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COTTON PNEUMOTRANSPORT PIPELINE CONTROL THROUGH MECHATRONIC (SCADA) SYSTEM

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Abstract:

Objective. In the article, the results of the research of the change of air speed and aerodynamic force in the cross-section of the pipe during transportation of cotton, seed, lint, fiber waste from the separator cyclone, cyclonic fluff in pneumatic transport are reflected.

Methods. Our research shows that the semi-empirical law describing the change in static pressure along a transport line, proposed by us, is well confirmed by experimental data.

Results. In pneumatic transportation of raw cotton, more than half of the installation capacity is spent on moving air. However, the percentage of energy consumption for transporting air at high flow rates is less than at low flow rates, which is also clear - relatively more effort is required to deliver an environment with a high specific gravity at high speeds. provides low speed.

Conclusion The results of the inspection of energy consumption in pneumatic transportation of cotton fibers from one distance to another through the pipeline using aerodynamic air are presented. Based on the results of theoretical and practical research, a reduction in the cost of energy-efficient management of the process of pneumatic transportation of cotton has been achieved.

Keywords: cotton raw material, pneumatic transport equipment, air speed, pipe, pipe cross-section, diameter, aerodynamic force.

Air pressure in the pipeline of pneumatic transport and its change

Introduction. Today, the demand for natural products, including fabrics and clothing made from natural fibers, is increasing year by year in the global and local markets. This is primarily due to the intensively growing population. It can be felt that the cultivation and processing of cotton plays an important role in the country's economy, and that the reforms carried out in it are related to the future of the country.

Air transport is a process of purposeful transfer of a specific object or material from one place to another using directed air pressure, in which the role of the carrier element is played by the air flow.

The transportability of air has been known to man since ancient times. It has states of rest and motion, and its state of rest is usually temporary. Any change in the external environment - an increase or decrease in temperature, pressure - causes it to move. Depending on the level of this movement, it is called differently. Air moving at the slowest speed is called gentle wind, a gentle breeze when it speeds up a little it's called the wind that shakes the body, breeze, at medium speed it's called wind, and when it accelerates even more it's called a hurricane, tornado. Today, huge opportunities are being created for private entrepreneurship and small business in the Republic of Uzbekistan, including the processing of agricultural products as a result of a number of scientific researches. We conducted our scientific research work at "VEN-KON AIR ENGINEERING" LLC, Namangan city, Namangan region. Cotton

Andijon - 35 varieties of cotton, seed, lint, fiber waste from the separator cyclone, the process of air transportation of cyclonic fluff is carried out in a closed system separated from the external atmosphere. A test experiment was conducted.

Methods. To visualize this process, we will take the simplest aerodynamic device scheme and first consider the laws of air movement in it.

The fan or pump is located in the center of the pneumatic device. When the system is at rest, that is, when the fan is not running, it is under the pressure of the outside atmospheric air. In this case, the dynamic pressure is zero, and the pressure inside the pipe is equal to the external atmospheric pressure:

2 Modification of aerodynamic force and power consumption for pneumatic transport through a mechatronic system

When the fan is activated, it draws air from the first half of the equipment and blows it to the other side. As a result, there is a vacuum environment (thin air) on one side of the equipment, and a dense air environment (excess pressure) on the other side.

Figure 1 shows the results of measurements of the cotton variety Andijan - 35

Figure 2 shows the results of measuring fiber waste from the Andijan-35 cotton separator cyclone

The total air pressure P_{tot} that the fan can produce is equal to the sum of the static P_{st} and dynamic P_d pressures in the pipe:

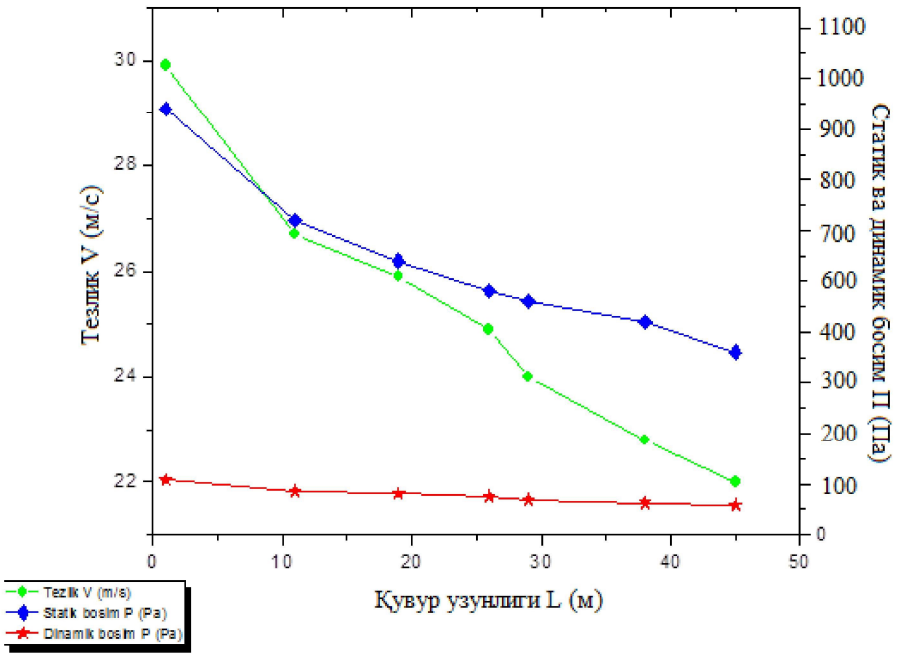
$$P_{tot} = P_{st} + P_d \quad , (1)$$

However, the pressure from the pipe to the left, that is, to the fan, is negative - P (vacuum), and the pressure after the fan, that is, to the right, has a positive + P sign. In this case, the static pressure P_{st} is directed vertically from the pipe wall to its center on the suction side, and from the pipe center to its walls on the drive (blower) side. Also, the maximum pressure is at the inlet and outlet of the fan, that is, on both sides of the fan, and decreases accordingly. We obtained results of static and dynamic pressure of pipes of different lengths during scientific research.- negative at the entrance, positive at the exit and both ways - to the ends of the pipe

