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THE METHOD OF DETERMINING THE PARAMETERS OF THE SYSTEM ON WHICH THE CROWN DISCHARGE NEEDLES ARE INSTALLED WITH THE MAXIMUM CURRENT DISCHARGE IN ORDER TO INCREASE THE ENERGY EFFICIENCY IN DRYING COTTON RAW MATERIALS

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Abstract
An analysis of the results of the use of types and methods of corona discharge processing in electric technology using steaming (boiling), thermal neutralization, drying, and heat to reduce production costs and reduce moisture content for the development of techniques and technologies for the initial processing of cotton raw materials is presented. The main goal is to reduce the moisture content of the produced product to the optimal moisture content required for storage; that is, after reducing the moisture content of the product, it should be below the critical moisture content, and regardless of which oilseed is dried, the main task is to reduce the moisture content of the product to the required amount and, at the same time, increase the energy efficiency is not to lose its quality.

Keywords: corona discharge current, thermal neutralization of the electric field, moisture reduction, storage, quality improvement, evaporation (boiling), drying, heat, electrotechnology.

Introduction

Comprehensive economic reforms in our country have brought about significant changes in the cotton processing industry. Cotton fiber has been exported since the years of independence, but by today it is planned to phase out the export of cotton fiber. As a result, cotton fibers are fully processed in our country, and finished products are produced.

Taking into account the above, scientific research works on the development of innovative technologies for the processing of agricultural products and the production of exportable products are being accelerated.

As we all know, drying and cleaning, ginning and fiber cleaning, lintering and ginning, fiber waste processing, and fiber and lint dressing are the main processes in cotton processing.

Research on the process of reducing the moisture content of raw cotton is carried out in order to scientifically justify the optimal methods and regimes of the process, as well as to obtain the necessary expressions for the design and calculation of the equipment.

Our study revealed the following advantages of the electric field of the corona discharge current compared to the existing direct voltage corona discharge process for reducing the moisture content of raw cotton.

- stability of the discharge process;
- increase of the discharge current with a corresponding increase in the power characteristics of the electric field;
- the dependence of the processes in the electric field on the parameters of the power supply scheme.

These benefits, without a doubt, should improve the effectiveness of the process of suppressing heat to the material in the electric fields of the Corona discharge in reducing the moisture content of raw cotton.

The application of streamer-shaped corona discharge to trap heat by separating the moisture reduction of raw cotton requires the generation of a flow of unipolar volume charges using an electric field that separates volume charges of different polarities. For this purpose, we used the "potential electrode-grounded electrode with corona discharge needles" electrode system (Fig. 1).

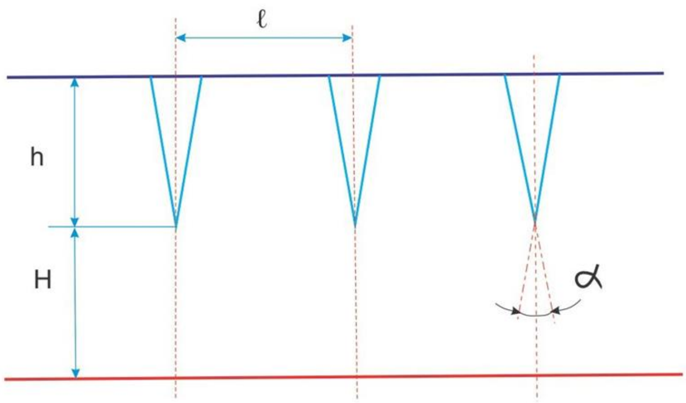

Figure 1. Parameters of the plane-to-ground plane electrode system with Corona discharge needles.

Experimental studies of the characteristics of the streamer-shaped corona discharge determined the values of the maximum current discharge in various parameters of the electrode system "potential plane with corona discharge needles installed—ground plane". In order to determine the parameters of the electrode system, which ensures maximum absorption of hot air into the material, a number of experimental studies were conducted in the air flow.

The volt-ampere characteristics of the streamer-shaped corona discharge were studied at different distances between the length h of the corona discharge needles and the distance N from the tip of the needles to the grounded electrode, equal to h+H = 0.1 m. At the same time, the use of the distance between such electrodes for the heat absorption of the air flow of more than 10 m3/s requires a significant complication of the heat absorption into the material with flat and cylindrical electrodes. The most appropriate is to increase the distance between the electrodes to 0.15 m. The length of the crown discharge needles and the distance between the needles have been changed. A schematic of the stand for the modified study is shown in (Figure 2).

