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APPLICATION OF THE PRINCIPLE OF GAZODYNAMICSTO AGRICULTURAL TECHNOLOGIES

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APPLICATION OF THE PRINCIPLE OF GAZODYNAMICS TO AGRICULTURAL TECHNOLOGIES

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Pre-sowing treatment of seeds of agricultural plants in the monograph entitled “Application of the principle of gas dynamics to agricultural technologies” softening of crusts formed in the soil; cotton picking; excavation of cylindrical wells in dense layers of soil; focused on the application of cocoon worms to anesthesia.

Abstract. Combustion (explosion) of a mixture of ordinary fuel (gasoline, gas) and air in a specially designed generator produces the following parametric impulse forces: detonation shock wave - 35 atm; flow rate of the product of combustion of the mixture - 800 m / s; the velocity of the detonation wave in the pipe is 1500-1800 m / s.

Gasodynamic impulse forces with the above parameters act on it as a sharp, short strong shock when directed at any surface.

In this pamphlet, the detonation shock wave generated by the combustion (explosion) of a mixture in a generator is described as an “instrument”: processing of plant seeds before sowing; softening of the crust formed in the soil; cotton harvesting; digging wells in densely layered soils; the possibilities of applying cocoon worms to anesthesia are described

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ABSTRUCT

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INTRODUCTION

Special attention is paid to the widespread introduction of modern equipment and agricultural technologies in Uzbekistan, improvement of reclamation of irrigated lands. Increasing productivity and regular improvement of soil fertility, successful harvesting, efficient use of each day of sunny days will allow to sow grain, start autumn-winter activities on time and have a rich harvest next year. In order to carry out agro-technological work, it is necessary to have modern equipment and devices. Such a new technique was developed, which was one of the agrotechnologies used to soften the crust formed in the soil and gave good results.

The peculiarity of this method is that a very large pressure wave with a shock impulse force generated by the explosion of a mixture of air and fuel in a specially designed generator softens the layer without touching it as a mechanical instrument, without creating lateral shear stress due to its perpendicular action as compressed air. The result is that the lateral shear tension is relieved as if by hand. In that case, the seed will not be injured, and the newly sprouted seedling will not be damaged.

Expanding the scope of this feature method, it was also applied to other sectors of agriculture: processing of plant seeds for sowing and harvesting of cotton; digging wells for loosening in the compacted lime-arsenic soil layer on irrigated lands; to anesthetize the silkworm inside the cocoon.

In the mechanized principle of cotton picking, the mechanical tool collides with the cotton fiber, attaches it to the hopper, and then throws it into the machine hopper using moving air.

In the new method, under the influence of gas-dynamic detonation shock wave, the fibers in the cotton ball are separated and thrown into the machine bunker.

The process of digging cylindrical holes (wells) in dense layers under the influence of gas-dynamic shock waves consists of the following. The impact wave detonation pipe is directed vertically to the dense layer with the open side and drills cylindrical wells.

According to the study, the drilling speed of wells is 1.5 m / min.

To anesthetize the silkworm inside the cocoon, a shock wave acoustic field with a frequency of 1 ÷ 20 Gts and a speed of 1500 ÷ 1800 m/s is created by means of a detonation generator. treated and anesthetized the worms inside the cocoons.

The wave generated in the detonation generator is released as a shock wave and moves in the air, and the product of combustion continues to move behind it. The shock wave, in turn, enters the cocoon and anesthetizes the worm there.

1. APPLICATION OF THE PRINCIPLE OF GASODYNAMICS IN AGRICULTURAL TECHNOLOGIES

§ 1.1. Current issues in agricultural technology.

The most difficult and responsible technological operations in cotton growing are loosening of arable lands by plowing, softening of the soil surface formed by heavy spring rains after sowing, softening of the layer of undergrowth (thick layer of gypsum) and harvesting of cotton. All of the techniques that implement these agrotechnologies are based on a mechanical principle, and there is currently no technique that works on a different principle that has a higher efficiency, can replace or replace it.

However, it should be noted that no one seems to object to the creation of new copies of them by conducting scientific work on techniques that can work on a principle other than the mechanical principle. The technique, which worked on the other principle proposed, was applied in the technology of softening the crust formed in the soil, and gave good results.

The peculiarity of this method is that the gas is affected by the force of the gas-dynamic impulse without touching the object. The impulse force had a normal effect on the coil and did not produce a transverse shear stress. The absence of shear tension creates a softening of the joint as if by hand. In that case, the seed was not injured, and the new plant was not damaged.

The new gas-dynamic method can be applied to other technological sectors of agriculture by further expanding the scope of impact wave technology generated by the explosion of a gas mixture in a specially designed generator: pre-aerodynamic sowing of plant seeds; cotton picking machine; to drill wells in the compacted lime-arable soil layers on irrigated lands; to anesthetize the silkworm inside the cocoon.

The use of explosive energy in agriculture is a very rare case. First: the explosion has enough destructive power. But curbing it is not a simple task.

Second, the explosion process is a complex situation, the understanding of which leads to considerable difficulties in science, and only in the next 35 years will the theory of explosion processes emerge. We do not aim to fully describe this complex physical state in this pamphlet, nor can it be done in a short and simple form, but we will try to give a brief understanding of the explosion of gaseous mixtures.

Our goal is to use this information to dispel the traditional fear and apprehension in the face of what is called an explosion, and to convince the reader that it is a truly remarkable event that can be used in conventional peace techniques.

§ 1.2. Brief description of the physical classification of the process of explosion of air-fuel mixture in the pipes

Combustion of various fuel mixtures (fuel + oxygen or oxidation) is currently the main source of energy. Thermal power plants, heating complexes, automobiles, railway locomotives, ships, planes, missiles, process equipment, etc. - all underlie the combustion of carbon or carbon fuels in an oxidizing environment, mainly oxygen. It’s hard to imagine a modern society that denies or replaces this ubiquitous process. In fact, humanity is constantly and persistently looking for other ways to provide itself with energy, and this is going to achieve some success. For example: the conversion of solar energy into electricity (there is currently a competition going on to create the best design for solar-powered cars), the use of hydropower and finally nuclear energy. However, it is impossible to rely on a cheap and low-cost process other than burning fuel to provide near-term energy. Moreover, it is too early to say that such achievements are being successfully used, for example, nuclear energy. The reason for this fear is now well known. Why did we use the word “waste” to refer to the combustion of fuel with oxygen? Think for yourself: man likes wood, coal, peat, oil and natural gas, which is formed from driving it (gasoline, diesel fuel, kerosene). Natural resources that have been accumulated and accumulated in nature for billions of years are being burned in the furnaces of technical progress. In addition, the oxygen in the air, which we now understand the value of dignity, is also irreversibly burned. The plant world, which covers only the surface of the earth, is barely making up for this oxygen. What needs to be done is to reduce its use so that the fuel can last longer. It’s possible, it’s probably different. First, the amount of oxygen consumption in the air must be coordinated with the amount of oxygen released by the plants. This can be done through the conservation and reproduction of terrestrial forests in human activities. Second, man needs to find an easy way to get hydrogen from the environment and learn to use it instead of the oil, gas, wood, etc. that are currently used. Especially when hydrogen burns in oxygen, it not only produces the required amount of heat, but also does not pollute the environment, because the product of this combustion is pure water. When the time comes, it goes without saying that some success has been achieved: the first demonstration flight of a jet passenger plane powered by hydrogen fuel instead of paraffin, which was considered scarce, took place. It should be noted that the source of hydrogen in water is practically inexhaustible on the earth's surface, however, after hydrogen burns, it returns to nature again as water. Of course, switching to hydrogen fuel is not an easy task, but once it is started, there is no promising fuel to replace it.

Why are we so perfectly focused on the environmental problems that arise from fuel combustion in energy production? Because from now on, this booklet will be about innovation, which will again make human labor easier by burning fuel sources that are valuable for that planet. First of all, we decided to put it into practice after making sure that the innovation we have made is logical, appropriate to the development of technology, and that not another drop of evil has been added to the patience that still fills our era.

Now we return to the combustion process itself and how it is used in the machine below.

The most common type of combustion is called "normal combustion". Its physical meaning is that part of the heat is sent as light energy to the cold part of the fuel and oxidizer mixture. The mixture begins to heat up, and the closer it is to the combustion zone, the more intensely it heats up. And finally, it burns. The burning part of the mixture is replaced by a new mixture, and this process continues uninterrupted. So normal combustion takes place, just like gas welding, combustion on a gas stove in the house, and many other cases. In some cases, it is more convenient to send the combustible mixture to the combustion zone through a cavity filled with the combustible mixture without transferring it to the combustion zone. But the main mechanism is the mechanism by which the combustible mixture is heated by the heat in the combustion zone. An example of such combustion in internal combustion engines is the combustion of a gasoline-air mixture in the space above the piston, from which the flame generated by the electric charge spark from the spark plug spreads throughout the mixture.

In technical devices where heat energy is extracted from combustion (often) the heat flow in the combustion zone is artificially sent to heat the newly arrived fuel mixture. An increase in temperature increases the amount of fuel burning per unit time. This is usually caused by the mixing of the hot product in the combustion zone with the new mixture coming into the combustion zone (this phenomenon is called turbulization). The same phenomenon is used when a fireman burning coal in a furnace mixes burning coal, when the designer of the aircraft engine combustion chamber designs a new mixture flowing into the combustion zone at high speed. However, designing such a large number of mixture-burning “stoves” is not an easy task. That is why there is a whole master science that designs boilers for thermal power plants, internal combustion engines, rocket engines, etc., as mentioned above. But the achievements of man in this science are not so great. One of the reasons for this is that the combustion rate of hydrocarbon fuels (gasoline, natural gas ...) with an air mixture reaches several meters per second. Due to artificial turbulence, this speed can be increased several tens of times, but this does not satisfy the designers of heat engines.

There is another major drawback to a normal (or turbulent) combustion mechanism. However, it is not possible to create great pressure as a result of combustion in an open space. In order to obtain a large pressure relative to atmospheric pressure, a closed (such as internal combustion engines) or semi-closed (one-way closure of the combustion zone, such as rocket and jet engines) gaps must be created at the site of combustion. This creates a number of inconveniences that lead to an increase in the size and mass of the structure.

However, there is another type of combustion in nature called detonation or explosion. [1.2].

In internal combustion engines, rocket and jet engines, domestic (natural gas), thermal power plants, the combustible mixture can burn in an explosive manner. We encounter such a process a lot. For example, a detonation in car engines is also called a “knock” of the pistons, or an explosion of household gas indoors or outdoors. And so the concept of an explosion is often associated with unfortunate events that lead to bad consequences. This is probably why man is not boldly looking for effective ways to use explosions in technology.

We consider the explosion of a fuel-air mixture in a pipe with one side completely closed and one side completely open. [3-8]. Figure 1.1 shows the different stages of this explosion.

Assume that the pipe is filled with a gasoline-air mixture (Figure 1.1a). The ratio of gasoline to air is such that the amount of oxygen in the air reaches the oxidation of gasoline, or this is called the stoichiometric ratio. The normal carburetor of an internal combustion engine operates at one or more different ratios. Assume that the pressure (P) of the mixture is equal to the atmospheric pressure (Po) and the temperature (t) is t = 20 ° C, while the mixture is at rest (its velocity “U” is zero). These dimensions are reflected in the drawing.

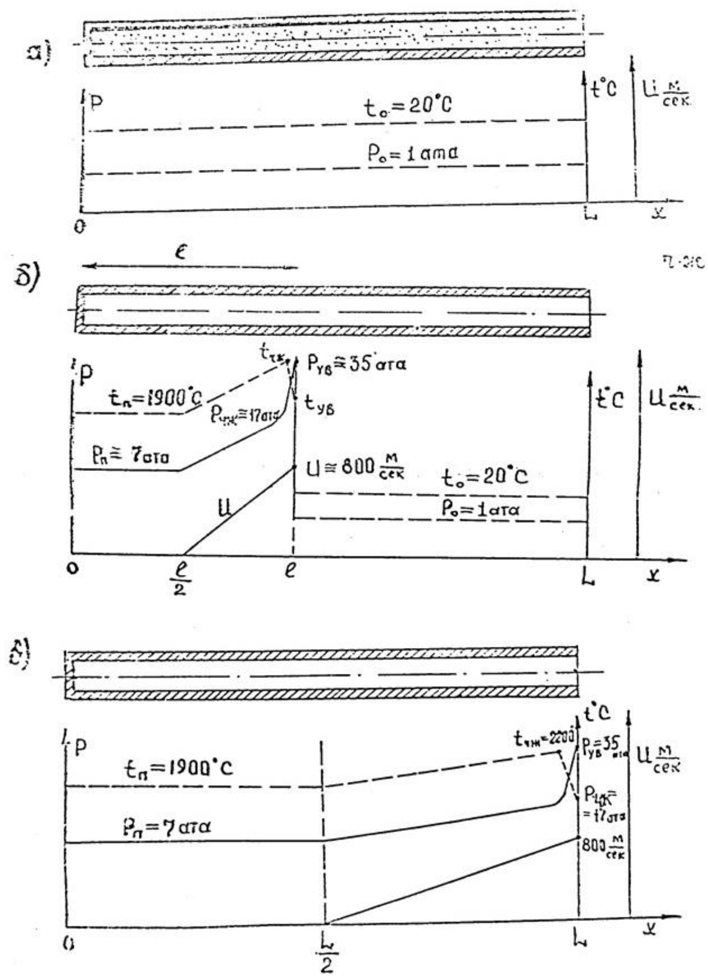


Fig. 1.1. Stages of combustion in the pipe

Assume that we ignited the mixture using a strong electric spark at a sufficient speed on the closed side of the pipe. The power of the spark can be chosen so that the combustion is with a sudden explosion, the detonation Figure 1.1b shows the dimensions of the gas state when the combustion with the explosion in the pipe is propagated by the closed side of the pipe at a distance l. In the parts of the pipe that have not yet burned (part L- l of Fig. 1.1b) the pressure Po. the temperature t and the velocity U of the mixture (as in Fig. 1.1a) have initial values. There is no change in this part of the pipe.

On the closed side of the cross-section of the pipe at a distance l at a distance of a few mm in the zone of the mixture Puv = 35atm is formed a very thin - a shock wave of a few mm. As a result of such compression, the mixture is heated to approximately t = 1500 ° C. Naturally, at such a temperature, the mixture ignites and burns completely in a short time, with the temperature of the combustion products at t = 2000 ° C and the pressure at P = 17 atm. The symbol "ЧЖ" indicates a separate zone where the combustion of the mixture ends.

It is derived from the initials of the names Chempen and Juge, the scientists who studied detonation combustion.

The shock wave travels to the open side of the pipe at a speed of U = 800 m/s without standing still like a new mixture on the closed side of the pipe.

In the part of the pipe from l / 2 to to l, R, t, U change as in the first figure. In the cross section of the pipe at a distance of l / 2 from the back, a zone called a quiet zone is formed. Here, the products of combustion have a velocity of 0, a pressure of P = 7 atm, a temperature slightly lower than tChJ, and tn = 1900 ° C.

The shock wave travels to the closed side of the pipe at a speed of D = 1800 m/s. This velocity is theoretically called the detonation velocity and is denoted by the letter D. When the shock wave reaches the open position of the pipe, it burns all the mixture in the pipe and the dimensions set in Fig. 1 v are set in the pipe, namely the pressure of length L / 2 Pp - 7 atm and when this open surface rises to 17 atm; the velocity of the products of combustion is up to 800 m/s at a distance of L/2÷L, the temperature tn = 1900 ° C, and in the thin zone the compression is up to Ruv = 35 atm. The time taken for the whole mixture to burn is equal to L / D. (If the pipe length is 1 meter, the time is 1/1800s, if it is 3 meters, the time is 3/1800s = 1 / 600s).

The time taken for the whole mixture to burn is equal to L / D. (If the pipe length is 1 meter, the time is 1/1800s, if it is 3 meters, the time is 3/1800s = 1 / 600s). As we have seen, combustion is instantaneous and a lot of potential (combustion product pressure), kinetic (movement of combustion products at 800 m / s) and heat (hot combustion product) is generated in the pipe. We make sure that no destructive force is generated in this explosion, and that the pressure generated can withstand a normal plumbing pipe. If we can create such explosions in a row, we get the energy of a generator of the explosion type that lasts as long as an internal combustion engine.

