



| Research Article



Belt Conveyors for the Purpose of Increase Work Efficiency In Cotton Ginning Plants for Transportation

Panjiyev Orifjon

teacher of Gulistan State University

Yangiboyev Ikromjon

teacher of Gulistan State University

Abstract: Cotton is one of the most valuable types of raw materials, from which more than 300 types of products of wide consumption, technical and special purpose are produced. Cotton fiber is the main type of raw material for textile, knitting, tailoring and other sectors of light industry. Various types of gauze, sewing thread, artificial silk, various technical products and many other products are produced from it.

Increasing labor productivity, improving the quality of products produced in the cotton ginning industry, reducing its cost, increasing the accuracy and technological efficiency of machines, as well as complex mechanization and automation of the technological process of the initial processing of cotton require the creation of more advanced equipment.

Key words: Auger, SHX, EX-15, barometric pressure of moist air, absolute air humidity, moisture capacity, relative humidity dew temperature of the air, heat preservation, heat capacity, air density

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INTRODUCTION

The continuity of the technological process is a feature of the initial production of cotton, and a large number of machines and mechanisms with different functions and connected to each other in terms of product production productivity are involved in the execution of operations.

The production of new progressive machines for the initial processing of seeded cotton requires expansion of design, experimental and research work, development of the machinery base and technology of cotton cleaning production.

The following operations are carried out at the cotton processing stations: seed cotton handed over by farms is weighed on a scale; seeded cotton received without a bag is taken down to the ground where it is worked or stored; the sides of the pits are leveled, covered with a tarpaulin, and tunnels and wells are dug; seeded cotton is transported to the drying-cleaning shop and inside the shop; seeded cotton is loaded onto car and tractor trailers; covered seeds brought from cotton gins or railway wagons are unloaded.

The following operations are carried out in cotton ginning plants: seeded cotton brought from cotton processing centers is received, that is, it is weighed, brought to the field or warehouse; seeded cotton is transported to the drying-cleaning workshop or the main workshops of the factory; seeded cotton and seed are transported between workshops; the seed is continuously weighed in the technological process and transported to the place of storage; seed is loaded into cars and railway wagons; seeds are covered and transported to the place of storage; dead and fibrous waste is transported between workshops; fiber and fluff are put into a press bag; bales of prepared fiber, lint and fibrous waste are transported to the loading area and loaded; bales are loaded onto railway wagons; sawed cylinders are transported to the gin shop, and finished sawed cylinders are transported to the saw shop; prepared wire or tape belts are transported to the press shop.

The above-mentioned works are mainly mechanized, and various means of transportation are used in their execution. Transport vehicles are divided into pneumatic and mechanical types.

Pneumatic transporters are very common in the cotton ginning industry and are used to transport seeded cotton and fiber between and within workshops. Pneumatic vehicles work in air suction and air driving methods. In the air suction system, the fan sucks air from the pipe so that the cotton moves with the air inside the pipe.

In an air drive system, a fan drives air into the pipe and carries the seed cotton or seed along with it.

The main reason for the widespread use of pneumatic conveying equipment in the cotton ginning industry is that seeded cotton or its products do not die during transportation, in addition, this device is compact, and its pipes can be installed in any direction in the area of the factory or cotton preparation stations. But the pneumatic transporter consumes more energy than other devices. Usually, the pneumatic conveying device is connected to the continuous technological process in all shops of the cotton ginning plant, and its normal operation greatly affects the productivity of the cotton ginning plant and the drying-cleaning shop.

The length of the pneumatic conveying device for seeded cotton transportation is different, depending on the type of installed fan, it can be up to 250 meters. Also, the productivity of the device is different and can be 12 tons per hour or more.

Pipes with a diameter of 400, 420, 450 mm are usually used in the cotton cleaning industry, and pipes with a diameter of 320-350 mm are used in drying-cleaning shops in inter-shop pneumatic transportation. Places of pipes connected to each other and other pipe systems connected to a continuous process must be sealed from the outside environment.

Mechanical transport means include screw and belt conveyors and elevators installed in workshops.

Screw conveyors are used for distribution of cotton to gins and cleaning machines, transportation to automatic scales, transfer to drying equipment, as well as transportation of dried and cleaned cotton from workshops.

ShX screw conveyors with a diameter of 400 mm and a pitch of 300 mm are usually used in the cotton ginning industry. ShX brand screw conveyor transporting seeded cotton consists of a mover, auger screw, shaft, suspension supports, cover, auger shell, scraper.

