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# Development of A Modernized Tube For Determining The Speed And Pressure Of The Air Flow

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Designed and manufactured a modernized trubka to determine the pressure and velocity of the air flow. made tube attached to the manometer MMN-246(5)of -1.0 and a study on verification in the device PAT No. 016 and dmts-01.M The State. Standard for determination of the pressure and Soroti air flow. Determined parameters of the devices PAT No. 016 and dmts-01.M (taken for reference) and manometer MMN-240(5)of -1.0. Based on the obtained data, we plot the analysis results. In devices PAT No. 016 and DMC-01 and MMN-240(5)of -1.0 the values of the correction ratios to determine the pressure "S" and velocity "D" of the air flow for each value of the coefficient K , taking into account the inclined installation of the pipe. The results of the calibration of manometer MMN-246(5)of -1.0 with the upgraded tube State. Standard "Uzhydrometcenter" issued certificate No. 170 (15,03,2017).

**Maintaining.**

One of the pressing problems of today is to determine the pressure, speed and performance of the air flow created by the fan of the sprayer used to protect agricultural crops.As we know, the basic principles of the movement of air and liquid in nature are generalized, and their movement is often studied on the basis of general equations.

The energy state of the liquid and the air flow, which on the basis of the Bernoulli equation is equal to the sum of potential and kinetic energy and is applied to study hydrodynamic and aerodynamic motions, and on the basis of the equation, their main parameters are determined.

French scientist Henri Pitot in 1732 developed, manufactured and applied in practice tubes for measuring the total pressure of a flow of a moving fluid.

It is known that the total pressure is the sum of the hydrostatic and dynamic pressure.

German scientist Ludwig Prandtl, in order to determine the dynamic pressure in the driving fluids in the developed Pitot tube, installed a second tube from the outside with a diameter larger than that tube, on one side and connected to a manometer with separate channels.

At the same time, the channels were connected through the liquid, and the tube was inserted into an open atmosphere, through which the dynamic pressure of the liquid in the liquid found in the measuring device. This device is named after Pito Prandtl.

American and British scientists have led in scientific research in this area and refer to fluid pressure under their own names [1,2].

Later, BG Turbin conducted a series of scientific studies on the drainage project, increased the pressure of the air flow and gave recommendations for its development [3].

However, the measurement of the airflow rate generated by a sprayer used in crop protection is one of the major problems.

The aim of this study is to develop and, on the basis of this, manufacture a modernized tube with high sensitivity, which determines the pressure and speed of the air flow created by the sprayer fan and substantiates its main parameters.

Main part.

The development of measuring instruments for air flow parameters in our country is one of the most pressing problems. In developed countries, fan sprayer has researched and analyzed studies of pressure and air flow rate [1,2,3,4,5,6,7,8].

In this area, B.G. Turbin's research on pipe design and development was the basis for solving the problem. When analyzing the project of drainage of pipes by B.G. Turbin, the main part of the pipe has a spherical shape and suggests a design.

In our opinion, when the tube core is spherical, the velocity of a certain air velocity flows up to a certain angle equal to the spherical surface, i.e. when the air flow in the pipe is blocked, the air flow circulates in the direction of the barrier. At a certain moment, the air is converted in front of the barrier and changes its movement.

This causes the air flow pressure to differ from the actual value.

When we analyze the above points, we have developed an air pressure sensor design to eliminate the aforementioned defects at the end of our main workpiece.

Therefore, the tip of the tube is cone-shaped and prepared on this basis.

The tip of the tube is made in the form of a sharp cone 50 mm long, which led to a reduction in compressed air than a spherical shape.

As shown in Figure 1, the tip of the tube (tapered part) is manufactured separately, with the specified diameters in two sizes. The pipe is inserted into the inner hole of the cone. Hole 3 is inserted into the outer part of the cone and hole 5 is inserted into the hole.

At the end of the two tubes, hooks 4 were installed to connect the hoses, and the tube was tested at a pressure of 0.2 kg/sm$^2$. The tube was connected to an MMH-240 (5) -1.0 micromanometer (Fig. 2).

For this purpose, we connect the channel of the first channel (I), that is, small tube 2, to the MMH-240 (5) -1 (+) instrument. At the same time, the total pressure of the air flow through this channel of the channel r enters the device.

We connect the second (II) channel of the pipe with the flows of MMH-240 (5) -1.0 (-) air coming from the second tube (coming from the side holes) 3, and the static pressure $P_{st}$ is formed in this channel.