The energy strength of each explosion is controlled by the amount of mixture in the pipe. To better visualize such blast pipes as an energy source, we compare them with internal combustion engines. The 8-cylinder 4-stroke engine consumes 6x15 = 90 liters of mixture per second when rotating 1800 times per minute (30 rpm). The same amount of mixture can be ignited in 9 explosive tubes with a diameter of 25 mm and an operating frequency of 10 times per second. The amount of energy obtained from a mixture of the same amount will be the same in both cases if the combustion is complete. Thus, the ZIL-131's 8-cylinder engine and 9 blast pipes with a diameter of 25 mm, a length of 1 meter and an operating frequency of 10 times per second emit the same amount of energy, figuratively speaking, in a small explosive pipe, ZIL Part of the energy of the engine of the car -131 provides potential (pressure), kinetic (flow motion) and thermal energy. Of course it can be used to do a variety of things. From now on, this booklet will talk about it.

2. EXISTING METHODS AND DEVICES FOR LOOSING THE SOIL CRUD

§ 2.1. Methods for loosening the soil crust

Loosening of the soil crust is carried out mainly in two ways: manual and mechanical.

Manual processing of the soil crust is carried out with catmen (hoes) and rakes, and other tools can also be used depending on the thickness of the crust and the composition of the soil.

The manual cultivation of the soil crust is a time consuming operation with low productivity and must be carried out under difficult conditions. It was previously described that loosening of the soil crust should be carried out at a rapid pace within 3-4 days. However, despite the involvement of a large number of people and the increase in the duration of their working day, it is not possible to provide the required period for processing the peel, which negatively affects the germination and yield of cotton.

The mechanized method of cultivating the soil crust is carried out by harrowing using toothed (tooth) harrows, as well as using a rotary hoe.

Of the toothed harrows in cotton growing, the most common trailed harrows " zigzagger " [11].

Trailed tine harrows "zigzag" are intended for crushing the surface layer of the soil during early spring and pre-sowing harrowing, crust destruction and partial combing of weeds. Toothed harrows are produced in three types: BZSS - 1.0 with a specific pressure per tooth of 1.83 kg; VZTS - 1.0 with a specific pressure per tooth of 2.16 kg. BZTH - 1.0 with a specific pressure per tooth of 2.23 kg (table 2.1).

Table 2.1

The main characteristics of the harrows:

Parameters	barons type		
	BZSS – 1,0	BZTS – 1,0	BZTH -1,0
Overall dimensions, mm length height width	 1352 280 970	 1352 220 970	 1352 220 970

Continuation of Table 2.1

The main characteristics of the harrows:

Harrow weight, kg	36,7	43,28	44,6
Tooth dimensions, mm сечение длина	 16x16 160	 16x16 160	 16x16 160
The distance between the two adjacent teeth, mm	50	50	50
Productivity, ha / hour	(0,8-1,2)	(0,8-1,2)	(0,8-1,2)

The destruction of the soil crust by the indicated harrows is carried out in fields where seedlings have not yet appeared. Moreover, harrowing must be carried out across the rows in one track.

Loosening with a zigzag harrow does not allow adjusting the crust processing process depending on its thickness. In addition, seedlings are damaged, seeds are removed to the surface, and as a result, high-quality processing is not provided.

The main working body of a rotary hoe is a rotating needle sprocket, loosely mounted on the axis of rotation. During operation, the sprockets roll over the soil surface and, with their needles, make numerous punctures in the soil crust.

The soil crust is loosened along the rows with a rotary hoe after the emergence of cotton seedlings.

The disadvantage of a rotary hoe is that soil particles fall on the axis of rotation, which leads to the termination of the rotation of needle stars, which begin to furrow the beds along with cotton sprouts. In addition, by rotating the sprocket, the needles can extract cotton seeds from the soil and pull out seedlings.

§ 2.2. The mechanism of soil crust formation

Before describing the mechanism of the formation of a soil crust, we present the existing information about what the soil itself is, from what and how it was formed.

Soil formation is a complex and lengthy process, which mainly consists of the physical and chemical weathering of rocks and the addition of organic and organomineral compounds to the weathering products.

Under the influence of the sun, wind, water, the destruction of solid rocks into small particles (such as sand, dust) has occurred and is currently taking place. These particles gradually cover the surface of the earth. Their chemical composition is silicon and various water-soluble minerals such as salts. As a result of the activity of living organisms (mainly bacteria), organic matter (compounds of carbon, hydrogen, oxygen), as well as mineral substances with a nitrogen content taken by bacteria from the atmosphere, accumulate in the layer of particles. As a result, a fertile layer is formed - the soil in which plants can already live and develop. Thus, the main components of the soil are:

The sizes of these particles are very diverse, from thousandths of a millimeter to a millimeter or even a few millimeters;

1.– water-insoluble rock particles.

2. - water-soluble mineral substances also in the form of fine solid particles, or in an aqueous solution;

3. - organic substances in the form of small particles of amorphous mass, most often stuck together into larger agglomerates with a size of a fraction of a millimeter (compacted colloids);

4. - water distributed between solid particles or in the so-called attached form;

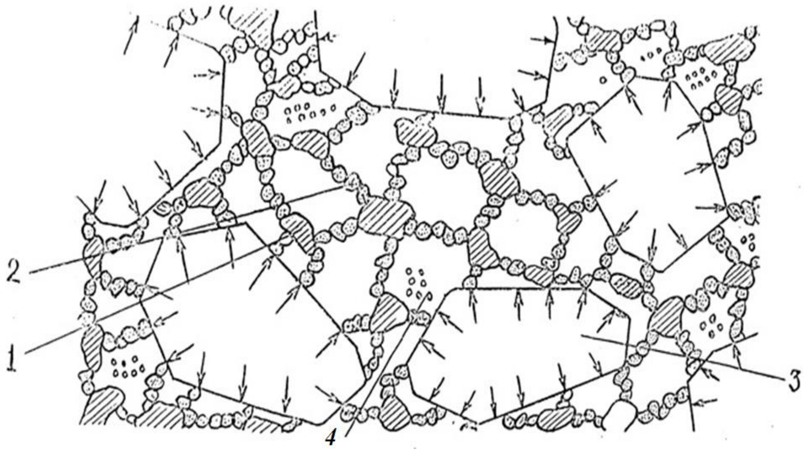


Fig. 2.1. Soil structure

1-clay (composed of very fine and hard particles), 2-compacted colloids, 3-large solid particles (sand grains), 4-pores partially filled with gases and water

Depending on the composition and size of solid particles, on the composition of mineral and organic substances, soils are divided into different types. Cotton growing is developed on an irrigated soil type, which is divided into different subtypes: gray soils, meadow saz, meadow-takyr, etc. All of them have a characteristic feature - a high content of very fine solid particles. This feature explains their tendency to form a soil crust.

What is the mechanism of soil crust formation?

Figure 2.1 shows a schematic diagram of the structure of a clay soil prior to crust formation [9].

After watering or heavy rains, gas inclusions in the pores are replaced by water. With the subsequent intensive evaporation of water (sunny, hot weather), the water from the pores passes into the atmosphere, and the flow of air into the released pores is impeded. As a result, the pressure in the pore decreases, i.e. vacuum is created. Atmospheric pressure compresses the pores freed from water and the soil as a whole is compacted. This creates a compacted and firm soil crust.

§ 2.3. Some characteristics of soil crust in cotton growing regions

The area of the Fergana region is 7.1. thousand km^2. of these, most of the region's territory is occupied by irrigated lands, the rest - by sands.

In the region, there are widespread sierozem and hydromorphic soils of the sierozem belt. The soils of the sierozem belt (Fergana, Kuva regions,) the southern parts of the Rishtan, Altyaryk, Uchkuprik, Uzbekistan, Besharik regions, located on the left side of the Big Fergana Canal, are subdivided into two micro-districts:

a) meadow and sierozem-meadow loamy, non-saline and slightly saline lands of the sierozem belt of strict irrigation in the eastern part of the region (Kuva, Fergana region and Kuvasay city)

b) light gray pebble soils in the southern adyr zone of most districts of the region, with a thin arable horizon, underlain by thick gravel at various depths (Altyaryk, Rishtan, Uzbekistan regions).

The soils of the serozem belt are characterized by a low content of humus, nitrogen compounds, phosphorus, with a fragile lumpy structure and intense mineralization of organic matter. These soils also have a weak water-resistant strength and a low structure. These soils contribute to the formation of a solid soil crust on them after irrigation and precipitation. Its power and strength increase on soils with a heavy texture - on heavy loamy and clayey, gray-brown soils. Salinity and salinity also increase the tendency of soils to form a crust.

For example, on virgin and light loamy light gray soils, the crust thickness is 0.3 ÷ 0.5 cm. on light and typical gray soils - 0.8 ÷ 1.5 cm, on slightly saline takyr soils of loamy and clayey and clayey textures - 2, 5 ÷ 4.5 cm;

According to the data, crust formation on the main types of soils of the Tashkent oasis is given in table. [ten].

Table 2.2

Results of studies of crust formation on the main types of soils of the Tashkent oasis

Horizon depth, cm.	Aggregates on arable soil word		Aggregates for crusting		Peel parameters	
	Mechanical strength, g	Water resistance,%	Mechanical strength, g		Mechanical strength, g	Water resistance,%
1	2	3	4	5	6	7
Section 1. Old-irrigated meadow heavy loamy soils						
0-42	366,5	7,2	373,2	3,8	3,5	2,5-3,0

Continuation of Table 2.2

Results of studies of crust formation on the main types of soils of the Tashkent oasis

1	2	3	4	5	6	7
Old-irrigated meadow - boggy heavy loamy soils						
0-34	383,2	7,5	385,1	3,2	3,5	2,0-2,5
Old-irrigated sierozem - meadow heavy loamy soils						
0-41	379,3	6,7	376,4	3,2	3,5-4,0	2,5-3,0
Virgin typical sierozem, heavy loamy						
0-3 3-7 7-21	179,9 115,3 157,1	14,3 14,4 13,1	230,7	7,5	1,0-1,5	0,5-1,0
Newly irrigated typical gray soil, heavy loamy						
0-37 0-35 0-37	302,2 265,1 292,4	4,8 4,5 5,1	291,8 269,2 279,6	2,8 2,6 2,6	3,0-3,5 3,0-3,5 2,5-3,0	1,5-2,0 1,5-2,0 1,5-2,0
Old-irrigated gray soil, heavy loamy						
0-40	226,5	6,2	235,4	3,0	3,0-3,5	2,0-2,5
Old-irrigated typical gray soil, medium loamy						
0-37	232,6	6,4	243,1	3,1	2,5-3,0	1,5-2,0

As you can see from the table. 1, depending on the type of soil, the thickness of the soil crust can vary from 1.0 cm to 4.0 cm and the width of the cracks - from 0.5 cm to 3.0 cm.

We have presented some characteristics of the soil crust for two regions of Uzbekistan; in other cotton-growing regions, the soil crust has similar characteristics.

Table 2.3

Influence of the timing of soil crust loosening on the development and yield of cotton

Experience Option	Flowering period		Fruiting period			Productivity, %
	Stem height, cm	Number of sympodial branches, pcs.	Stem height, cm	Number of sympodial branches, pcs	Number of chickens pcs.	
1. Loosening of the crust was carried out in a timely manner	30,2	6,1	97,0	13,2	8,0	100,0
2. Loosening of the crust was carried out with a delay of three days	25,5	4,5	91,3	12,3	4,7	90,0
3. Loosening of the crust was carried out with a delay of six days.	23,5	3,7	87,7	11,5	3,8	73,0

If the plants remain under the crust for a long time, they die due to the swelling of the sprout trunk, and the leaves begin to grow downward. The period of crust formation is very short, from about May 10 to 25, and therefore requires a great concentration of efforts to destroy it.

If cotton grows through the crust, then it is largely "injured", as a result of which its development lags behind normal by 15–20 days and, as a result, leads to a decrease in yield.

3. DESIGN OF ATTACHED EQUIPMENT AND RESULTS PRACTICAL PREMINES OF GDRP – 3

§ 3.1. Design of attachments GDRP - 3

The mechanized method of soil crust processing is based on the principle of detonation of air-fuel mixtures in pipes, described at the beginning of the brochure. The strength of a microexplosion can be regulated both by the magnitude of each individual explosion and by the frequency of their repetition. The created and used explosion generators are capable of producing up to 20 microexplosions per second. (12)

The destruction of the soil crust is carried out by a shock wave coming out of the explosion generator. For this, the combustion chamber of the explosive generator is positioned so that the cut of the open end of the pipe is at a certain distance for a given soil from its surface. (3.1 - fig).

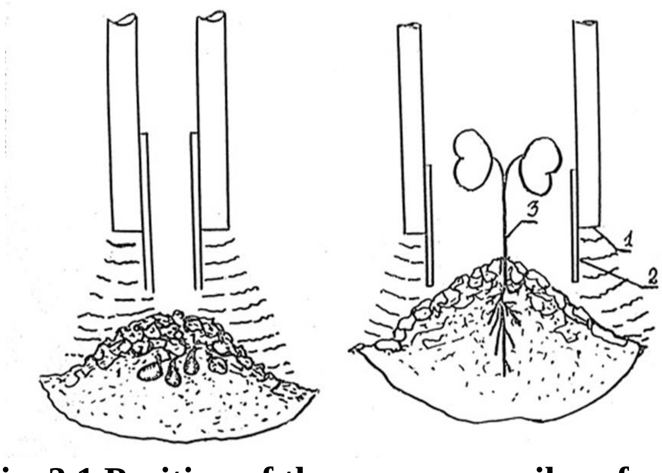


Fig. 3.1 Position of the screen on soil surfaces

1-pipe, 2-screen, 3- plants

Detonation waves generated in the combustion chamber, when leaving the open end of the pipe 1, breaks up into a shock wave propagating through the air, and the following stream of combustion products. The shock wave creates impulsive pressure on the soil surface and the crust breaks down. In this case, the screen 2, fixed on the lateral surface of the pipe, prevents the impact of the shock wave on the plants 3. The impact of the shock wave destroys the soil crust and pushes its elements in the aisle, thereby freeing the subnork layers for ventilation.

With this method of processing, the plants are not damaged, since mechanical contact of the processing tool with the soil is completely excluded.

The method is implemented on the installation GDRP - 3. which has a capacity of up to 1.5 hectares / hour.

Installation GDRP - 3 (Fig. 3.2) is mounted on a tractor and consists of the following main parts:

- a frame that serves to fasten all the components of the installation to the tractor;

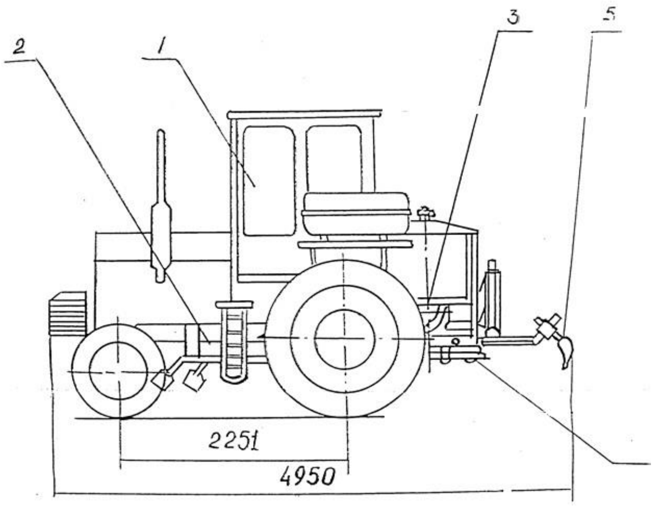


Fig. 3.2. Gas-dynamic devices for loosening the soil

1-tractor 2-frame, 3-compressor, 4-GDV (generator), 5-acupunctur

- a mixer that creates a fuel-air mixture to power generators;

- generators that convert the chemical energy of the fuel-air mixture into detonation energy, which affects the soil;

- control and monitoring systems for the operation of the installation.