The screw conveyor is made up of several links, and its length is determined depending on the number of machines in the battery and the transportation distance.

The screw should be placed in the groove in such a way that there should be a gap of 25-32 mm between the tip of the screw and the wall of the rod.

The speed of rotation of the screw is taken depending on the performance of the screw conveyor. But it must not exceed 120 rpm.

The efficiency of the screw conveyor depends on the diameter of the screw, pitch, speed of rotation, density of seed cotton and the filling coefficient of the drum. Volumetric productivity of the conveyor (m^3/hour):

$$V = 47 \cdot D^2 \cdot S \cdot n \cdot \psi$$

Productivity by mass (kg/h):

$$Q = 47 \cdot D^2 \cdot S \cdot n \cdot \psi \cdot \rho$$

If the screw conveyor is installed at an angle, the filling of the drum with seeded cotton is reduced, so the productivity formula is increased by the coefficient S . Depending on the horizontal slope angle of the conveyor, the value of S is obtained β as follows.

β	0°	5°	10°	15°	20°
S	1,0	0,9	0,8	0,7	0,65

The electromotive force for moving the screw of the horizontal conveyor is calculated by the following formula

$$N = \frac{Q_k \cdot L \cdot g \cdot W}{3,6 \cdot 10^3 \cdot \eta}$$

If the screw conveyor works as a distributor, after each gin or cleaning machine, the productivity of the conveyor decreases. This is the power consumed

$$N = \frac{W}{3,6 \cdot 10^3 \cdot \eta} \sum Q_k \cdot L \cdot g$$

The EX-15 brand cotton elevator is installed in the cotton ginning plant and in the drying-cleaning and cleaning shops of the cotton preparation centers. The main working parts of the elevator consist of a 500 mm wide rubberized belt and fixed buckets installed every 600 mm.

The belt is worn on the upper leading and lower tensioning drums with a diameter of 630 mm.

The elevator body is made in the form of a metal case, which consists of an upper head, a box section in the middle and a lower part (head). The belt moves at a speed of 1.9 m/sec through an electric motor, a reducer and a belt drive.

The height of the elevator varies depending on the location. The middle part of the case consists of sections of 1.7-2 meters and can be assembled at any height. The seed cotton is loaded into the loading pipe of the elevator with a flat shovel. Seeded cotton is removed from the elevator through a rake installed in its upper part.

The productivity of the elevator is usually 12-15 t/h. The volume of the elevator shafts (m^3) is taken depending on the performance of the elevator, that is:

$$e = \frac{Q_E \cdot a}{3,6 \cdot \vartheta \cdot \varphi \cdot \rho}$$

Screw conveyors Screw conveyors are used for distributing seed to linters, transporting seed from ginning and linting, as well as transporting fiber waste. They are similar to the conveyors used in the transportation of seed cotton in terms of structure and operation.

The screw conveyor consists of a metal shaft, a screw rotating on edge bearings and intermediate bearings, an electric motor, a reducer, an open shaft and a cover.

Tarnov is made of tin with a thickness of 3-4 mm, and it is assembled from the same pieces, each of which is up to 3.5 meters long. The top of the tarnov is covered with a cover, thanks to which dust does not come out of the cover. The conveyor screw is also made of 3.5 meter long pieces.

In the cotton ginning industry, screw conveyors with a diameter of 300 mm and a step of 225 mm are used for seed transportation, rotating with a frequency of 80-120 rpm, depending on the productivity. The screw receives the movement from the electric motor by means of a gear wheel or a worm reducer. The internal diameter of the screw is slightly larger than the diameter of the screw wing, and when it moves, a gap of 9-15 mm should remain between the wall of the screw and the edge of the screw wing.

It is not recommended to install screw conveyors on the ground where the seed transportation distance is more than 20 meters.

Different brands of screw conveyors are produced depending on the place of installation and the task to be performed.

Currently, modernization of technological machines and devices, technological processes, creation of machines with high productivity and efficiency, using less metal and materials, is considered one of the urgent tasks.

An improved design of the PLA brand supply device was proposed.

The improved seed cotton storage preparation device is composed of capacity, conveyor, console, wheels, and differs from the existing PLA brand supply device in that it has two rows of piles with piles instead of two belt horizontal conveyor. auger installed.

The proposed design of the device for preparing seed cotton for storage works in the following order. The seeded cotton collected from the fields and brought to the preparation stations or cotton ginning factories is subjected to laboratory tests, weighed and brought to be harvested.