The two channels are interconnected by a liquid (alcohol), in which the difference in static pressure with the total pressure of the air flow is equal to the dynamic pressure $P_{din}$, which is determined by the image of the tube.

The total air flow pressure (P) is equal to the sum of dynamic ($P_{din}$) and static ($P_{st}$) pressures.

$$P = P_{дин} + P_{ст}, \tag{1}$$

Further, the dynamic pressure was determined as follows

$$P_{дин} = P - P_{ст}, \tag{2}$$

or

$$P_{дин} = \gamma \cdot 1 = \frac{p \cdot \vartheta^2}{2} \quad , \tag{3}$$

Here: γ is the specific gravity of alcohol poured into the barrels of the micromanometer, kg/m$^3$;

$\rho$ is the air density, kg /m$^3$;

$\vartheta$ is the speed of the air flow, m /s;

Thus, MMH-240 (5) -1.0 micromanometers determine the dynamic pressure and air flow rate.

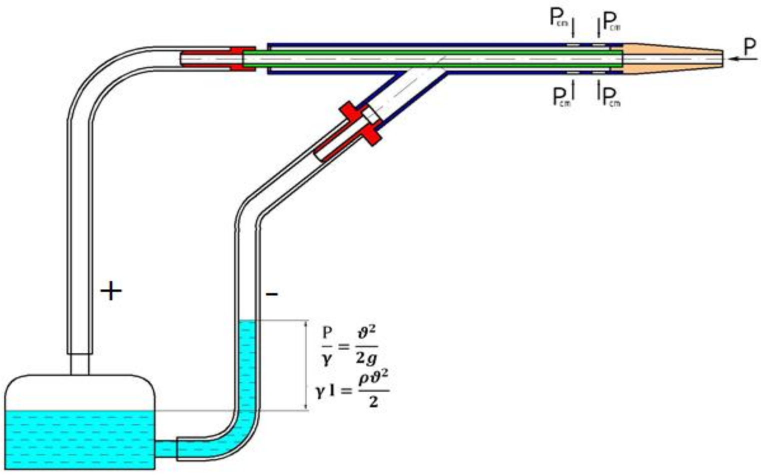



**Figure 2. General flow chart for determining the pressure and air flow rate by connecting the upgraded tube to the MMH-240 (5) -1.0 micromanometer**

Before conducting a study to determine the pressure of the air flow created by the universal spray valve, an aspiration psychometer 2 meters high (MV-4M GOST 6353-52) and humidity were installed on a specially designed table.

During the experimental work, the above information was recorded and recorded.

The dynamic pressure (4) of the air flow generated by the fan is determined using an improved tube connected to the MMH-240(5) -1.0 micromanometer:

$$P_{дин} = l \cdot K \cdot, n \cdot C, \qquad (4)$$

Here: *l*- Calculus from the petal (surface surface), mm;

K -coefficient of the angle of inclination of the tube, kg / m$^3$;

n is the coefficient of the difference between the intensities of alcohol;

C is the pressure coefficient that regulates the air flow pressure;

The surface consumption (surface surface) was determined by the expression:

$$l = l_1 - a, \qquad (5)$$

In this case: - pipe calculations before the experiment, mm;

Calculations taken from the pipe at the end of the experiment, mm;

The K factor representing the angle of inclination in the hole setting is as follows:

$$K = \gamma_{сп} \cdot \sin \alpha, \qquad (6)$$

In this case: - the density of the alcohol installed on the rail is $\gamma_{сп} = 0{,}8095 \pm 0{,}005$ G /sm$^3$;

- instrument scale, deviation.

As you know, air pressure is measured in the range of 0-240 kg/m$^2$ using MMH-240 (5.0) to 1.0 µm, which is obtained from the scale of the glass tube divided by 1 - 300 mm in the device. MMH-240 (5.0) is adjustable to five tilt angles relative to the horizontal axis to improve the accuracy of -1.0 micromanometers.