The frame (Figure 3.3) consists of a fixed frame, pivotally connected to the fixed frame and held in position by means of hydraulic cylinders. Hydraulic cylinders are designed to move the movable frame, they are standard items included in the tractor kit.

They are controlled by the hydraulic system of the tractor and provide fixation by a movable frame with generators attached to it in any extreme and intermediate positions. Upper extreme position - transport, lower and intermediate - working positions. By changing the distance from the generator's cut to the soil surface, it is possible to adjust the force of the impact and thus adapt to specific conditions (thickness and strength of the crust).

The mixer is designed to generate a homogeneous fuel-air mixture of stoichiometric composition that feeds detonation generators. A standard fan is not used as a mixer, which is driven from the tractor PTO shaft through a gearbox. Gasoline is injected at the outlet of the fan through a nozzle, and the automatic control system allows you to keep the ratio of gasoline to air constant, close to stoichiometric, and change the amount of the mixture in direct proportion to the speed of the tractor.

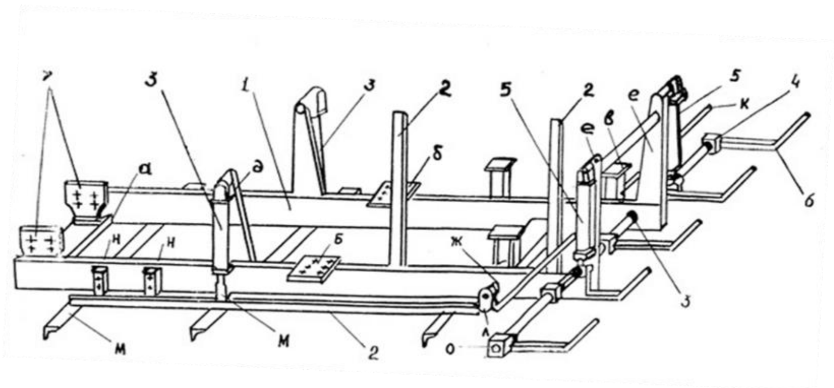


Fig. 3.3. Frame

1-fixed frame, 2-movable frame. 3.5-cylinder, 4-shaft, 6-arm, 7-bracket.

Before the first initiation. DT is filled with fuel assemblies. The pressure in the diesel fuel is equal to atmospheric. Further, near the closed end, detonation combustion is initiated. The detonation wave propagates along the diesel fuel to its open end, where the sound outflow of the PS into the atmosphere begins. And since the PS in the diesel fuel are accelerated to high speeds and the "piston effect" takes place, the pressure in the diesel fuel drops below atmospheric. The difference in pressure in the diesel fuel and the "mixer" contributes to the suction of a fresh portion of fuel assemblies. After filling the pipe with the mixture, the cycle is repeated.

In order for the diesel fuel to work in this mode, a number of conditions must be met:

a) it is necessary to prepare a detonation-capable mixture of fuel with air in a certain capable mixture of fuel with air in a certain ratio,

b) in a short time fill the pipe with the mixture,

c) initiate detonation combustion,

d) exclude spontaneous ignition of a fresh portion of the mixture.

The ignition chamber is made in the form of a tube with an inner diameter of 50 mm with external ribbing. At the inlet of the chamber there are: a fuel assembly inlet and a check valve, and by the outlet flange it is connected to a pipe of a smaller diameter. In the ignition chamber, a fresh charge of the fuel assembly is ignited by a high-voltage electric discharge at the spark plug electrode from the "initiation system".

Diesel fuel volume is the main working volume. Here the flame front accelerates to detonation velocity. The energy output of one cycle depends on the value of this volume. Diesel fuel is made as a separate unit and is a pipe with an inner diameter of 25 mm and a length of 1700 mm., With flanges at the ends.

The control system includes the control of the lowering height of the generators, the activation of the mixture formation system, and the initiation, as well as the control over the operation mode of the detonation tubes.

In the GDRP - 3 unit, the control system provides automatic shutdown of the entire unit in the event of a failure in at least one of the unit channels.

§ 3.2. Results of experimental testing of overhead equipment GDRP - 3.

Experimental development of GDRZ-3 was carried out on experimental fields.

The main provisions of the applied technique of the exioriment were as follows:

Experimental development of GDRZ-3 was carried out on experimental fields.

The main provisions of the applied technique of the exioriment were as follows:

1. The experimental field is subdivided into areas cultivated according to the traditional traditional technology. In general, the same agrotechnical measures of a general nature are carried out throughout the field.

2. Loosening with the use of GDRP - 3 is carried out at various stages from the period before germination to the period of cotton ripening. Repeatability of processing: from one time to several times.

3. For each site, differing in one or another processing conditions, the supervision of specialists is established over the process of germination and development of cotton until harvest.

4. The results of observations are processed and summarized by methods adopted in agricultural practice.

In addition to agrotechnical observations, studies are carried out on the soil that has been treated with shock waves. The main goal of these studies is to answer the question: do any soil parameters deteriorate after exposure to shock waves?

Table 3.1 presents the results of observations of the growth - development of cotton in one of the control and experimental plots. Measurement results at the end of August.

Table 3.1

Results of phenological observations

Experience characteristics	Cotton plant height, cm.	Number of sympodia on a bush, pcs	Number of boxes on a bush, pcs.
Control section (traditional processing)	78,3	12,4	10,1
Experimental plot with GDRP treatment before germination	77,1	12,8	11,9
Experimental plot with GDRP treatment during the period of mass shoots	79,3	13,3	11,7

As follows from these specific data, GDRP treatment has little effect on the height of cotton plants, but noticeably on the number of sympodia and bolls.

Finally, we present the data on cotton yield in control and experimental plots (Table 3.2). It is important to note that in all cases of HDRP processing, there is an acceleration of cotton ripening by an average of 10-12 days in comparison with cotton processed according to traditional technology.

Table 3.2

Results of phenological observations

Average yield from control plots (traditional processing)	Average yield from the experimental plot (processing of GDRI before germination)	Average yield from the experimental plot (treatment of GDRI in the period of mass shoots	Increase (average)
35,3	38,2	37,90	+2,75

Table 3.3

Influence of GDRP treatment on various groups of microorganisms in the soil

Soil samples	Horizon cm.	Butyric acid bacteria	Denitrification	Ammonificators	Nit nifiers	Ammonifiers	Aerobic cellulose bacteria
Before processing	0 – 10	10^6	10^5	10^5	10^4	10^5	10^4
GDRP	10 – 30	10^6	10^6	10^6	10^4	10^4	10^4
After processing	0 – 10	10^6	10^6	10^6	10^5	10^6	10^3
GDRP	10 – 30	10^7	10^6	10^7	10^6	10^5	10^4
One day after the treatment of	0 – 10	10^7	10^4	10^5	10^6	10^6	10^5
GDRP	10 – 30	10^6	10^5	10^7	10^5	10^6	10^5

Thus, the number of bacteria involved in the primary base of plant residues in the soil, in the formation of humus and in the processes of oxidation and mineralization of humus increases from exposure to shock waves, and the number of "harmful" bacteria decreases. Hence, apparently, the improved indicators of plant development.

4. RESULTS OF RESEARCHING THE PRINCIPLES OF CONSTRUCTING A COTTON PICKING DEVICE BASED ON THE USE OF A DETONATION WAVE PULSE

§ 4.1. Devices of cotton pickers based on gas-dynamic energy

It is the contactless principle of transmitting a force impulse to any object that opens up the possibility of using a detonation wave to build a cotton picking device. It is known that at present, mechanized methods of cotton picking are based on a contact mechanical principle: a mechanical tool hooks on the fiber of a cotton boll and pulls it out with subsequent release from the hook and pneumatic transportation to the hopper. We will not analyze here the positive and negative aspects of the mechanical principle of collection, they are well known. There are only two points to note:

a) all currently operating cotton pickers in all cotton-growing regions of the world are built on a mechanical principle.

Without them, it is unthinkable to imagine the technology of cotton cultivation.

b) according to the information published in the press available to us, any development of a cotton picking machine is not being completed on a principle other than mechanical.

The fact that more than 70 years have passed since the creation of the first real model of a cotton harvester based on a mechanical principle, and scientists and designers have not yet managed to find a worthy replacement for this principle, suggests that this task is extremely difficult.

In connection with the above, the author does not believe that this difficult task will be solved within the framework of this brochure. However, it is fair to say that the search must continue and that only in the search can truth be born.

Therefore, this brochure summarizes the first results of research on the use of a detonation wave as a source of force to release cotton fiber from the box and then transport it to the bunker. These results are not complete and are presented here rather in terms of production. The author plans to continue research and, in case of a positive solution to all the main problems of this problem, to start creating a real sample.

This brochure also focuses on another aspect of the use of the detonation wave as a source of force, namely, the use of the detonation tube as a tool for making holes in the compacted sublayer of old-irrigated soils, which is characteristic of cotton-growing areas and leads to waterlogging, salinization and loss of fertility of a large number of sown areas.

This issue was investigated also because it is expedient to make the mechanisms based on gas detonation (in this case, GDRP) universality. The versatility makes it possible to use the equipment much more economically. As for the relevance of the problem, it has been substantiated by the scientists of Uzbekistan quite thoroughly.

Let us first dwell on a brief analysis of one well-known gas-dynamic scheme of a cotton harvesting device. We are talking about the Pneumatic resonance cotton harvester PRHM-I, PRHM-2 developed by the Zvezda machine-building plant.

The designers used works [13,14] as prototypes of PRHM.

The schematic diagram of the PRHM is shown in Fig. 6 (one unit).

The air from the buffer tank in the direction of arrow A is pumped into the channel, from which it is spent in the working area (in the area of the cotton bush) through the breakers. The breakers provide intermittent (pulsating) air jets directed at the cotton bush. The "open-closed" breaker mode is selected in such a way that the oscillations of the air column in the channel in the direction of arrow B enter into resonance, thereby maximizing the speed of the air stream blowing over the cotton bush. The fiber, knocked out of the boxes, is carried into the hopper through the suction channel in the direction of arrow B. The cyclogram of the formation of a pulsed air jet using the pneumatic resonance effect is shown in Fig. 4.1.

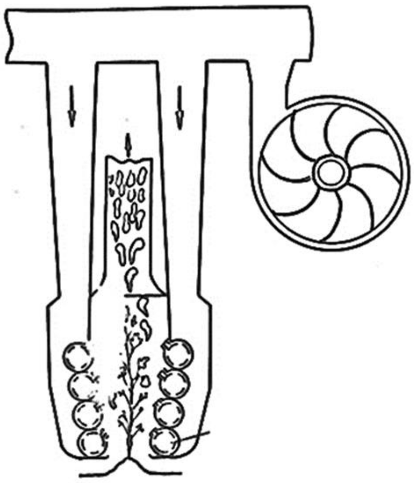


Fig. 4.1. Schematic diagram of PRHM

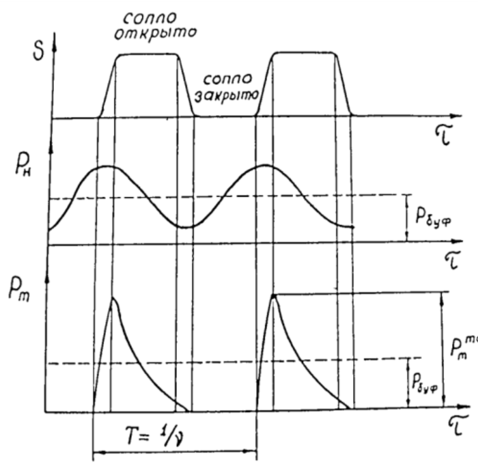


Fig. 4.2. Oscillogram of the formation of a pulsed air jet using the pneumatic resonance effect

Resonance mode allows you to have

$$\rho_m^{\max} \succ P_{buf}$$

For a specific machine (PRHM-1) resonant frequency

$$f = 26 \div 27 \text{ Hz. [14]}$$

According to the data, the overpressure in the buffer tank is

$$P_{buf} = 1000 \div 1200 \text{ mm,}$$

And at the nozzle exit in the oscillatory mode of the outflow

$$P_m = 1,8 \cdot P_{buf}$$

about 2000 mm of water column.

This means that the speed of the air jet directed to the bush is subsonic (less than 340 m/s)

The PRHM-2 machine differs in the arrangement of nozzles, keeping the main pneumatic resonance principle.

Tests have shown the fundamental possibility of picking cotton using the pneumatic zone method. However, such phenomena as the hanging of the fiber on the branches of the bush, insufficient completeness of the collection and increased contamination of the harvested cotton required improvements to the machine.

Within the framework of this work, a method for picking cotton was proposed and investigated by acting on a ripened box with a force pulse from a detonation wave.

The speed of the shock wave at the end of the tube is 1500-1800 m/s, the detonation products are 800 m/s (supersonic). The action time is approximately 0.002 s, i.e. impact type action. The short duration of action is a guarantee of non-ignition of the fiber from the heated detonation products. The interval between two "shots" at a frequency of Hz is equal to 0.1 s (50 times longer than the duration of the jet).

The first stage of the research was to determine the distances l from the open end of the detonation tube, at which the ripe segments of the cotton boll are knocked out. (fig. 4.3)

The mix supply unit (1) consists of a nipple and a “union” nut, provides the possibility of routine maintenance. (fig. 4.4)

The check valve assembly (2), mounted in the ignition chamber (30, provides a cyclic mode of operation of the GDV (filling the GDV with a fresh mixture at the intake stroke and prevents the flow of combustion products upstream at the working stroke);

The check valve assembly, the diagram of which is shown in Fig. 4.5, consists of the following elements:

- valve lattice (1), which is a round plate with holes for the passage of fuel assemblies;

- a petal valve (2) made of a thin spring

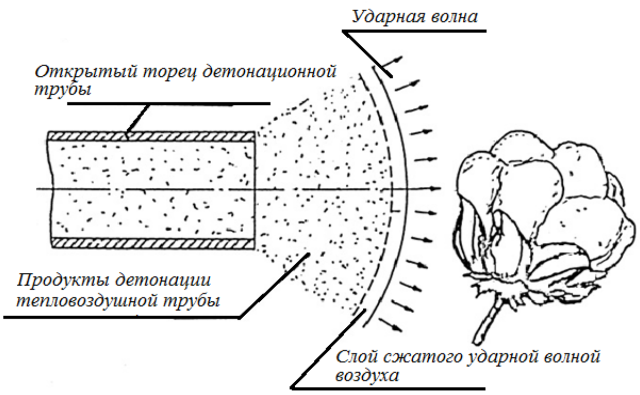


Fig. 4.3. Scheme of the combined arrangement of a detonation wave and a cotton box

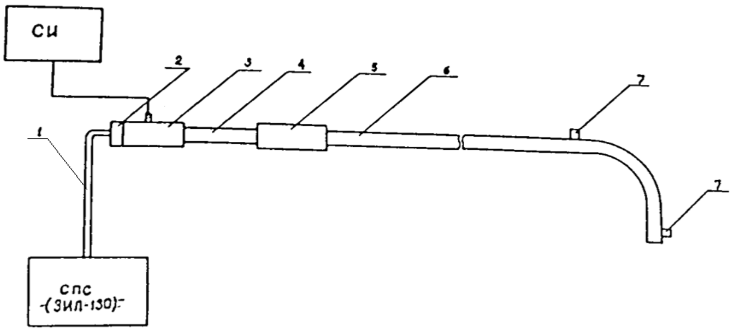


Fig. 4.4. GDV scheme

- supply unit (1); - check valve (2); - ignition chamber (3); - pipe (4) - turbulator (5); - detonation tube (6); - outlet nozzle (7)

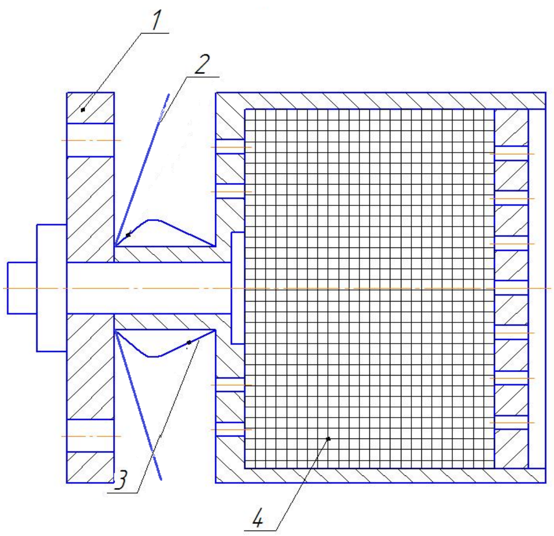


Fig. 4.5. Check valve assembly diagram

- valve travel stop (3);

- a flame arrester (4), which is a body with mesh washers and provides cooling of the PS supplied to the valve at the operating stroke, thereby weakening the theoretical and mechanical effect on the valve.