3. Power consumption in pneumatic transport and its variation

depending on the transportation of various types of cotton

Results. While we are doing scientific research work, it is necessary to use SCADA system in proposing a mechatronic control system for 1.1 kW motor with 2.2 kW inverter installation with frequency converter. The values of current, voltage, power, frequency, static pressure (P), dynamic pressure (P), velocity in m/s were obtained by adding three different cross-sectional surfaces with diameters of 140, 200 and 300 and extending the distance by adding pipes.



Graph 1. Distribution of dynamic, static and total pressure along the length of the air pipe

If we pay attention to the results, it can be seen that both the static pressure and the total pressure decrease along the length of the air pipeline during the transportation of cotton, seed, lint, fiber waste from the separator cyclone, cyclonic fluff in pneumatic transport. At the same time, the pressure drop in the small diameter air pipe is relatively sharper. For example, in a 140 mm air pipe, the static and total pressure is equal to zero at a distance of 45-50 m. Also, the static pressure in a 200 mm pipe is close to the full pressure values in a 300 mm pipe. This situation shows that the pressure drop in the 200 mm pipe is close to that of the 300 mm pipe, and their interchange does not lead to a large pressure loss.

A general trend in the graphs is that the aerodynamic drag is relatively high in a small diameter air duct. In fact, many studies have shown that reducing the diameter of the air pipe leads to an increase in its aerodynamic resistance.

If we pay attention to the graphs, at the same air speeds, a relatively large aerodynamic force is generated in pipes with a large diameter. Also, as the speed increases, the difference between the magnitude of the generated force becomes sharper. This is probably the reason why the industry switched to pipes with a diameter of 140, 200, 300 mm. Because when the pneumatic transport equipment was first used in the industry of our country, the diameter of the pneumatic transport pipe was 300 mm. Later, as labor

productivity in the industry and, accordingly, the productivity of machines increased, there was a need to increase the productivity of pneumatic transport equipment, and the industry solved the problem by increasing the diameter of the pipe, despite the high consumption of materials and energy.

However, in the current energy shortage, this solution does not justify itself, and the industry is gradually moving to the use of smaller diameter pipes, and our previous research [1] theoretically justified this event.

On the basis of the results of scientific research conducted on the introduction of the mechatronic system that controls the flow parameters in the cotton pneumatic transport and the development of a new device for increasing the efficiency of electrical energy, the new air in the cotton pneumatic transport pipeline by installing an inverter mechatronic system and software to the fan electric motors in the cotton primary processing enterprises a rational control system of the static pressure and speed of the flow was created.

Figure 3 shows the results of measuring cotton seeds of the Andijan variety – 35

Figure 4 shows the experimental results of the ability to transmit static and dynamic pressure in the seed duct of the cotton variety Andijan-35

Conclusions. After receiving the results of scientific research, in order to put them into production, a mechatronic system with a rational control of the flow parameters in the pipe was installed on the stationary pneumatic transport equipment that transports the cotton from the warehouses to the production workshops in the enterprise belonging to "Pop cotton gin ART SOFT TEX CLUSTER" LLC, Namangan region, Pop district. The installation of an inverter device on the VTs-12M fan allows to reduce the active and reactive power energy at the time of engine start-up (push moment) when transporting cotton in a pneumatic transport, to save the engine in the event of an accident, and to prevent burnout. Also, by adjusting the air pressure and speed in the pipe according to the distance of transportation, it was found that the quality indicators of the transported cotton

components improved compared to the existing equipment. Installation of an inverter mechatronic system with special software for fan electric motors at the "ART SOFT TEX CLUSTER" LLC enterprise, based on the results of scientific research.

According to the results of the experiments, it was found that the new device has the possibility of saving electricity by reducing the active and reactive power energy at the time of engine start-up (push torque).

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WAYS TO INCREASE THE EFFICIENCY OF GINING MACHINE

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Abstract:

Objective. In the process of separating cotton fiber from seeds, special attention is paid to preserving the original quality indicators of the fiber and seeds, creating technologies and equipment to control the quality of the product. The economic position of cotton ginners depends on the quality of the fiber produced by the cotton gin. Therefore, research will need to be done to obtain quality fiber in the gin machine.

Methods. In order to improve the technique and technology of the process of separating cotton fiber from the seed, test works were carried out on a 30-saw laboratory gin machine with a trench, a net drum for the working chamber, and ribs for the mesh surface.

Results. By installing a rib with a channel, the seed separated from the fiber is easily removed from the working chamber and damage to the seed is reduced. The fiber does not remain in the working chamber for a long time and is taken out of the working chamber through the ribs installed on the surface of the trench. By installing a mesh drum in the center of the working chamber, increased density and reduced damage were achieved.

Conclusion. As a result of the scientific research, it will be possible to get into the working chamber of the gin machine in time. At the same time, in the working chamber of the gin machine, the tension of the raw shaft remains the same. In the process of separating the fiber from the seed, it is possible to avoid damage to the seed and various defects do not form in the fiber.

Keywords: cotton, fiber, short fiber, seed, fluff, saw, saw cylinder, raw material roller, seed hairiness, working chamber, seed comb, ribs, density.

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