

## TECHNOLOGICAL AND OPERATIONAL INSIGHTS INTO AIR-BASED COTTON TRANSPORTATION DEVICES

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### **Abstract**

The disadvantage of the device that transports cotton by air is the high consumption of electricity compared to the unit amount of transported material, and the rapid wear and failure of working bodies, including pipes, that are in direct contact with the transported material containing foreign bodies.

**Keywords:** Aerial Cotton Transportation, Operational Technology, Cotton Conveyance Equipment, Air Transport Systems, Cotton Handling Machinery, Agricultural Product Logistics, Pneumatic Conveying Systems, Material Handling Devices, Cotton Industry Innovations, Logistics and Distribution Technology.

### **Introduction**

In cotton ginning enterprises, a suction-type air transport device is mainly used to transport cotton (Fig. 1). It consists of the following main working elements: cotton is supplied to the pipe by means of a mechanical conveying device (1), it is transported by air along the working pipe (2), cotton is separated from heavy mixtures in the separator (3) and comes to the separator (4). falls. Polluted air is transferred to the cyclone (8) and the dust chamber (9) through the intake air duct (5), the centrifugal fan (6) that creates pressure in the pipes, and the discharge air duct (7). They, in turn, ensure that the air is cleaned of dust before it is released into the atmosphere.



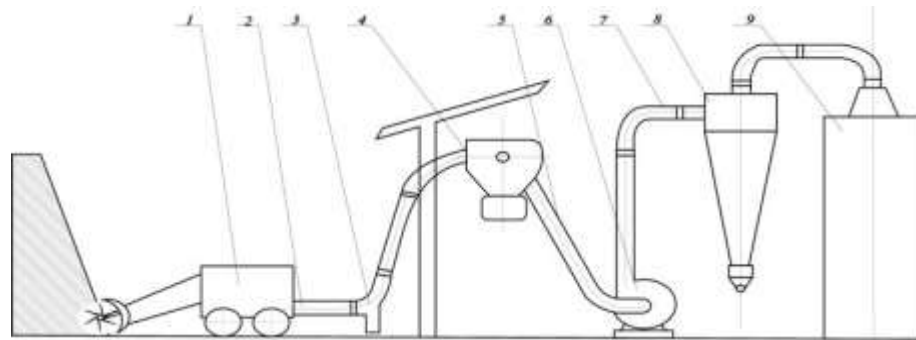


Figure 1. Air-assisted conveying device in cotton gins

1-Equipment for mechanical transfer of cotton to pipe;  
2nd working pipe; 3- stone crusher; 4- separator 5- suction air duct 6- fan; 7-  
exhaust air duct; 8th cyclone; Dust chamber 9 (I - cotton gin, II - production  
workshop).

The principle of operation of the air conveying device is that atmospheric air follows the material being transported along with it and sucks it into the pipe under the flow created due to the pressure difference. Inside the pipe, cotton moves with air and reaches the separator. The separator separates the material from the carrier air and transfers it to the technological equipment.

The advantage of the suction air conveying device is that the working pipe system can be easily changed depending on the location of the storage areas of cotton ginning enterprises, and its length can be extended by connecting additional pipes to the initial pipes. The production efficiency of the air transport device depends on the production capacity of the cotton gin (that is, the amount of raw cotton processed in one hour). For an advanced cotton gin with one battery, it is 10 tons per hour. The increase in the rate of cotton production puts the task of increasing the production capacity, increasing the productivity of the equipment, and improving the quality of the product before the cotton processing industry. The performance of these tasks depends to a large extent on the operation of the airborne carrier installed in the area. Because it is directly included in the continuous technological process of the cotton ginning enterprise and is considered an important part that determines its initial and work pace. The increase in the volume of cotton production led to the expansion of the territory of the enterprises and the increase in the length of the network of air transport devices in it, in some cases the length was 200 m or more. Since the radius of movement of a single air conveyor with a VTS-12M fan does not exceed 100-110



meters, the transportation of cotton from very distant places is usually done by connecting additional air conveyors in series. is done.