The ignition chamber (3) (see Figure 4.4), in which the fuel assemblies are ignited from the spark plug (6), is a channel with a diameter of 50 mm and a length of 250 mm.

The turbulator (5), which acts as a flame front accelerator, is made in the form of a pipe section with an inner diameter of 50 mm and a length of 250 mm.

The detonation tube (DT) (6), in which the main acceleration of the flame front and the formation of a detonation wave occurs, has an inner channel 25 mm in diameter and 1700 mm in length.

The outlet nozzle (7), which forms the profile of the shock wave and the dimensions of the PS jet acting on the cotton, is a profiled tube connected to the detonation tube.

It consists of 2 sections. In the first one, filled with a mixture, the process of detonation combustion of fuel assemblies proceeds, as in the detonation tube; at the interface between the fuel assembly and air, the detonation wave degenerates into a shock wave from the inflated boundary to the outlet cut of the nozzle.

During the research, several nozzles of various lengths with outlet diameters of 50 and 140 mm were used.

The energy output (impulse) of one cycle depends on the volume of the detonation tubes (6) and the outlet nozzle (7).

The diagrams of the nozzles used in the research are shown in Fig. 4.6 (a, b).

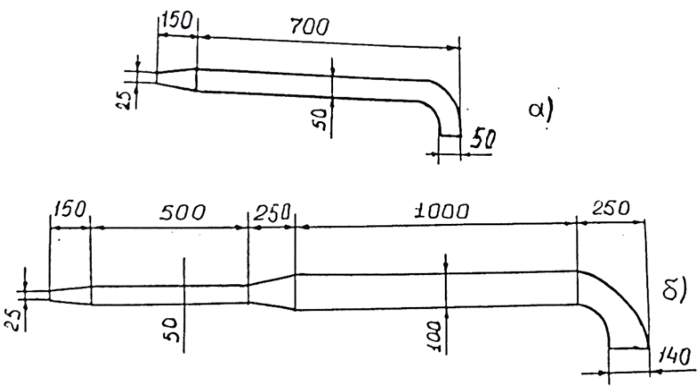


Fig. 4.6. GDV outlet nozzles

The working chamber (Fig. 12), through which the cotton bush passes during the movement of the combine, and where it is exposed to the gas-dynamic effect, is a profiled box, which has slots in the front and rear walls of the walls and a slot in the bottom.

GDV outlet nozzles are mounted in the side walls of the chamber. Also, the chamber is equipped with a ventilation window, which connects it to the system of pneumatic distribution of cotton into the bunker.

Two working chambers were developed and tested. In the working chamber, made according to the first option (Fig. 4.7), eight GDV outlet nozzles with a channel diameter of 50 mm (see Fig. 4.7) were mounted on the side walls of the chamber, four on each side. A ventilation window connecting the chamber with the channel of the pneumatic transport system was provided in the upper part of the chamber.

The design of the working chamber provided for the following adjustments:

- adjustment of the angle of rotation of the outlet nozzles;

- adjustment of the width of the working chamber (a) from 300 mm to 400 mm;

- adjustment of the depth of insertion of the nozzles into the working chamber (l) from 135 to 175 mm.

- in the working chamber, made according to the second option (Fig. 4.8), there are four outlet nozzles of the GDV with a channel diameter of 140 mm (Fig. 4.6, b,), two on each side wall of the chamber. A ventilation window is located on the opposite side wall opposite each nozzle.

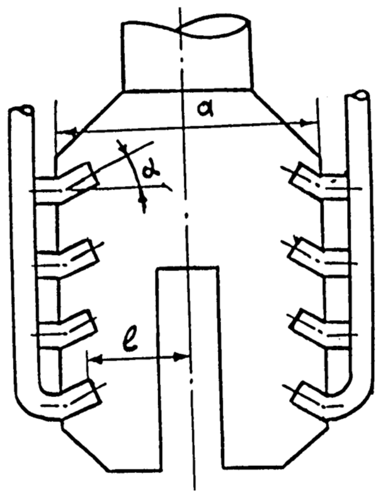


Fig. 4.7. Working chamber layout (Option 1)

The working chamber is double-circuit.

In the first circuit, there is a gas-dynamic treatment of cotton, and the second circuit is the beginning of the ventilation tract.

The design of the second version of the working chamber does not provide for adjusting the relative position of the chamber body and the outlet nozzles of the GDV.

During the tests, we used a pneumatic conveyor system for cotton from the working chamber to the bunker, developed for a serial spindle cotton harvester, including a ventilation duct connecting the working chamber with a fan, a Ts4-70 # 5 centrifugal fan and an air duct connecting the fan to the bunker.

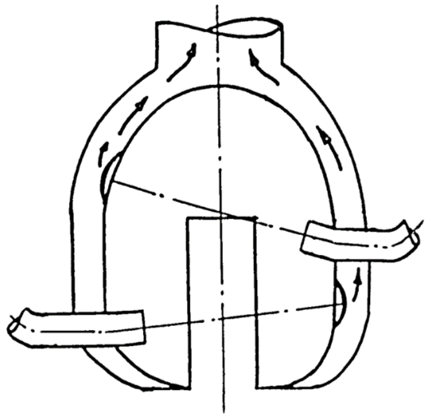


Fig. 4.8. Schematic diagram of the working chamber. (Option 2)

During the experiment, a motor mixing system was used, driven by a tractor power take-off shaft.

The effective impact area refers to the area where the cotton is knocked out of the boll in one shot.

We investigated GDV with outlet nozzles with a diameter of 25 mm, 50 mm, 100 mm, the diagrams of which are shown in Fig. 4.9, a, b, c.

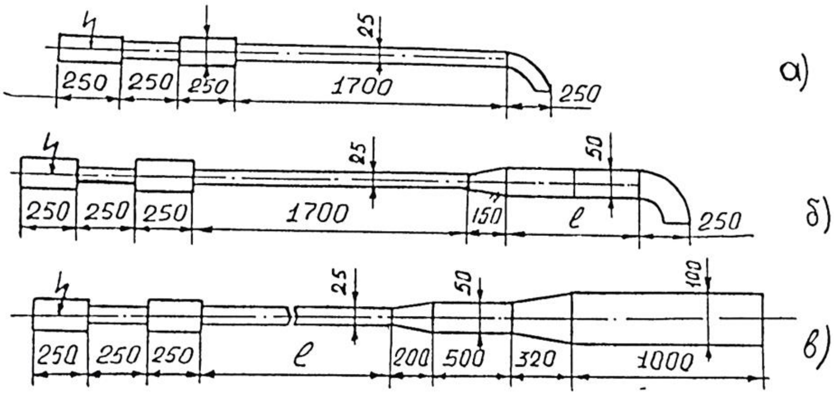


Fig. 4.9. The scheme of the experiment

The cotton boll was placed in a horizontal plane passing through the axis of the outlet nozzle, and the cotton boll in the working area was oriented in the direction opposite to the outlet nozzle.

Before placing the box in the study area, the setup was warmed up for 3 min at $f = 5$ Hz, and then set to $f = 0{,}5$ Hz mode.

A branch from one box was attached to a special rail and, after the installation entered the operating mode, it was placed at a predetermined point of the investigated zone.

Table 4.1-4.2-4.3. shows the results of studies of the GDV with outlet nozzles with a diameter of 25.50 and 100 mm, respectively.

Table 4.1

X (cm)	40	30	50	40	20	20	20	20	30	20
У (cm)	0	0	0	0	20	10	5	3	5	0
Working effect (+-)	+	+	-	+	-	-	-	-	-	+

X, Y - coordinates of the location of the box in the working area;

\+ - knocking out cotton from a box in 1 shot;

\- - after the shot, all or part of the cotton remains in the box,

Table 4.2

L, cm	50	100	100	100	100
X, (cm)	30-40	40-60	30	30	30
У (cm)	0	0	10	5	20
Working effect (+-)	+	+	-	+	-

As can be seen from tables 4.1,4.2,4.3, the investigated detonation tubes (GDT) have the following range:

Table 4.3

L, cm	170	170	170	220	270	270	270
X, (cm)	100	75	50	85	110	50	50
У (cm)	0	0	7	0	0	5	10
Working effect (+-)	-	+	+	+	+	+	-

- GDV with nozzle 25 мм (fig.4.6 a)- 40 sm;

- GDV with nozzle 50 мм (fig.4.6 b)

l = 500 mm - 30-40 sm;

l = 1000 mm - 40-60 sm;

- GDV with nozzle 100 мм (fig.4.6 v)

l = 1700 mm - 75 sm;

l = 2200 mm - 85 sm;

l = 2700 mm - 110 sm;

The effective area of action is practically not a cone with a certain opening angle, but a cylinder with a diameter equal to the diameter of the outlet nozzle of the working body and a length equal to the pipe range.

Based on the results of the experiments, a schematic diagram of the construction of a cotton harvesting unit was developed, presented in Fig. 4.10

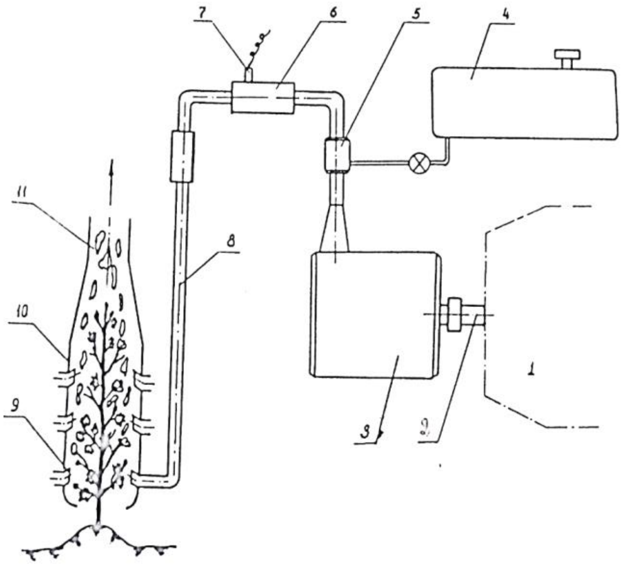


Fig. 4.10. Diagram of the cotton harvesting unit

1 - distributing gear of the tractor (x) at the combine;

2 - power take-off shaft;

3 - air compressor;

4 - fuel tank;

5 - fuel spray nozzle unit;

6 - detonation tube combustion chamber;

7 - electrically charged detonation initiator;

8 - detonation tube;

9 - outlet nozzles of detonation pipes;

10 - case;

11 - air duct for pneumatic conveying of cotton to the hopper.

The unit operates as follows. Compressor 3 is put into rotation from the transfer gearbox 1 through the power take-off shaft 2. Compressed air is supplied from the compressor to the nozzle unit 5, where it is mixed with fuel from the tank 4. The air-fuel mixture is fed into the combustion chamber 6 and then into the pipe 8 with the help of an electric discharge initiator 7 detonation combustion is initiated. Detonation wave as an impulse of force is directed by nozzles 9 to the cotton bush. The cotton is knocked out of the boxes and is carried by the pneumatic air stream into the receiving hopper. According to this scheme, several variants of the design of the housing 10 were made with a different combination of detonation pipes 8 and nozzles 9. The structures were mounted on standard combines, in which the spindle unit was replaced by the investigated one. The general view of these combines is shown in the photographs of Fig. 16.17.

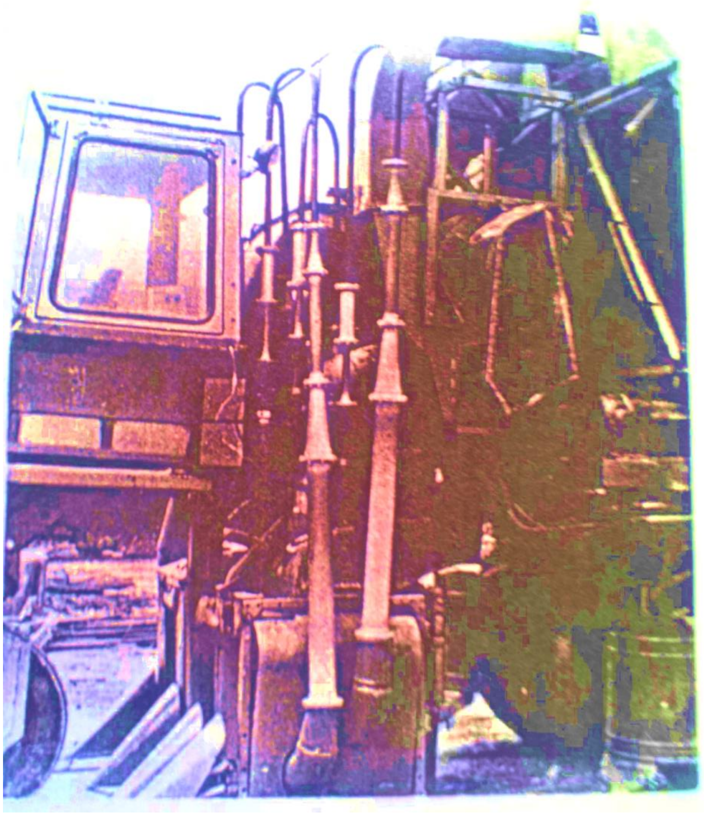


Fig. 4.11. General view of a combine with a detonation-type cotton picker

Fig. 4.12. General view of a combine with a detonation-type cotton picker

§ 4.2. Research results of an experimental cotton picker based on the use of a detanal wave force impulse

The first version of the cotton picker was mounted on a four-row cotton picker MT3-80X, instead of one serial spindle unit.

The cotton-picking unit included eight detonation wave generators with outlet nozzles 50 mm in diameter, an injector SPS (option 1), an eight-channel initiation system, and a variable geometry working chamber (option 1). The detonation tube had a complex configuration due to the arrangement of the unit on the machine.

Before testing the unit on cotton, the systems and assemblies of the mounted cotton harvesting unit were tested:

- a system for the preparation of a fuel-air mixture;
- initiation systems;
- pneumatic conveying systems for cotton from the working body to the hopper.

During the processing, stable operation of all eight GDVs was achieved at all frequencies in the range from 4 to 12 Hz (the frequency of operation of each individual GDV). At an initiating pulse frequency of 16 Hz, GDVs periodically broke down for combustion, due to the fact that the diesel fuel did not have time to fill with the fuel-air mixture and the pressure in them was insufficient to ensure stable operation of the check valve assembly.

At the same time, the most powerful claps were observed at low pulsation frequencies from 4 to 6 Hz, which also indicates the underfilling of the GDV from the conditions of full filling, the frequency is 4 Hz, which is confirmed by the calculation.

The processing of the unit showed that the optimal frequency of operation of the GDV from the conditions of full filling is the frequency of 4 Hz, which is confirmed by the calculation.

Before each experiment carried out on cotton, the cotton harvesting unit was heated for 3-5 minutes. At the same time, the functioning of all eight GDVs was checked.

The tests were carried out with the following setting of the working body:

- width of the working body A = 300mm;

- the angle of rotation of the outlet nozzles in relation to the horizontal plane 2 = 600;

- the distance between the outlet sections of the nozzles and its working chamber = 135mm.

The test results at frequencies of 4,6,10 Hz are shown, respectively, in table. 10; 11; 12, in which - in column 1 the number of opened (ripe) bolls on 8 control cotton bushes is given.

- column 2 shows the number of empty boxes after gas-dynamic treatment;

- column 3 shows the number of boxes with cotton residues (after processing);

- the column shows the number of cotton bolls (untouched) after processing;

- Column 5 contains data on cotton replacements about cotton hooks on the stem and the wake is empty, which occurs when the cotton knocked out of the boxes moves to the ventilation duct.