It is gradually rolled from the rear side of the trailer to the seed cotton supply device. In the proposed supply device, instead of the belt, piled augers are installed in two rows horizontally, and a mesh surface is designed under them to allow impurities to fall. Pile augers rotate clockwise. The seeded cotton rolled into the supply device is sifted by the piles of the augers, and the impurities released from them fall down through the mesh surface. The seeded cotton is pushed along the auger, goes down to the inclined elevator, and with the help of its brushes is transferred to the next transport device for threshing.

The purpose of improving the construction of the device for preparing seed cotton for storage is to prevent the appearance of various defects in the seeded cotton, as well as clean and high-quality storage. Seeded cotton is separated from various impurities and processed to a certain extent.

The productivity of belt conveyors is found from the following formula (t/h):

$$Q = 3,6 \cdot q \cdot \vartheta$$

When cotton and seed are transported continuously on a belt, its productivity can be found using the following formula

$$Q = 3,6 \cdot F \cdot \rho \cdot \vartheta$$

The productivity of cargo transportation on belt conveyors (t/h) is as follows

$$Q = k \cdot b^2 \cdot \rho \cdot \vartheta$$

The time (s) required to fill the trailer body with cotton using a belt conveyor is found as follows

$$t = \frac{3,6 \cdot Q'}{k \cdot B^2 \cdot \vartheta \cdot \rho}$$

The width of the belt is determined in relation to the given performance and permissible speed

$$B = \sqrt{\frac{Q}{k \cdot \vartheta \cdot \rho}}$$

Usually in the cotton ginning industry, belts with a width of 500 and 600 mm are used, and their movement speed is chosen around 1.0-1.2m/s.

There are three types of energy used to move a belt conveyor: the energy used in the conveyor's sole operation, the energy used in the horizontal direction of cargo transportation, and the power used in lifting the load up.

The power used to transport cargo to the leading drum shaft of the conveyor

$$N = (N_1 + N_2 + N_3) \cdot k_D$$

If the unloader is installed at the end of the belt conveyor, the power consumption (kW) is as follows

$$N_t = 0,275 \cdot N + 0,005 \cdot Q + 0,4$$

Total power (kW)

$$N_{\text{sum}} = N + N_t$$

Electric motor power

$$N_{el} = \frac{N_{izm} \cdot k}{\eta}$$

By safety, we understand that negative factors that exist during human life activities have been partially or completely eliminated.

The problem of environmental protection is not the problem of today. At different stages of human development, these problems have appeared with different aspects. For example, at the beginning of the Middle Ages, when coal was used for heating and other purposes in the big cities of the world, these cities became smoky as a result.

Implementation of solutions to environmental issues will depend on special state bodies and the activities of the population. The purpose of such activity is rational use of natural resources, elimination of environmental pollution, education and upbringing of the entire population of the country in ecological knowledge.

Our republic ranks fifth in the world in cotton fiber production and second in export. It is no exaggeration to say that what the President said that "Uzbekistan is the main producer and supplier of cotton fiber, a product that is in high demand in the foreign market" has been confirmed by now. 60-80 percent of the fiber used in fabric production is sent from our country to leading European countries. Due to the sale of cotton fiber on the world market, a large amount of foreign currency is coming to the treasury of the Republic.

The volume of cotton grown in our republic in one year is on average 3.5-3.9 million tons. is a ton. Organization and coordination of all activities related to the reception, storage and processing of cotton of this volume, implementation of a uniform scientific and technical policy in the field, production of products that meet the requirements of world market standards and delivery to consumers. The main task of Uzbekistan is to process cotton and sell cotton products. There are 130 cotton ginning enterprises, 511 cotton processing centers in the system of cotton ginning industry in our republic, and each joint-stock company has a production base equipped with modern technology.

Organization of all activities related to the reception, storage and processing of cotton grown in our republic, equipping cotton ginning enterprises with serum and efficient equipment for the production of products that meet the requirements of world market standards, modernization of existing equipment and technologies. is one of the urgent tasks of the time.

The technological process of ginning and storage of seeded cotton, the constructions of vehicles and devices used in transportation and ginning at the cotton gins and cotton preparation centers of our republic were studied and analyzed. In order to ensure clean and high-quality storage of processed cotton, the design of the device for preparing cotton seeded with PLA brand for storage has been improved. The improved device helps seed cotton to retain its natural properties during storage in warehouses.

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