For the transportation of cotton in the technological process of the cotton ginning enterprise, the suction-type air transport device is more common. During transportation in the mode of high speed, the speed of cotton inside the pipe reaches 20–25 m/s, at this speed it hits the pipe walls, rubs, hits the turning points (shells) of the pipe, the inner walls of the separator and separator. This will definitely have a negative impact on the quality of cotton. However, one of the conditions for maintaining the quality of cotton, that is, preventing damage to the cotton seed and the appearance of technological defects in the fiber, is to choose the optimal mode for transportation by air.

Further studies [9,10] show that the deterioration of cotton quality can be reduced when metal pipes are replaced by metalopolymer pipes. When cotton is transported in metal and metalopolymer pipes, the amount of defects is 0.09 \* 0.17% and 0.14\*0.22, respectively, when the moisture content of cotton is 8.5% and the air flow speed is 23.7 and 28.2 m/s. increases to %. At the same speeds, when the humidity was increased to 24%, it was found that there were 0.14\*0.26% and 0.11\*0.3% defects.

During air transport, cotton becomes suspended. In this case, the adhesion of dirty-cotton mixtures to cotton is greatly reduced. In order to take advantage of this event, which occurs simultaneously with transportation, preliminary cleaning of raw materials from large and small impurities is carried out. In this regard, an additional set of cleaning equipment will be included in the system of the air transport device of cotton ginning enterprises. Together with the supplier and the working elements of the air transport device, they form the equipment of the air transport device system of cotton ginning enterprises [11, 12]. Now, let's take a look at the basic equipment of the cotton air conveyor system.

A shredder is used to mechanically shred the yarn and transfer the cotton evenly to the pipe. Demolition and transfer of cotton to the pipeline is carried out in the following order. The machine comes to the mine with its axle raised and begins to destroy it from top to bottom with horizontal layers. The milling machine enters the hopper, breaks the hopper, picks up the cotton and gives it to the conveyor. From it, the cotton comes to the receiving hopper of the platform, and then it is taken out by a loading conveyor.

An additional feeder is used in a number of cotton gins to facilitate the loading of cotton into the pipe of the air conveyor. It is mounted on a movable frame, the front of which consists of an open box, inside which a belt conveyor is installed, which rotates towards the open side of the box. Cotton is loaded from the side of the box with the help of a feeder, and when the belt conveyor rotates, it moves to the open part of the box, and then comes to the working pipe of the device.

The working pipeline (Fig. 2) consists of the main section and mobile links.

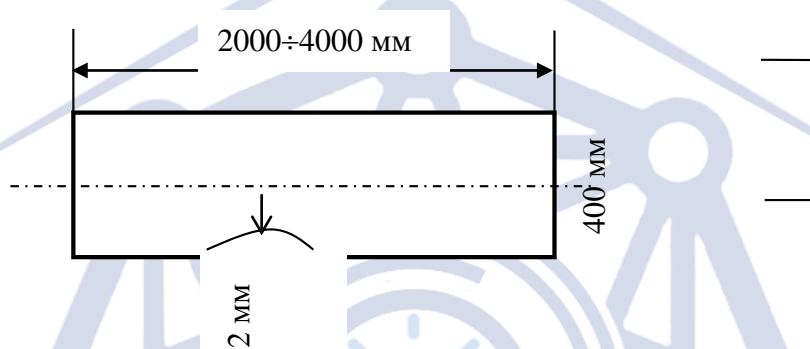


Figure 2. Working pipeline scheme

The main section is made of 2-3 mm steel sheet or asbestos-cement pipe with a diameter of 400-500 mm.

The length and layout of the pipe for transporting cotton depends on the architectural features of cotton ginning enterprises.

The main stationary pipe is 600-700 mm underground. laid in deep trenches or piers. Control wells are installed at certain intervals along the entire length of the pipeline. From here, the pipeline is branched to separate warehouses and is directed to the exit with the help of triple guides.

### Conclusion

The disadvantage of the device that transports cotton by air is the high consumption of electricity compared to the unit amount of transported material, and the rapid wear and failure of working bodies, including pipes, that are in direct contact with the transported material containing foreign bodies.



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