Table 4.4

№	Bush ordinal number	1	2	3	4	5	6	7	8
1	Number of opened boxes	12	13	8	10	13	16	9	16
2	Number of empty boxes	8	7	5	6	7	9	6	8
3	Number of half-empty boxes	2	2	2	1	3	4	2	4
4	Number of boxes with cotton	2	2	1	3	3	3	1	4
5	Number of hooks	2	-	1	-	2	4	1	5

The percentage of effectively processed bolls (empty) of the total number was 50%.

Table 4.5

№	Bush ordinal number	1	2	3	4	5	6	7	8
1	Number of opened boxes	10	14	14	9	13	12	16	13
2	Number of empty boxes	6	6	4	6	5	6	6	5
3	Number of half-empty boxes	3	6	9	2	8	3	4	5
4	Number of boxes with cotton	1	2	1	1	-	3	6	3
5	Number of hooks	2	5	2	1	3	2	4	3

The percentage of effectively processed bolls of the total number was 44%.

Table 4.6

№	Bush ordinal number	1	2	3	4	5	6	7	8
1	Number of opened boxes	9	20	14	13	8	6	8	12
2	Number of empty boxes	1	6	2	4	3	1	2	1
3	Number of half-empty boxes	7	12	10	5	4	3	5	7
4	Number of boxes with cotton	1	2	2	4	1	2	1	4
5	Number of hooks	2	2	2	1	4	-	1	2

The percentage of effectively processed bolls of their total number was 22%

As can be seen from Tables 4.4, 4.5, the optimal frequency of each GDV, at which the maximum completeness of cotton picking (50%) is ensured, is 4 Hz.

At the same time, the full operating frequency of the cotton picker is 32 Hz.

Experimental study of the efficiency of gas-dynamic processing of cotton at different angles of rotation () of the outlet nozzles of the GDV.

The studies were carried out at a frequency of 4 Hz. For three values of the angles of rotation of the outlet nozzles - 200; 400; 600. The test results are shown in tables 4.7,4.8.

Treatment efficiency was assessed in the same way as in the previous section.

Treatment efficiency was assessed in the same way as in the previous section.

The results show that a decrease in the angle of rotation of the exit nozzles from 600 to 200 leads to a decrease in the processing efficiency by 20%.

At a turning angle of 400, the machining efficiency is still satisfactory (49%).

When practically impossible to process the upper tier of the cotton bush.

Investigation of the effect of the distance between the cut of the outlet nozzles and the cotton stalk (axis of the working chamber $\alpha = 20^0, 40^0$) on the processing efficiency.

The experiments were carried out at a frequency f = 4 Hz, angles of rotation of the outlet nozzles 400.

The experiments were carried out at a frequency f = 4 Hz, angles of rotation of the outlet nozzles 400.

Table 4.7

№	Bush ordinal number	1	2	3	4	5	6	7	8
1	Number of opened boxes	8	10	14	11	14	12	9	9
2	Number of empty boxes	4	5	6	5	2	3	5	3
3	Number of half-empty boxes	4	3	4	4	9	3	3	3
4	Number of boxes with cotton	2	2	4	2	5	6	1	3
5	Number of hooks	1	1	2	3	3	-	1	1

The percentage of empty boxes of the total number of boxes was 38%.

Table 4.8

№	Bush ordinal number	1	2	3	4	5	6	7	8
1	Number of opened boxes	9	7	7	12	9	10	10	11
2	Number of empty boxes	5	4	3	6	6	7	3	3
3	Number of half-empty boxes	3	3	4	4	5	2	5	5
4	Number of boxes with cotton	1	-	-	2	2	1	2	2
5	Number of hooks	4	3	3	4	1	3	2	-

The percentage of empty boxes of the total number of boxes was 49%.

The design of the working chamber made it possible to set two dimensions of the width of the working chamber (a):

- α=300 mm;
- α=400 mm;

In this case, the distance between the outlet sections of the GDV nozzles and the axis of the working chamber (l) was 135 and 170 mm, respectively.

In this case, the distance between the outlet sections of the GDV nozzles and the axis of the working chamber (l) was 135 and 170 mm, respectively.

The results of studying the efficiency of working chambers with a width of $\alpha = 300$ mm (l = 135 mm) and a width of $\alpha = 400$ mm (l = 170 mm) presented in Tables 4.7 and 4.8 show that minor changes in dimensions α from 300 to 400 mm and from 135 to 170 mm have a significant effect on processing efficiency is not rendered.

The unit was field tested with the following setting of the working chamber:

- total 32 Hz (the frequency of each GDV was 4 Hz);

- the angle of rotation of the outlet nozzles;

- working chamber width;

- distance from the cut of the outlet nozzle to the cotton stem (to the camera axis).

Field tests of the cotton harvesting unit, which were carried out at a speed of the combine's movement across the field of 3.6 km/h (1 m/s), showed its fundamental efficiency (stable operation of all GDVs and knocking out cotton from bolls) and the promise of a gas-dynamic method of harvesting cotton.

The completeness of the cotton harvest from the control bed was about 50%. At the same time, no damage was revealed to cotton stems and unripe bolls. The contamination of the harvested cotton with leaves is satisfactory.

During the entire test cycle, a number of significant shortcomings in the units and systems of the unit were identified:

- Abundant condensation and strong gasoline undercutting at the junction of the fuel hoses with the generators located on the left side of the working body; the reason for this, obviously, is an insufficiently effective mixture formation system, which does not allow obtaining finely dispersed fuel assemblies and the asymmetry of the fuel supply system from the mixing chamber to the GDV, as a result of which a richer mixture is sent to the first 4 GDV (left) from the distribution "spider";

- some inhomogeneity in the operation of the GDV due to the asymmetry of the fuel assembly supply system, which affects the conditions for filling the GDV of fuel assemblies and causes some difference in the ratio of the components of the mixture entering the different GDV;

- the complexity of testing in the field of measuring instruments, a test low-frequency mode (for example, 0.5 Hz) should be provided, which makes it possible to make sure by ear that an initiating electrical impulse has arrived at all spark plugs;

- the practical impossibility of adjusting the composition of the mixture during the operating mode, because the screw for adjusting the composition of the mixture is located in the immediate vicinity of the working body;

- two front (lower) exit nozzles of the GDV are located sufficiently high above the ground level (200 mm), as a result of which the lower tier of the cotton bush remained outside the zone of gas-dynamic effect;

- limited possibilities of adjusting the outlet nozzles of the GDV relative to the body of the working chamber in the vertical and horizontal directions, which led to a significant service of the research range;

- the practical complexity of realizing the readjustment of the location of the outlet nozzles of the GDV in the working body;

- insufficient frequency of operation of each GDV 4Hz, determined by the power of the air compressor, does not provide a continuous zone of gas-dynamic effect during the movement of the unit and does not allow increasing the completeness of cotton picking by more than 50% (at a minimum speed of the combine of 3.78 km/h, the distance along the ridge between two consecutive actuations of each GDV is 26 cm).

The second cotton harvesting unit was mounted on a 2-row cotton harvesting machine KhNP - I, 8, instead of a serial spinel unit.

The cotton-picking unit included four GDVs with outlet nozzles with a diameter of 140 mm, a propulsion system (option 2), a four-channel initiation system and a working chamber (option 2).

During the development of the systems and units of the unit, stable operation of all 4 GDVs was achieved, the optimal frequency of operation of each GDV was determined from the condition of its full filling with a mixture, which was 2.5 Hz (while the total frequency of operation of the unit was 10 Hz). of operation of the GDV more than 5 Hz, a clear deterioration in the work was observed, which is explained by the fact that the GDV did not have time to fill the fuel assemblies before the working cycle.

The results are tested are shown in table. 4.8,4.9,4.10

The completeness of cotton picking at frequencies of 4, 10 and 20 Hz was 39%, 87% and 71%, respectively.

Table 4.9

$$\int = 4Гц$$

№	Course number	1	2	3	4	5	6	7	8
1	Number of opened boxes	8	6	8	7	7	8	7	8
2	Number of effectively processed (empty) bolls	3	2	3	3	3	4	2	3

Table 4.10

$$\int = 10Гц$$

№	Course number	1	2	3	4	5	6	7	8
1	Number of opened boxes	7	8	7	6	8	8	7	8
2	Number of effectively processed (empty) bolls	0	2	1	1	2	0	1	1

Table 4.11

$$\int = 20Гц$$

№	Course number	1	2	3	4	5	6	7	8
1	Number of opened boxes	7	7	8	6	8	7	7	8
2	Number of effectively processed (empty) bolls	2	2	3	2	2	1	2	3

The results of the experiments showed that the maximum completeness of cotton picking is achieved at a unit operating frequency of 10 Hz. With an increase in the frequency to 20 Hz, the collection completeness decreases due to some underfilling of the GDV with the mixture and, consequently, a decrease in the single impulse of the GDV. A decrease in the frequency to 4 Hz leads to a decrease in the completeness of cotton picking due to breaks in the strip zone of the gas-dynamic effect on the cotton ridge when the combine moves.

During field trials, the cotton picker proved to be a workable design, providing efficient cotton harvesting. The tests were carried out at a combine speed of 3.6 km/h (I m/s). The maximum completeness of cotton picking was obtained when the unit was operating at a frequency of 10 Hz and amounted to 80 ÷ 90%. At frequencies of 4 and 20 Hz, the cotton picking efficiency was 35% and 68%, respectively.

Unlike unit No. 1 with a nozzle SPS, in unit No. 2 with an engine SPS, no leakage of gasoline was noticed in the connecting nodes for the entire cycle of meals.

During the tests, no cases of damage to cotton stalks were found. However, there have been isolated cases of damage to unripe cotton bolls. There was also an increased contamination of the harvested cotton with leaves. This suggests that the gas-dynamic impact on the cotton course from the GDV is excessively high (the volume of fuel assemblies undermined in each cycle of the GDV is 15 liters, while the volume of one GDV of cotton harvester No. 1 is 3 liters).

The tests were accompanied by significant noise generated by the GDV, which somewhat complicated the research.

During the entire test cycle, no cases of cotton fiber ignition from combustion products were detected.

The following conclusions can be made on the main things that have been said above:

1. The detonation wave has a sufficient force impulse to knock ripe cotton out of the box at a distance of up to 135 cm.

2. The field of impulses must be calculated based on the cylindrical distribution of the acting force in space.

3. By means of experimental processing, the first specimens of cotton picking on the detonation principle reached a collection completeness of up to 70 ÷ 80% in one pass with a degree of contamination of 15%.

4. It has been confirmed by experiment that the ignition of cotton fiber from contact with detonation products does not occur.

5. The principle as a whole has confirmed its efficiency, and in order to create a real machine, it is necessary to conduct more detailed studies of the designs of a spindleless cotton picker.

5. DETONATION WAVE GENERATOR IN THE PROBLEMS OF DRAINING AND DEATHING PUPPETS OF WHITE SILKWINE

One of the most time-consuming, complex and critical technological operations in the process of growing raw cotton is the operation of drilling the cords in the sub-plow layer.

The use of a detonation pipe as a tool for making cords in a compacted sublayer of old-damaged soils, which is characteristic of cotton-growing swarms and leads to waterlogging, salinization and loss of fertility in a large number of renal areas.

The technological scheme of using the generator for the formation of drainage holes (boreholes) is shown in Figures 5.1 and 5.2.

A detonation tube directed with its open end towards the ground and moved in a vertical direction drills a cylindrical borehole. According to experimental data, the drilling speed is 1.5 m/min.

The well formation process is as follows. At the 1st cycle - filling the pipe with a fuel-air mixture, at the 2nd cycle - ignition and the passage of the detonation wave to the open end of the pipe. 3rd cycle - the cycle of the detonation wave and detonation products flowing into the face of the destruction of the soil into small fragments. The detonation product stream carries the destroyed soil out of the well. If in the well during the 1st stroke it also explodes and the pressure rises in the bottom hole, leading to cracking of the side walls of the well.

After the detonation products have escaped into the atmosphere, the tube is again filled with a mixture and the cycle is repeated.

The size of the side cracks (their length) is 30 cm.

According to the recommendations of specialists, the density of wells (holes) in saline areas should be 50 pieces per 1 ha.

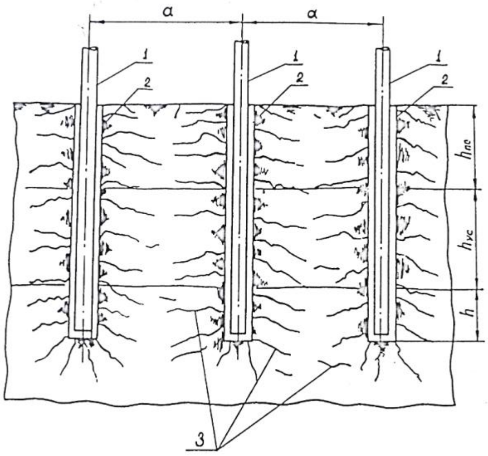


Fig. 5.1. A diagram of the mutual arrangement of detonation generators buried in the soil

h_{nc} - arable layer; compacted layer; h - buried under the compacted layer; I - detonation tubes; 2 - borehole walls; 3 - cracks in the soil from the borehole walls.

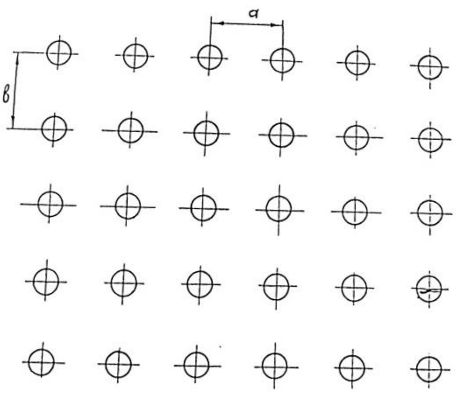


Fig. 5.2. Wells arrangement diagram (plan view)

a - is the distance between two adjacent wells along the front; b - the distance between two adjacent wells in depth.

Attached equipment GDRP-3 allows drilling 8 holes with a depth of 2 m in 3 minutes of machine time. To adapt the GDRP-3 equipment to the drilling task, it is required to manufacture additional nozzles for detonation pipes and a lifting mechanism.

The approximate drilling time for one hectare is:

$$t = \frac{n \cdot (3 + \Delta t)}{8 \cdot 60} \text{ hour,}$$

Where t is additional time to machine;

n –the number of wells in 1 ha;

In Δt =2 min, t =30 min.

After processing by the installation based on the use of a pulse of detonation force, a slight increase in hydrocarbonates was observed.

An increase in the content of hydrocarbonates in the soil layer, in our opinion, is associated with an increase in the concentration of CO2 directly in this layer, which occurs due to the side of the fuel-air mixture in the gas-dynamic pipes. After the intake of CO2, the following reaction occurs in relatively moist soils:

$$H_2O + CO_2 = H_2CO_3$$

Carbonic acid is known to be weak, but it can quickly react with soil carbonates:

$$CaCO_3 + H_2CO_3 = Ca(HCO_3)_2$$

The resulting H_2, CO_2 and HCO_3 temporarily support the slightly alkaline reaction and thus the soil solution is enriched with calcium and magnesium due to their carbonates.

As a result, the nitrification process is intensified and, as a result, there is an improvement in cotton nutrition due to nitrates.

The author continues the research begun with the aim of creating additional equipment for the GDRP-3 for carrying out drainage works.

6. SCHEME OF EXPERIMENTS ON THE DEATH OF PUPPETS OF TUTA SILKWINE

There are known methods of primary processing of cocoons by introducing them into the working environment, which simultaneously kills the pupa. As a working medium, for example, steam, methyl bromide, liquid nitrogen are used.

There is a known method of primary treatment of cocoons (and. with. No. 592876 class DO16 7/02 dated 02.15.78) by soaking them with water at a temperature of 50 ÷ 750C, characterized in that, in order to increase the efficiency of the process, the cocoons after soaking are exposed to the action of an alternating electric current with a frequency of more than 1000 Hz.

The method of primary processing of cocoons (A.S. No. 57094 KLDO16 7/02) consists in chemical carrot with a mixture of air with methyl bromide and subsequent drying, while the carrot is carried out within 2 ÷ 4 hours until the pupa is completely killed, and drying on shady racks drying for 30 ÷ 45 days.