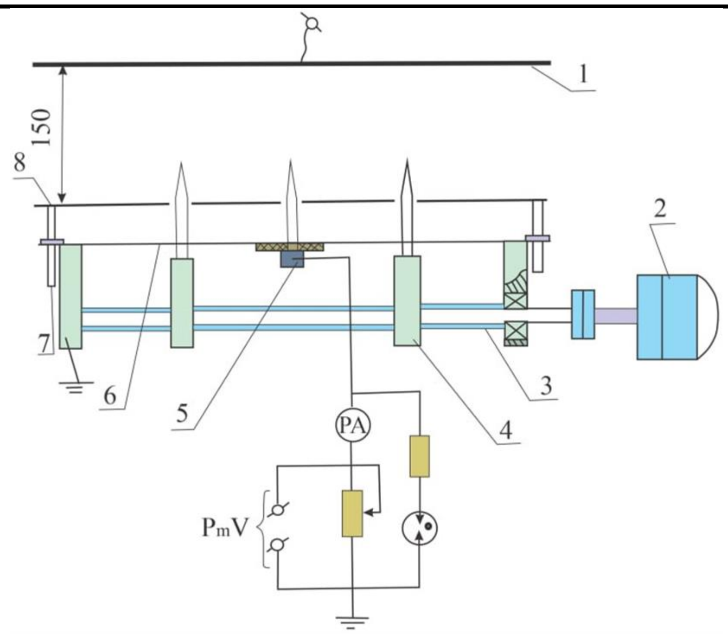

Figure 2. Scheme of the stand for studying the effect of the distance between the Corona discharge needles in a row and the length of the needles on the streamer-shaped Corona discharge current.

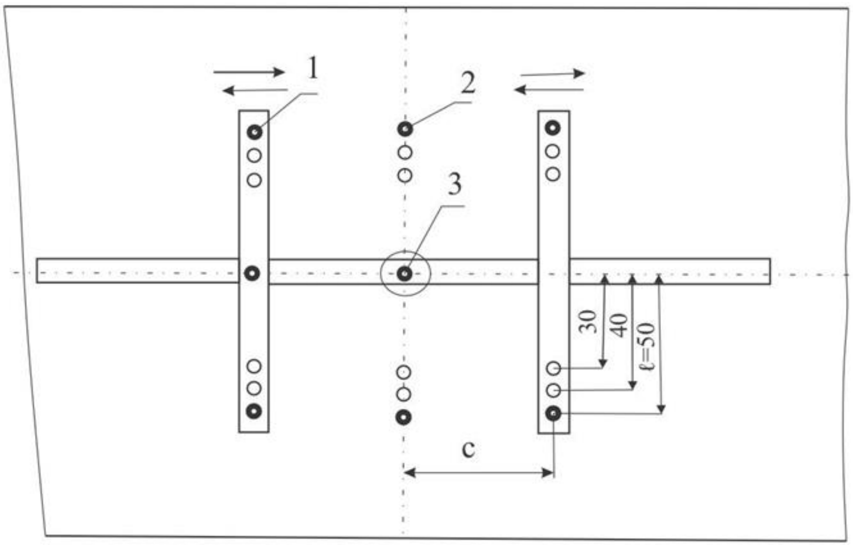

Figure 3. A stand diagram for studying the effect of the distance between needles of different lengths on the streamer-shaped corona discharge current.

A row of moving needles 1 was attached to the measuring stand (Fig. 3). A measuring needle 3 is installed in the middle of a row of fixed 2 needles. The sliding speed of the carriages on the stand is 1mm-1. KSP-4 self-recording potentiometer drawing tape drawing speed is 2mm-1. Recording the process is carried out until a stable value of the discharge current is established. The minimum distance from the edge of the measuring needle to the tip of the needles in motion is 10 mm.

Heat absorption into the material In order to prevent low absorption of heat into the material after cutting off the high voltage source of cotton raw material on the electrode surface, the experiment was carried out in the following sequence:

The measured mass of raw cotton was placed in the supplier;

• a high-voltage source was connected to the stand, and the voltage was increased until a spark

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hole was formed during the discharge interval;

• then the stress was reduced by 20% compared to the punching stress;

• the centrifugal fan motor is started and the voltage is set to ensure that the air flow speed is equal to 8 m/s;

• the stopwatch and the motor of the drying drum are started at once;

• after 40 seconds of operation of the stand, the fan and dosing conveyor were turned off. After the fan has stopped completely, the high-voltage mabai is also turned off;

• after the residual charge is lost from the high-voltage source, its outputs are connected to the ground;

• the stand box was separated, raw materials with reduced moisture were collected in each section, and mass was measured on a VLTK-1000 scale with a measuring width of 1000 g and each division of 2 g.

