environmental Science, Volume 868, International Conference on Agricultural Engineering and Green Infrastructure Solutions (AEGIS 2021) 12th-14th May 2021, Tashkent, UzbekistanCitation I S Hasanov et al 2021 IOP Conf. Ser.: Earth Environ. Sci. 868 012091DOI 10.1088/1755-1315/868/1/012091

8. Ruziqulov Jasur Uktam ugli, Isakov Zafarjon Shuxrat ugli, Qurbonboyev Sindorbek Sarvarbek ugli, Ruziqulova Dilnoza Uktamovna, Xusinov Sarvarbek Nodirbek ugli. (2022). Increasing the working productivity of the case 1150 l bulldozer by improving the working equipment. Neo Science Peer Reviewed Journal, 4, 87–90. https://www.neojournals.com/index.php/nsprj/article/view/83 .

9. Imomov Shavkat Jakhonovich, Murodov Tohir Faxriddin ugli, Isakov Zafarjon Shuxrat ugli, Ochilov Nuriddinjon zokirovich, Iskandarov Johongir Ochil ugli, & Ruziqulova Dilnoza Uktamovna. (2022). Local fertilizer machine with auger. Neo Science Peer Reviewed Journal, 4, 91–93. Retrieved from https://www.neojournals.com/index.php/nsprj/article/view/84

10. Ruziqulov J., Kurbonboyev S., Xusinov S., Ruziqulova D. (2023). Improvement of the scraper work equipment and improving its efficiency. Eurasian Journal of Academic Research, 3(1 Part 4), 12–16. извлечено от https://in-academy.uz/index.php/ejar/article/view/8935

11. P.G.Hikmatov, J.U.Ruzikulov, O.S.Sayidov, Ruziqulova Dilnoza Uktamovna, Improved machine for spreading and compacting road construction materials., International Bulletin of Applied Science and Technology: Vol. 3 No. 6 (2023): International Bulletin of Applied Science and Technology https://researchcitations.com/index.php/ibast/article/-view/2020

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 05,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

12. P.G.Hikmatov, J.U.Ruzikulov, O.S.Sayidov, Ruzikulova Dilnoza Uktamovna,Selection of an auger device for a machine for spreading and compacting improved road construction materials, International Bulletin of Applied Science and Technology: Vol. 3 No. 6 (2023): International Bulletin of Applied Science and Technology https://researchcitations.com/index.php/ibast/article/-view/2009

13. J.U.Ruzikulov, D.U.Ruzikulova, U.F.Khusenov. Energy-saving device for temporary ditch production france international scientific-online conference: "Scientific approach to the modern education system" PART 18, 5th October https://interonconf.org/index.-php/fra/article/view/7258/6260