Known application of Japan (No. 55_49164 class DO16 7/04) for a method of steaming cocoons by immersing them in boiling water, characterized in that in order to increase the steaming efficiency by filling the cocoons with water, the cocoons are immersed when water is boiling in a film mode, when after immersion, the cocoons are brought out to the surface of the water and kept with protrusion above the water by an amount not exceeding the thickness of the cocoon shell; in this case, the holding time of the cocoons above water is 10–15 s.

The disadvantages of the known methods are that during processing, the valuable technological properties of the shell deteriorate, that is, the breakage increases, the length of the cocoon thread decreases, as a result of which the output of the plan and its quality decrease.

The aim of the study is to improve the quality of the cocoon thread and increase the processing productivity.

This goal is achieved by using an acoustic field created by a pulsed generator of detonation waves (GDW) with a frequency of 1 ÷ 20 Hz and a shock wave speed of 1500 ÷ 1800 m/s for 1 ÷ 3 minutes as the working medium in which the cocoons are placed, while the cocoons are located at the source of shock waves at a distance of 0.5 ÷ 0.7 m from the source of shock waves.

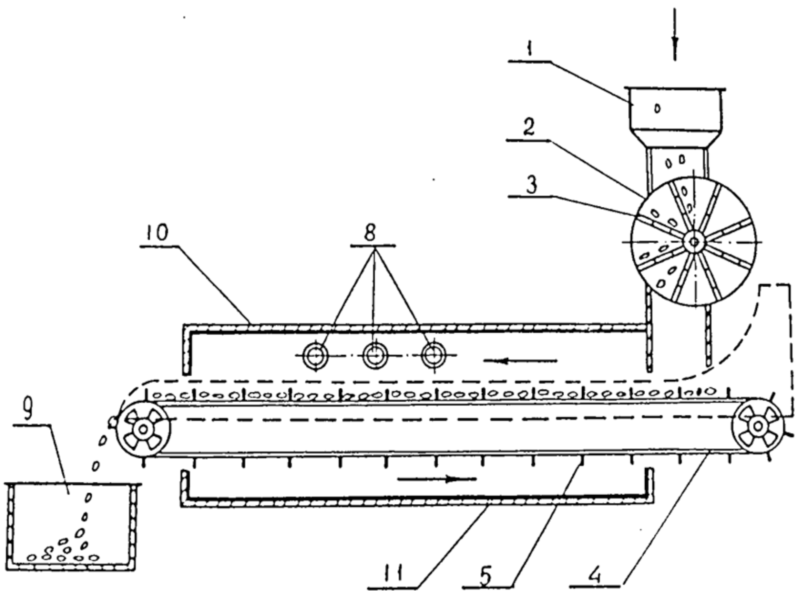
The detonation wave generated in the GDV, upon leaving it, breaks up into a shock wave moving through the air and a contact discontinuity moving behind it. A shock wave (SW) penetrates the shell of the cocoon and kills the pupa in it.

The proposed device that implements the method works as follows.

Untreated silk cocoons (Figure 6.1) are fed from a hopper (not shown) to the inlet pipe 1 and the metering drum 2 (which can be made with elastic blades 3) is fed to the conveyor belt 4 by transverse slats 5. The conveyor belt is bounded from the sides by plates 6, and from above it is screened by a fine-mesh metal mesh 7, which is acoustically transparent for shock waves and protects the cocoons from the dynamic effect of the flow of combustion products emanating from the GDV following the shock wave.

As the conveyor belt moves, the cocoons fall into the zone of the acoustic field created by the detonation wave generator 8.

After passing through the acoustic impact zone, the treated silk cocoons are poured from the conveyor belt into the hopper



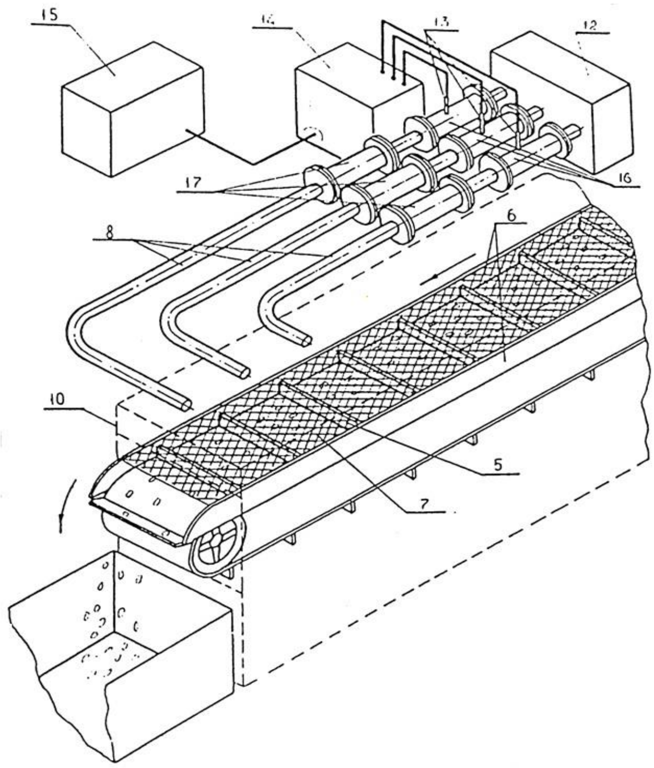


Fig. 6.1. Device for the primary processing of the cocoon (sectional view)

To localize the dynamic impact of the PS flow, an acoustically transparent mesh screen is installed above the conveyor chute.

In the experiments, portions of cocoons were placed at different distances from the end in the plane of the GDV end on a line perpendicular to the generator axis. The frequency of generation of shock waves varied from 1 Hz to 16 Hz. The exposure time varied in interval from 1 min to 5 min, the speed of shock waves was 1500-1800 m/s.

Of the most effective processing parameters are the generation frequency of the shock wave f = 16 Hz and the distance from the GDV axis t = 0.75 m, D beats. waves = 1750 m/s.

The quality of the killing of the pupa was assessed at its opening according to the state of the liver tissue.

Thus, in comparison with the known methods, this method has the following advantages:

1 - allows to increase processing performance;

2 - excludes from the technological cycle a long-term operation subsequent

to the processing of shadow drying;

3 - does not impair the quality of the cocoon thread.

1.The possibility of drainage of swampy and saline soils by drilling boreholes with a detonation pipe has been experimentally shown. The development of a unit unified with GDRP-3, capable of making 8 boreholes up to 3 cm deep and 50 mm in diameter in 5 minutes of total time, is proposed.

2. Research has been carried out to kill silkworm pupae in the field of detonation waves. Positive results were obtained: the silkworm pupa dies after being weaned by detonation waves with a frequency of 16 Hz for 3 minutes.

The method and device are patented.

2-excludes from the technological cycle a long-term operation subsequent to the processing of shadow drying;

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The method and device are patented.

GENERAL CONCLUSIONS

The main provisions of the applied technique of the exioriment were as follows:

1.The test field is subdivided into sections that are cultivated according to the traditional traditional technology. In general, the same agrotechnical measures of a general nature are carried out throughout the field.

2. Loosening with the use of GDRP - 3 is carried out at various stages from the period before germination to the period of cotton ripening. Repeatability of processing: from one time to several times.

3. For each site, differing in one or another processing conditions, specialists are monitored for the process of germination and development of cotton until harvesting.

4. The results of observations are processed and generalized by methods adopted in agricultural practice.

5. During the entire test cycle, no cases of cotton fiber ignition from combustion products were revealed.

6. The detonation wave has sufficient force impulse to knock ripe cotton out of the boll at a distance of up to 135 cm.

7. The field of impulses must be calculated based on the cylindrical distribution of the acting force in space.

8. By means of experimental processing, the first specimens of cotton picking on the detonation principle reached a collection completeness of up to 70-80% in one pass with a degree of contamination of 15%.

9. It has been confirmed by experiment that the ignition of cotton fiber from contact with detonation products does not occur.

10. The principle as a whole has confirmed its efficiency, and in order to create a real machine, it is necessary to conduct more detailed studies of the designs of a spindleless cotton picker.

11. The possibility of drainage of swampy and saline soils by drilling bore-

holes with a detonation pipe has been shown experimentally.

12. Positive results were obtained: the silkworm pupa dies after being irradiated with detonation waves with a frequency of 16 Hz for 3 minutes.

13. Formed H_2, CO_2 and HCO_3 support the slightly alkaline reaction temporarily and thus the soil solution is enriched with calcium and magnesium due to their carbonates.

14. As a result, the nitrification process intensifies and, as a result, there is an improvement in cotton nutrition due to nitrates.

15. The author continues the research begun with the aim of creating additional equipment for the GDRP-3 for carrying out drainage works.

16. Research on the killing of silkworm pupae in the field of detonation waves has been carried out. Positive results were obtained: the silkworm pupa dies after being weaned by detonation waves with a frequency of 16 Hz for 3 minutes.

17. Excludes from the technological cycle a long-term operation following after the processing of shadow drying;

18. Does not impair the quality of the cocoon thread.

REFERENCES

1. Isomiddinov, A., Axrorov, A., Karimov, I., & Tojiyev, R. (2019). Application of rotor-filter dusty gas cleaner in industry and identifying its efficiency. *Austrian Journal of Technical and Natural Sciences*, (9-10).
2. Rasuljon, T., Akmaljon, A., & Ilkhomjon, M. (2021). SELECTION OF FILTER MATERIAL AND ANALYSIS OF CALCULATION EQUATIONS OF MASS EXCHANGE PROCESS IN ROTARY FILTER APPARATUS. *Universum: технические науки*, (5-6 (86)), 22-25.
3. Tojiev, R.J. (2019). Drying glass feed stock in drum drier for manufacturing glass products. *Scientific-technical journal*, *22*(3), 137-140.
4. Фролов, В.Ф., Круковский, О.Н., & Ахунбаев, А.А. (1992). Сушка высоковлажных тонкодисперсных материалов. *Минский международный форум «Тепломассообмен в химико-технологических устройствах» Тез. докл.*, 83.
5. Рахимов, Н.Р., Тожиев, Р.Ж., Сайдахмедов, Ш.М., & Хайдаров, И.М. (2001). Датчик-зонд для контроля за влажностью и содержанием воды в нефти и нефтепродуктах. *Узбекский журнал нефти и газа*, *2*, 39-40.
6. Тожиев, Р.Ж., Ахунбаев, А.А., & Миршарипов, Р.Х. (2018). Сушка тонкодисперсных материалов в безуносной роторно-барабанном аппарате. *Научно-технический журнал ФерПИ,-Фергана*, (2), 116-119.
7. Мадаминова, Г.И., Тожиев, Р.Ж., & Каримов, И.Т. (2021). Барабанное устройство для мокрой очистки запыленного газа и воздуха. *Universum: технические науки*, (5-4 (86)), 45-49.
8. Isomidinov, A.S., Karimov, I.T., & Tojiev, R.J. (2021). SEARCHING THE LOSING OF HYDRAULIC PRESSURE IN ROTOR-FILTER GAS CLEANER APPARATUS. *Scientific-technical journal*, *3*(1), 69-72.
9. Тожиев, Р. Ж., Ахунбаев, А. А., Миршарипов, Р. Х., Муллажонова, М. М. К., & Йигиталиев, М.М.У. (2021). Анализ процесса сушки минеральных удобрений в барабанном аппарате. *Universum: технические науки*, (8-1 (89)), 31-36.
10. Rasuljon, T., Azizbek, I., & Bobojon, O. (2021). Studying the effect of rotor-filter contact element on cleaning efficiency. *Universum: технические науки*, (6-5 (87)), 28-32.
11. Тожиев, Р.Ж., Садуллаев, Х.М., & Исомиддинов, А.С. (2016).

Детонацияга асосланган зарбли тўлқин берадиган генератор қурилмасини халқ хўжалигининг айрим соҳаларига қўллаш ва синаб кўриш. *Фар ИТЖ*, (4), 21-26.

12. Ахроров, А.А.У., Исомиддинов, А.С., & Тожиев, Р.Ж. (2020). ГИДРОДИНАМИКА ПОВЕРХНОСТНО-КОНТАКТНОГО ЭЛЕМЕНТА РОТОР-ФИЛЬТРУЮЩЕГО ПЫЛЕУЛОВИТЕЛЯ. *Universum: технические науки*, (8-3 (77)).
13. Tojiev, R., Ortikaliyev, B., & Tojiboyev, B. (2019). Improving selecting technology of raw materials of fireproof bricks. *Тенденции и переспективы развития науки и оброзования в условиях глобализации. Украина*, *27*(46), 606-609.
14. Тожиев, Р.Ж., Миршарипов, Р.Х., Ахунбаев, А.А., & Абдусаломова, Н.А.К. (2020). Оптимизация конструкции сушильного барабана на основе системного анализа процесса. *Universum: технические науки*, (11-1 (80)).
15. Рахимов, Н.Р., Тожиев, Р.Ж., Тилаволдиев, О., & Ахунов, К.Х. (2003). Оптоэлектронный колориметр для контроля за цветовыми различиями нефтепродуктов. *Узбекский журнал нефти и газа*, (3), 39.
16. Тожиев, Р.Ж. (1993). *Механико-технологические решения бесконтактного воздействия на почву и растения с разработкой газодетонационных агрегатов для высокоэффективного возделывания хлопчатника* (Doctoral dissertation, ВНИИ мех. сел. хоз-ва).
17. Тожиев, Р.Ж., Исомиддинов, А.С., Ахроров, А.А.У., & Сулаймонов, А. М. (2021). ВЫБОР ОПТИМАЛЬНОГО АБСОРБЕНТА ДЛЯ ОЧИСТКИ ВОДОРОДНО-ФТОРИСТОГО ГАЗА В РОТОРНО-ФИЛЬТРОВАЛЬНОМ АППАРАТЕ И ИССЛЕДОВАНИЕ ЭФФЕКТИВНОСТИ АППАРАТА. *Universum: технические науки*, (3-4 (84)), 44-51.
18. Исомиддинов, А.С., & Давронбеков, А.А. (2021). Исследование гидродинамических режимов сферической углубленной трубы. *Universum: технические науки*, (7-1 (88)), 53-58.
19. Rasuljon, T., Azizbek, I., & Abdurakhmon, S. (2021). Research of the hydraulic resistance of the inertial scrubber. *Universum: технические науки*, (7-3 (88)), 44-51.
20. Тожиев, Р.Ж., Каримов, И.Т., & Исомидинов, А.С. (2020). Чанглигазларнихўлусулдатозаловчиқурилманисаноатдақўллашнингилми

й-техник асослари: Монография. *ФарПИ" Илмий-техника" журналинашриётбўлими-Фарғона, 91.*

21. Тожиев, Р.Ж., & Ортикалиев, Б.С. (2019). ОЛОВБАРДОШ ҒИШТ ИШЛАБ ЧИҚАРИШДА ХОМ АШЁЛАРНИ САРАЛАШ ЖАРАЁНИНИ ТАДҚИҚ ҚИЛИШ. *Журнал Технических исследований*, (2).
22. Тожиев, Р.Ж., Садуллаев, Х.М., Сулаймонов, А., & Герасимов, М.Д. (2019). НАПРЯЖЕННОЕ СОСТОЯНИЕ ВАЛА С ПОПЕРЕЧНЫМ ОТВЕРСТИЕМ ПРИ СОВМЕССТНОМ ДЕЙСТВИИ ИЗГИБА И КРУЧЕНИЯ. In *Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях* (pp. 273-281).
23. Tojiev, R.Z., Sadullaev, H.M., Soliev, O.K., & Muminov, H.N. (2019). NEW STRUCTURE OF CALCINER'S FIRE CHAMBER. In *INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION* (pp. 20-24).
24. Zhumabaevich, T.R., Mansurovich, S.H., Khursanovich, S.O., & Nuriddinovich, M.H. (2019). New structure of calciner’s fire chamber. *International scientific review*, (LV).
25. Рахимов, Н.Р., Тожиев, Р.Ж., & Сайдахмедов, Ш.М. (2003). Оптоэлектронное устройство для определения содержания эмульсионной воды в нефти и нефтепродуктах. *Узбекский журнал нефти и газа*, (1).
26. Tojiyev, R.J., Ortiqaliyev, B.S.O.G.L., Abdupattoyev, X.V.O., & Isomiddinova, D.I.J.Q. (2021). DONADOR-SOCHILUVCHAN MAHSULOTLARNI SARALASHDA SM-237A MARKALI MASHINALARINI O ‘RNI. *Scientific progress*, *2*(2), 1378-1381.
27. Аликулова, Д.А., Тожиев, П.Ж., Тураев, Х.Х., & Джалилов, А.Т. (2020). Влияние наполнителей на теплофизические свойства полиэтилена. *Главный редактор*, 45.
28. Исомидинов, А.С., Каримов, И.Т., & Тожиев, Р.Ж. (2018). Ротор фильтрли чанг тозалаш курилмасига берилаётган суюклик сарфини тажрибавий аниклаш. *Замонавий ишлаб чикаришнинг иш самарадорлиги ва энерго-ресурс тежамкорлигини ошириш муаммолари. Халкаро илмий-амалий анжуман. – Андижон, - 2018. - Б*, 424-428.
29. Исомидинов, А.С., Тожиев, Р.Ж., & Каримов, И.Т. (2018). Дул усулда чангли газларни тозаловчи роторли курилма. *Фаргона политехника*

институтининг илмий-техник журнали. - Фаргона, (1), 195-198.