An additional experiment was carried out according to the following methodology to determine the zone of heat absorption into the material necessary to reduce the amount of moisture by 10%:

1. The amount of material mass in the case of low absorption of heat into the material was determined by the following formula:

$$m_{ocm} = m_0 - \Sigma m_n.$$

2. The material humidity of the air flow in the residual mass of heat absorption into the material was determined by the following formula:

$$Z_{ocm} = m_{ocm} /(hbV).$$

3. The length of the dosing conveyor, where the mass of the material is not preserved, is determined as follows:

$$d = (m_{ocm} v)/(Z_{jcn} hbV).$$

The dependence of the current of one needle corona discharge electrode on the distance to the adjacent corona discharge needle electrodes when the distance between the electrode planes was 0.15 m was obtained when the effective value of the impulse voltage was 5.4x104 V and the frequency was 500 s-1. Discharge gap breakdown occurred at a voltage of 5.8 x 104 V. The resulting diagrams were plotted on a single graph for comparison (Figure 3.5). The graphs show that the current of one corona discharge electrode is significantly dependent on the distance to the other needle electrodes, as well as their length.

The results of studying the parameters of the electrode system

The distances between the needle electrodes in a row were determined from the turning points of the curves marked by dots on the graphs.

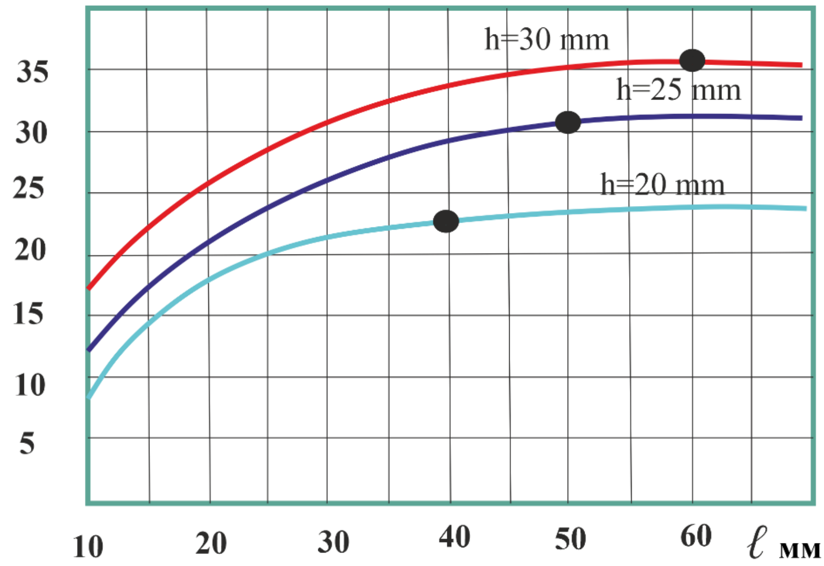

Figure 5. Dependence on the current of one corona discharge needle of different lengths and the distance from it to adjacent needles when H+h = 0.15 m

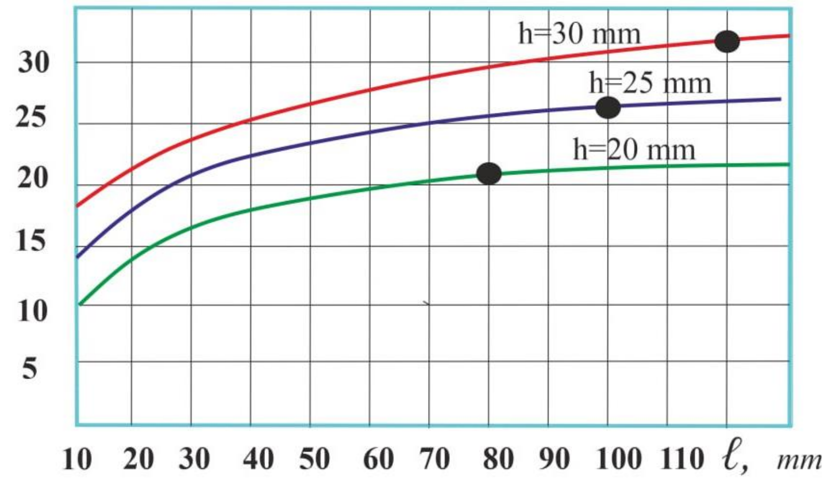

Figure 6. The dependence of the current of one corona discharge needle of different lengths on the distance between rows of corona discharge needles; the distance between the planes was H+h = 0.15 m.

Conclusion:

In the obtained data, it is clearly shown that the distance between the crown needles in the rows is less than twice the distance between the needle rows. This ratio cannot be analyzed analytically. The reason for this was discovered during experimental studies of the suppression of aerosol particles from the air flow. The most optimal of the known parameters of the electrode system, "potential plane with crown needles—ground plane," were selected based on experimental studies of the process of suppression of aerosol particles from the air stream.

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