30. Isomidinov, A.S., Tojiev, R.J., & Karimov, I.T. (2018). Rotor device for cleaning dusty gases by wet method. *Scientific and technical journal of Fergana Polytechnic Institute. - Fergana*, (1), 195-198.
31. Tojiev, R.J., & Sadullaev, X.M. (2018). DETERMINATION OF THE ANGLE OF CAPTURE OF THE CRUSHING CHAMBER OF A CONE CRUSHER, TAKING INTO ACCOUNT THE KINEMATICS OF THE ROLLING CONE. *Scientific-technical journal*, *22*(3), 55-60.
32. Алиматов, Б.А., Тожиев, Р.Ж., & Садуллаев, Х.М. (2001). Барботажный экстрактор без взаимного уноса жидкостей в смежные ступени. *Науч.-техн. журн. Ферг. политехн. ин-та. Фергана*, (2), 62.
33. Рахимов, Н.Р., Тожиев, Р.Ж., & Холмирзаев, А.А. (2000). Оптических параметров нефти и нефтепродуктов.
34. Тожиев, Р.Ж., Ковнеристов, Г.Б., & Алиматов, Б.А. (1984). Основные факторы, влияющие на срок службы конвейерных лент и их выявление.
35. Isomidinov, A., Boykuzi, K., & Khonnazarov, R. (2021). Effect of Rotor-Filter Device Operation Parameters on Cleaning Efficiency. *International Journal of Innovative Analyses and Emerging Technology*, *1*(5), 100-105.
36. Rasuljon, T., Azizbek, I., & Akmaljon, A. (2021). Analysis of the dispersed composition of the phosphorite dust and the properties of emission fluoride gases in the production of superphosphate mineral fertilizers. *Universum: химия и биология*, (6-2 (84)), 68-73.
37. Тожиев, Р.Ж., Ахроров, А.А., & Исомидинов, А.С. (2020). Analyze of contact surface phases in wet type rotor-filter gas collector. *Ученый XXI века. международный научный журнал*, (5-3), 64.
38. Tojiev, R.J., Tuhtakuziev, A., & Ergashev, M.M. (2020). STUDY OF MOVEMENT UNIFORMITY OF MOUNTED DISC HARROWS IN DEPTH OF PROCESSING. *Scientific-technical journal*, *24*(3), 28-31.
39. Isomidinov, A.S., Karimov, I.T., & Tojiev, R.J. (2021). SEARCHING THE LOSING OF HYDRAULIC PRESSURE IN ROTOR-FILTER GAS CLEANER APPARATUS. *Scientific-technical journal*, *3*(1), 69-72.
40. Isomidinov, A.S., Karimov, I.D., & Tojiev, R.J. (2020). SEARCHING THE LOSING OF HYDRAULIC PRESSURE IN ROTOR-FILTER GAS CLEANER APPARATUS. *Scientific-technical journal*, *24*(1), 163-166.

41. Каримов, И.Т., Алиматов, Б.А., & Тожиев, Р.Ж. (2000). Гидродинамика барботажных экстракторов. *Научно-технический журнал Ферганского политехнического института*, (3), 109-112.

42. Ортикалиев, Б.С., & Тожиев, Р.Ж. Оловбардош гишт ишлаб чикаришда хом ашёларни саралаш жараёнини тадкик килиш. *Техник тадкикотлар журнали-2019 й*.

43. Karimov, I., Tojiyev, R., Madaminova, G., Ibroximov, Q., & Xamdamov, O.T. (2021). HYDRODYNAMICS OF WET DUSH POWDER BLACK DRUM EQUIPMENT. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 49-56.

44. Sadullaev, X., Tojiyev, R., & Mamarizaev, I. (2021). EXPERIENCE OF TRAINING BACHELOR-SPECIALIST MECHANICS. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 116-121.

45. Karimov, I., Tojiyev, R., Madaminova, G., Ibroximov, Q., & Xamdamov, O.T. (2021). WET METHOD DUST REMOVER BLACK DRUM DEVICE. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 57-63.

46. Tojiyev, R., Axunboev, A., Xakimov, X., & Teshaboev, A. (2021). DRYING FINE MATERIALS IN THE CONTACT DEVICE. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 139-143.

47. Tojiyev, R., Ortiqaliyev, B., & Sotvoldiyev, K. (2021). IMPROVING THE DESIGN OF THE SCREED FOR FIREBRICKS USING SOLIDWORKS. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 91-99.

48. Tojiyev, R.J., Akhunbaev, A.A., & Mirsharipov, R.X. (2021). RESEARCH OF HYDRODYNAMIC PROCESSES WHEN DRYING MINERAL FERTILIZERS IN DRUM DRYERS. *Scientific-technical journal*, *4*(4), 10-16.

49. Tojiyev, R.J., Sadullayev, X.M., & Tuychiyeva, S.S. (2021). IDENTIFYING ANGLE OF CAPTURE OF A CRUSHING CHAMBER, BY TAKING INTO ACCOUNT THE KINEMATICS OF MOVABLE CONE CRUSHER. *Scientific-technical journal*, *4*(1), 59-66.

50. Герасимов, М.Д., Воробьёв, Н.Д., Герасимов, Д.М., & Степанищев, В.А. (2017). Исследование многоступенчатого вибрационного механизма с направленными колебаниями каждой ступени. *Вестник Белгородского государственного технологического университета им. В.Г Шухова*, (3).

51. Тожиев, Р.Ж., Исомиддинов, А.С., & Ахроров, А.А. У. (2021).

ИССЛЕДОВАНИЕ ПЛЕНОЧНОГО СЛОЯ НА РАБОЧЕЙ ПОВЕРХНОСТИ РОТОРНО-ФИЛЬТРУЮЩЕГО АППАРАТА. *Universum: технические науки*, (7-1 (88)), 42-48.

52. Tojiev, R. (2021). FACTORS AFFECTING THE LIQUIDITY OF COMMERCIAL BANKS. *International Finance and Accounting*, *2021*(1), 9.

53. Тожиев, Р.Р., Бобокулова, О.С., Мирзакулов, Х.Ч., & Суванов, Ф.Р. (2020). ТЕХНОЛОГИЯ ПЕРЕРАБОТКИ СУХИХ СМЕШАННЫХ СОЛЕЙ ОЗЕРА КАРАУМБЕТ НА СУЛЬФАТА НАТРИЯ. *Евразийский Союз Ученых*, (6-6 (75)).

54. Abdullaev, A.S., Nurmukhamedov, X.S., Mavlonov, E.T., Tojiev, R.J., & Usmanov, B.S. (2020). CALCULATION OF THE HUMIDITY OF MASHED ROOT VEGETABLES OBTAINED BY INSTANTANEOUS PRESSURE RELIEF. *Scientific-technical journal*, *24*(4), 37-41.

55. Тожиев, Р.Ж., Ахроров, А.А., & Герасимов, М.Д. (2019). ИССЛЕДОВАНИЕ МЕТОДОМ ФОТОУПРУГОСТИ КОВЕЙЕРНЫХ ЛЕНТ ПРИ РАЗЛИЧНЫХ УСЛОВИЯХ НАГРУЖЕНИЯ. In *Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях* (pp. 266-273).

56. Tojiev, R.J. (2019). DETERMINATION OF ANGLE CAPTURE OF THE CONE CRUSHER IN THE HORIZONTAL PLANE. *Scientific-technical journal*, *22*(2), 148-149.

57. Tojiev, R.J. (2019). INTENSIFICATION OF HEAT TRANSFER IN CROSSCUT WASHING OF HEAT EXCHANGER’S MATRIX. *Scientific-technical journal*, *22*(4), 29-34.

58. Тоджиев, Р.Ж., Саддулаев, Х.М., Герасимов, М.Д., & Воробьёв, Н.Д. (2018). АСИММЕТРИЧНЫЕ КОЛЕБАНИЯ ВИБРАЦИОННЫХ МОДУЛЕЙ СТРОИТЕЛЬНЫХ И ДОРОЖНЫХ МАШИН. In *Энерго-, ресурсосберегающие машины, оборудование и экологически чистые технологии в дорожной и строительной отраслях* (pp. 215-224).

59. Tojiev, R.J., & Gerasimov, M.D. (2018). DEVELOPMENT OF A VIBRATORY VULNER MODEL WITH REGULATED PARAMETERS. *Scientific-technical journal*, *22*(4), 60-65.

60. Мирзакулов, Х.Ч., Тожиев, Р.Р., & Бобокулова, О.С. (2017). Исследование процессов упарки и фильтрации очищенной рапы озер Караумбет и Барсакельмес. *Universum: технические науки*, (8 (41)).

61. Тожиев, Р.Ж., Мансуров, Ю.Н., Тажибаев, Р.К., Махмудов, А.М., Мадаминов, М.М., Сабиржанов, М.М., ... & Кожин, А.В. (2002). Саперная лопата.

62. Краснощеков, Ю.И., Карабаев, М.К., Тожиев, Р.Ж., Товчигречко, В.Н., Соболев, Л.Ю., Максаков, А.А., ... & Корчаков, В.Ф. (1995). УСТРОЙСТВО ДЛЯ СБОРА УРОЖАЯ ХЛОПКА.

63. Краснощеков, Ю.И., Бурханов, Р.Б., Тожиев, Р.Ж., Товчигречко, В.Н., Максаков, А.А., Горанский, Н.Б., ... & Карабаев, М.К. (1994). УСТРОЙСТВО ДЛЯ ОБРАБОТКИ ПОЧВЫ.

64. КАРАБАЕВ, М.К., КРАСНОЩЕКОВ, Ю.И., ТОЖИЕВ, Р.Ж., ТОВЧИГРЕЧКО, В.Н., СОБОЛЕВ, Л.Ю., МАДАМИНОВ, Б.А., ... & ГОРАНСКИЙ, Н.Б. (1993). Способ первичной обработки коконов и устройство для его осуществления.

ADDITIONAL REFERENCES

1. Дусматов, А.Д., Хурсанов, Б.Ж., Ахроров, А.А., & Сулаймонов, А. (2019). ИССЛЕДОВАНИЕ НАПРЯЖЕННО ДЕФОРМИРОВАННОЕ СОСТАЯНИЕ ДВУХСЛОЙНЫХ ПЛАСТИН И ОБОЛОЧЕК С УЧЕТОМ ПОПЕРЕЧНЫХ СДВИГОВ. In *Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях* (pp. 48-51).

2. Karimov, I.T., Ahrorov, A.A., & Kahorov, I.I. (2019). THE METHOD OF DETERMINING THE SIZE OF THE MIXING ZONE BUBBLING EXTRACTOR. In *INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION* (pp. 11-15).

3. Ахунбаев, А.А., Ражабова, Н.Р., & Вохидова, Н.Х. (2020). Исследование гидродинамики роторной сушилки с быстровращающимся ротором. *Экономика и социум*, (12-1), 392-396.

4. Mirsharipov, R.H., & Akhunbaev, A.A. (2020). Research of Hydrodynamic Parameters of Drum Dryer. *International Journal of Advanced Research in Science, Engineering and Technology*, *7*(11).

5. Sadullaev, X., Alimatov, B., & Mamarizaev, I. (2021). DEVELOPMENT AND RESEARCH OF A HIGH-EFFICIENT EXTRACTION PLANT AND PROSPECTS FOR INDUSTRIAL APPLICATION OF EXTRACTORS

WITH PNEUMATIC MIXING OF LIQUIDS. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 107-115.

6. Sadullaev, X., Tojiyev, R., & Mamarizaev, I. (2021). EXPERIENCE OF TRAINING BACHELOR-SPECIALIST MECHANICS. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 116-121.
7. Исомидинов, А.С. (2019). Исследование гидравлического сопротивления роторно-фильтрующего аппарата. *Universum: технические науки*, (10-1 (67)).
8. Ergashev, N.A. (2020). DETERMINATION HYDRAULIC RESISTANCE OF DEVICE THAT HAS THE VORTEX FLOW CREATING CONTACT ELEMENT. *Austrian Journal of Technical and Natural Sciences*, (3-4).
9. Sadullaev, X., Muydinov, A., Xoshimov, A., & Mamarizaev, I. (2021). ECOLOGICAL ENVIRONMENT AND ITS IMPROVEMENTS IN THE FERGANA VALLEY. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали*, *1*(5), 100-106.
10. Исомидинов, А.С. (2019). Исследование гидравлического сопротивления роторно-фильтрующего аппарата. *Universum: технические науки*, (10-1 (67)).
11. Каримов, И.Т. (2019). Анализ результатов исследований по определению газовой подушки газораспределительного устройства барботажного экстрактора. *Universum: технические науки*, (10-1 (67)).
12. Хакимов, А.А. (2020). Связующее для угольного брикета и влияние его на дисперсный состав. *Universum: химия и биология*, (6 (72)), 81-84.
13. Хакимов, А.А., Салиханова, Д.С., & Каримов, И.Т. (2018). Кўмир кукунини брикетловчи қурилма. *Фарғона политехника институти илмий техника журнали. - 2018. - № спец*, *2*, 169-171.
14. Ализафаров, Б.М. (2020). ECOLOGICAL DRYING OF FINE DISPERSED MATERIALS IN A CONTACT DRYER. *Экономика и социум*, (11), 433-437.
15. Ахунбаев, А.А., Туйчиева, Ш.Ш., & Хурсанов, Б.Ж. (2020). УЧЁТ ДИССИПАЦИИ ЭНЕРГИИ В ПРОЦЕССЕ СУШКИ ДИСПЕРСНЫХ МАТЕРИАЛОВ. *Universum: технические науки*, (12-1 (81)).
16. Алиматов, Б.А., & Садуллаев, Х.М. (2021). СРАВНЕНИЕ ЗАТРАТ ЭНЕРГИИ ПРИ ПНЕВМАТИЧЕСКОМ И МЕХАНИЧЕСКОМ

ПЕРЕМЕШИВАНИИ НЕСМЕШИВАЮЩИХСЯ ЖИДКОСТЕЙ. *ЭНЕРГЕТИКА*, *86*(5).

17. Xoshimov, A.O., & Isomidinov, A.S. (2020). Study of hydraulic resistance and cleaning efficiency of dust gas scrubber. In *International online scientific-practical conference on" Innovative ideas, developments in practice: problems and solutions": Andijan. - 2020.-51 p.*
18. Исомидинов, А. С. (2019). Исследование гидравлического сопротивления роторно-фильтрующего аппарата. *Universum: технические науки*, (10-1 (67)).
19. Исомидинов, А.С. (2020). Разработка эффективных методов и устройств очистки пылевых газов химической промышленности: Дисс.… PhD. *Ташкент,-2020.-118 с.*
20. Isomidinov, A.S. (2020). Development of effective methods and devices for the purification of dust gases from the chemical industry: Diss. PhD.
21. Ortikaliev, B.S., & Mukhamadsadikov, K.J. (2021). Working widht and speed of the harrow depending on soil resistivity. *Web of Scientist: International Scientific Research*.
22. Мирзахонов, Ю.У., Хурсанов, Б.Ж., Ахроров, А.А., & Сулаймонов, А. (2019). ПРИМЕНЕНИЕ ПАРАМЕТРОВ НАТЯЖНОГО РОЛИКА ПРИ ТЕОРЕТИЧЕСКОМ ИЗУЧЕНИИ ДИНАМИКИ ТРАНСПОРТИРУЮЩИХ ЛЕНТ. In *Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях* (pp. 134-138).
23. Karimov, I.T., Ahrorov, A.A., & Kahorov, I.I. (2019). THE METHOD OF DETERMINING THE SIZE OF THE MIXING ZONE BUBBLING EXTRACTOR. In *INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION* (pp. 11-15).
24. Ахунбаев, А.А., Ражабова, Н.Р., & Вохидова, Н.Х. (2020). Исследование гидродинамики роторной сушилки с быстровращающимся ротором. *Экономика и социум*, (12-1), 392-396.
25. Mirsharipov, R.H., & Akhunbaev, A.A. (2020). Research of Hydrodynamic Parameters of Drum Dryer. *International Journal of Advanced Research in Science, Engineering and Technology*, *7*(11).
26. Эргашев, Н.А., Маткаримов, Ш.А., Зияев, А.Т., Тожибоев, Б.Т., &

Кучкаров, Б.У. (2019). Опытное определение расхода газа, подаваемое на пылеочищающую установку с контактным элементом, работающим в режиме спутникового вихря. *Universum: технические науки*, (12-1 (69)).

27. Эргашев, Н.А., Алиматов, Б.А., Герасимов, М.Д., & Дикевич, А.В. (2018). Повышение эффективности пылеулавливания в производстве дорожно-строительных материалов. In *Энерго-, ресурсосберегающие машины, оборудование и экологически чистые технологии в дорожной и строительной отраслях* (pp. 228-232).
28. Эргашев, Н.А., Алиматов, Б.А., & Дикевич, А.В. (2018). ЗАТРАТЫ ЭНЕРГИИ В МОКРОМ ПЫЛЕУЛОВИТЕЛЕ ПРИ ПРОИЗВОДСТВЕ ДОРОЖНО-СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ. In *Энерго-, ресурсосберегающие машины, оборудование и экологически чистые технологии в дорожной и строительной отраслях* (pp. 232-238).
29. Алиматов, Б.А., Эргашев, Н.А., & Тишабаева, У.А. (2016). АВТОКЛАВНАЯ ОБРАБОТКА МАЛОКВАРЦЕВЫХ СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ. In *Актуальные проблемы менеджмента качества и сертификации* (pp. 6-8).
30. Ergashev, N., & Tilavaldiev, B. (2021). Hydrodynamics of Wet Type Dusty Gas Collector. *International Journal of Innovative Analyses and Emerging Technology, 1*(5), 75-86.
31. Алиматов, Б. А., & Эргашев, Н. А. ГИДРАВЛИЧЕСКОЕ СОПРОТИВЛЕНИЕ ПЫЛЕУЛОВИТЕЛЯ С ПРЯМОТОЧНО-ВИХРЕВЫМИ КОНТАКТНЫМИ ЭЛЕМЕНТАМИ. *"Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях": материалы междуна*.
32. Алиматов, Б. А., Тожибоев, Ш. С., & Харламов, Е. В. (2010). ГИДРАВЛИЧЕСКОЕ СОПРОТИВЛЕНИЕ МОКРОГО ПЫЛЕУЛОВИТЕЛЯ С ПРЯМОТОЧНО - ВИХРЕВЫМИ КОНТАКТНЫМИ ЭЛЕМЕНТАМИ. In *Интерстроймех-2010* (pp. 14-19).
33. Isomidinov, A. (2019). Mathematical modeling of the optimal parameters of rotory filter apparatus for wet cleaning of dusty gases. *International journal of advanced research in science, Engineering and technology*, *6*(10), 258-264.
34. Хакимов, А.А., Салиханова, Д.С., & Каримов, И.Т. (2019). Кўмир кукунидан брикетлар тайёрлашнинг долзарблиги. *Фаргона политехника институти илмий техника журнали. – 2019. - №*, *23*(2), 226-229.

35. Isomidinov, A.S., & Madaliev, A.N. (2018). HYDRODYNAMICS AND AERODYNAMICS OF ROTOR FILTER CLEANER FOR CLEANING DUSTY GASES. In *LI INTERNATIONAL CORRESPONDENCE SCIENTIFIC AND PRACTICAL CONFERENCE" INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION"* (pp. 29-32).

36. Хакимов, А.А. (2020). Связующее для угольного брикета и влияние его на дисперсный состав. *Universum: химия и биология*, (6 (72)), 81-84.

37. Isomidinov, A., Boykuzi, K., & Khonnazarov, R. (2021). Effect of Rotor-Filter Device Operation Parameters on Cleaning Efficiency. *International Journal of Innovative Analyses and Emerging Technology*, *1*(5), 100-105.

38. Alimatov, B.A., Sokolov, V.N., & Sadullayev XM, K.I. (1990). Mnogostupenchatyy barbotajnyy ekstraktor [Multistage bubbling extractor]. *AS USSR*, (1607859).

39. Алиматов, Б.А., Соколов, В.Н., Салимов, З.С., & Хурсанов, Б.Ж. (2003). Исследование распределения капель по размерам в многоступенчатом барботажном экстракторе. *Журнал прикладной химии*, *76*(8), 1309-1311.

40. Каримов, И.Т. (2001). Исследование гидродинамических процессов перемешивающих зон барботажного экстрактора. канд. дисс. *Т. ТДТУ*.

41. Хакимов, А.А. (2021). ОПРЕДЕЛЕНИЕ ПОКАЗАТЕЛЕЙ КАЧЕСТВА УГОЛЬНОГО БРИКЕТА. *Universum: химия и биология*, (5-2 (83)), 40-44.

42. Хакимов, А. (2020). ТЕХНОЛОГИЯ БРИКЕТИРОВАННОГО УГЛЯ. *Матеріали конференцій МЦНД*, 76-78.

43. Каримов, И.Т. (2001). *Исследование гидродинамических процессов в смесительных зонах барботажного экстрактора* (Doctoral dissertation, – Ташкент: Ташкентский гос. техн. ун-т, 2001. – 131 с).

44. Каримов, И.Т. (2019). Анализ результатов исследований по определению газовой подушки газораспределительного устройства барботажного экстрактора. *Universum: технические науки*, (10-1 (67)).

45. Алиматов, Б.А., & Садуллаев, Х.М. (2021). СРАВНЕНИЕ ЗАТРАТ ЭНЕРГИИ ПРИ ПНЕВМАТИЧЕСКОМ И МЕХАНИЧЕСКОМ ПЕРЕМЕШИВАНИИ НЕСМЕШИВАЮЩИХСЯ ЖИДКОСТЕЙ. *ЭНЕРГЕТИКА*, *86*(5).

46. Хурсанов, Б.Ж., & Алиматов, Б.А. (2020). ЭКСТРАКЦИОННОЕ

ИЗВЛЕЧЕНИЕ РЕДКИХ МЕТАЛЛОВ ИЗ ОТВАЛОВ ГОК. *Universum: технические науки*, (6-1 (75)).

47. Ikromali Tojimatovich, K. A. R. I. M. O. V. (2019). Interfacial contact surface and the size of the bubble in a bubbling extractor when mixing liquid phases with an inert gas. *Chemistry and Chemical Engineering*, *2019*(4), 6.
48. Karimov, I.T. (2019). Analysis of experimental research in determining bubbling extractor mixing zones' sizes. *Химия и химическая технология*, (2), 62-65.
49. Karimov, I., Alimatov, B., & Rakhmonov, H. (2019). DISPERSION AND DIMENSION DISTRIBUTION OF HEAVY LIQUID INTO DROPLETS IN A FLUID PHASE EXTRACTOR MIXER. In *ТЕХНИЧЕСКИЕ НАУКИ: ПРОБЛЕМЫ И РЕШЕНИЯ* (pp. 76-86).
50. Karimov, I.T. (2019). Analysis of experimental research in determining bubbling extractor mixing zones' sizes. *Химия и химическая технология*, (2), 62-65.
51. Karimov, I.T., Ahrorov, A.A., & Kahorov, I.I. (2019). THE METHOD OF DETERMINING THE SIZE OF THE MIXING ZONE BUBBLING EXTRACTOR. In *INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION* (pp. 11-15).
52. Алиматов, Б.А., & Тишабаева, У.А. (2016). ПОВЫШЕНИЕ КАЧЕСТВА ПОЛИМЕРНЫХ СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ. In *Актуальные проблемы менеджмента качества и сертификации* (pp. 3-5).
53. Алиматов, Б.А., Садуллаев, Х.М., Каримов, И.Т., & Хурсанов, Б.Ж. (2008). Методы расчета и конструирования жидкостных экстракторов с пневмоперемешиванием. Isomidinov, A., Madaminova, G., Qodirov, D., & Ahmadaliyeva, M. (2021). Studying the Effect of Interior Scrubber Hydraulic Resistance on Cleaning Efficiency. *International Journal of Innovative Analyses and Emerging Technology*, *1*(5), 87-93.
54. Алиматов, Б. (2014). Многоступенчатый барботажный экстрактор.
55. Хакимов, А.А., Вохидова, Н.Х., & Нажимов, Қ. КЎМИР БРИКЕТИ ИШЛАБ ЧИҚАРИШНИНГ ЯНГИ ТЕХНОЛОГИЯСИНИ ЯРАТИШ. *ЎЗБЕКИСТОН РЕСПУБЛИКАСИ ОЛИЙ ВА ЎРТА МАХСУС ТАЪЛИМ ВАЗИРЛИГИ Заҳириддин Муҳаммад Бобур номидаги Андижон давлат университети*, 264.

56. Алиматов, Б.А., Соколов, В.Н., Салимов, З.С., & Хурсанов, Б.Ж. (2003). Исследование распределения капель по размерам в многоступенчатом барботажном экстракторе. *Журнал прикладной химии*, *76*(8), 1309-1311.

57. Karimov, I., Boykuzi, K., & Madaliyev, A. (2021). Volume-Surface Diameters of Drops in Barbotaj Extractor. *International Journal of Innovative Analyses and Emerging Technology*, *1*(5), 94-99.

58. Ахунбаев, А.А. (2021). ГИДРОДИНАМИЧЕСКАЯ МОДЕЛЬ ДВИЖЕНИЯ В БАРАБАННОМ АППАРАТЕ С УЧЕТОМ ВЛИЯНИЯ ПРОДОЛЬНОГО ПЕРЕМЕШИВАНИЯ. *Universum: технические науки*, (9-1 (90)), 34-38.

59. Alimatov, B., & Khursanov, B. (2020). Analysis of droplets size distribution and interfacial surface during pneumatic mixing. *Asian Journal of Multidimensional Research (AJMR)*, *9*(6), 165-171.

60. Alimatov, B., & Khursanov, B. (2020). Analysis of droplets size distribution and interfacial surface during pneumatic mixing. *Asian Journal of Multidimensional Research (AJMR)*, *9*(6), 165-171.

61. Алиматов, Б.А., & Хурсанов, Б.Ж. (2008). Технические основы создания машин.

62. Фролов, В.Ф., Круковский, О.Н., & Ахунбаев, А.А. (1992). Сушка высоковлажных тонкодисперсных материалов. *Минский международный форум «Тепломассообмен в химико-технологических устройствах» Тез. докл*, 83.

63. Ахунбаев, А.А., Туйчиева, Ш.Ш., & Хурсанов, Б.Ж. (2020). УЧЁТ ДИССИПАЦИИ ЭНЕРГИИ В ПРОЦЕССЕ СУШКИ ДИСПЕРСНЫХ МАТЕРИАЛОВ. *Universum: технические науки*, (12-1 (81)).

64. Ахунбаев, А.А., & Ражабова, Н.Р. (2021). ВЫСУШИВАНИЕ ДИСПЕРСНЫХ МАТЕРИАЛОВ В АППАРАТЕ С БЫСТРО ВРАЩАЮЩИМСЯ РОТОРОМ. *Universum: технические науки*, (7-1 (88)), 49-52.

65. Ахунбаев, А.А., Нишонова, Ғ.Ғ., & Жалилова, Г.Х.Қ. (2021). ҚУРИТИШ АППАРАТЛАРИДА МАТЕРИАЛ ҚАТЛАМИНИ САҚЛАШ УЧУН САРФЛАНГАН ҚУВВАТ ҲИСОБИ. *Scientific progress*, *2*(6), 1624-1627.

66. Ахунбаев, А.А. (2021). ГИДРОДИНАМИЧЕСКАЯ МОДЕЛЬ ДВИЖЕНИЯ В БАРАБАННОМ АППАРАТЕ С УЧЕТОМ ВЛИЯНИЯ ПРОДОЛЬНОГО ПЕРЕМЕШИВАНИЯ. *Universum: технические науки*,

(9-1 (90)), 34-38.

67. Ахунбаев, Адил Алимович. "Сушка тонкодисперсных материалов в аппарате с кондуктивным подводом теплоты." (1990).

68. Axmedovich, X.A., & Saidakbarovna, S.D. (2021). Research the strength limit of briquette production. *ASIAN JOURNAL OF MULTIDIMENSIONAL RESEARCH*, *10*(5), 275-283.

69. Хакимов, А. (2020). ТЕХНОЛОГИЯ БРИКЕТИРОВАННОГО УГЛЯ. *Матеріали конференцій МЦНД*, 76-78.

70. Isomidinov, A.S., & Madaliev, A.N. (2018). HYDRODYNAMICS AND AERODYNAMICS OF ROTOR FILTER CLEANER FOR CLEANING DUSTY GASES. In *LI INTERNATIONAL CORRESPONDENCE SCIENTIFIC AND PRACTICAL CONFERENCE" INTERNATIONAL SCIENTIFIC REVIEW OF THE PROBLEMS AND PROSPECTS OF MODERN SCIENCE AND EDUCATION"* (pp. 29-32).

71. Isomidinov, A.S. (2019). Issledovanie gidravlicheskogo soprotivleniya rotorno-filtruyushchego apparata. *Universum: tehnicheskie nauki*, (10-1 (67)).

72. Abdukakhorovich, A.H., & Muhammadsodikov, K.D. (2021). IMPROVING THE DESIGN OF INTERNAL PLATES IN COLUMNAR APPARATUS. *ResearchJet Journal of Analysis and Inventions*, *2*(05), 109-117.

73. Isomidinov, A., Madaminova, G., Qodirov, D., & Ahmadaliyeva, M. (2021). Studying the Effect of Interior Scrubber Hydraulic Resistance on Cleaning Efficiency. *International Journal of Innovative Analyses and Emerging Technology*, *1*(5), 87-93.

74. Samrat, S.P., Ashwinkumar, G.P., & Sandeep, N. (2021). Simultaneous solutions for convective heat transfer in dusty-nano-and dusty-hybrid nanoliquids. *Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering*, 09544089211043605.

75. Мўминов, Ж.А., Умаров, Э.С., & Ортиқалиев, Б.С. (2019). Оғир юкланишли ва тез ҳаракатланувчи машина қисмларида сирпаниш подшипникларини танлаш. *Машинасозлик ишлаб чиқариш ва таълим: муаммолар ва инновацион ечимлар-2019й*, 338-340.

76. Мўминов, Ж.А., Умаров, Э.С., & Ортиқалиев, Б.С. (2019). Чангларни комбинацион тозалаш технологияси. *Журнал Технических исследований*, (2).

77. Mukhamadsadikov, K.J., & ugli Ortikaliev, B.S. (2021). WORKING WIDTH AND SPEED OF THE HARROW DEPENDING ON SOIL RESISTIVITY. *Web of Scientist: International Scientific Research Journal*, *2*(04), 152-158.

78. Ortikaliev, B.S., & Mukhamadsadikov, K.J. (2021). Working widht and speed of the harrow depending on soil resistivity. *Web of Scientist: International Scientific Research*.

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