At the same time, the coefficient K, which describes the angle of inclination, is introduced when installing a tube with five values K = 0.2; 0.3; 0.4; 0.6;

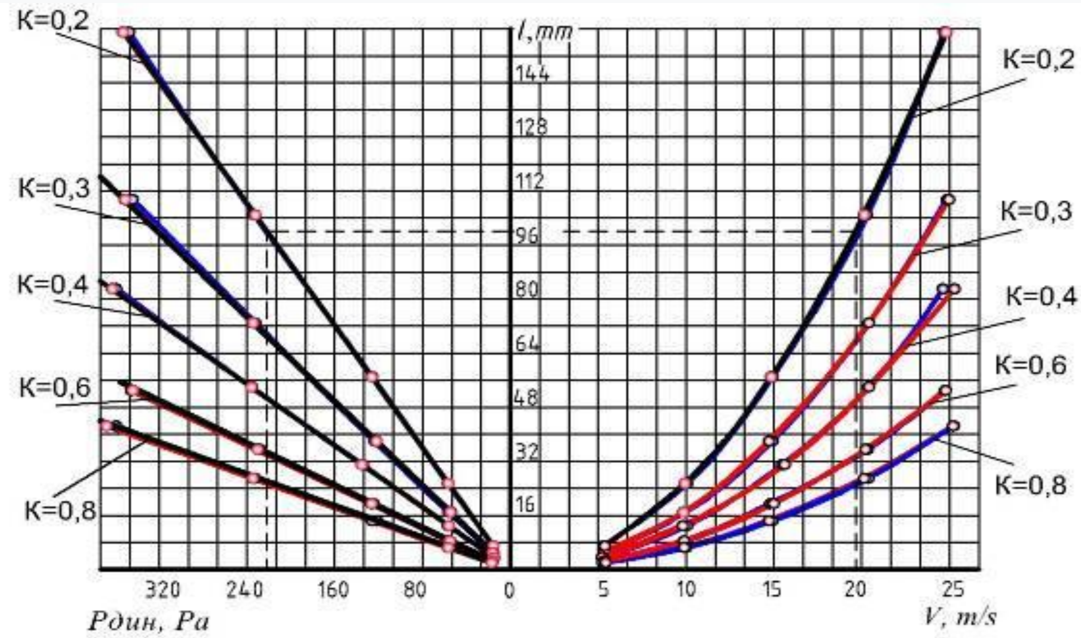
A value of 0.8 is calculated based on these values, and five holes open at the bottom of the device, and its value is expressed at each hole.

In the case of the angle corrected for each tilt, the instrument determines the air flow pressure in the range of 0-240 kg/$m^2$ higher, but in the case of the corresponding K value. For example, the connection MMH-240 (5.0) - 1.0 of the micromanometer was installed at an angle of K = 0.2, with 240x0.2 = 48 kg/$m^2$, i.e. its upper limit of air pressure is 48 kg/$m^2$ equal.

The difference in specific alcohol varies from alcohol to alcohol, which should be fed into MMH-240 (5) -1.0 micromanometers. MMH-240 (5) -1.0 based on the router $\gamma_{cn} = 0{,}8095 \pm 0{,}005$ G / $sm^3$, and alcohols were not present in such a specific ratio, alcohol was indicated instead of $\gamma_{cn}$ = 0,8844 G /$sm^3$.

n values are taken from the table above ambient temperature in the experimental procedure given in the guidelines for $\gamma_{cn}$ = 0,8844 G /$sm^3$.

The value of the coefficient C, which regulates the air flow pressure, was determined by comparing the MMH-240 (5) -1.0 index with each case K for the experiment and equal to: K = 0,2; S = 1,078; K = 0,3; S = 1,043; K = 0,4; S = 1,064; K = 0,6; S = 1,051; K = 0,8; S = 1,035;




-PAT No.016 is DMC-01.M (standard); -MMN-240 (5) -1.0 micromanometer

**Figure 4. Comparison diagram of the parameters "Uzhydrometcenter" (MEA) and MMN-240 (5) -1.0 micromanometers for calculating the pressure and air flow rate.**

Testing of pressure and air flow rate on PAT No.016 and DMT-01.M "Uzhydrometcenter" was carried out in accordance with the standard standard MMH-240 (5) -1.0 microns. MMN-240 (5) -1.0 micromanometer increased the air flow rate in the equipment for each value K = 25 m/s. At the same time, the air pressure at each detection point was measured simultaneously with PAT No. 016 and DMTs-01.M and mm N-240 (5) -1.0 micromanometers. Approval of hardware indicators. Indicators "Uzhydrometcenter" PAT No. 016 and DMT-01.M and MMN-240 (5) -1.0 micromanometers (No. 170, 03/15/2017) were identified and certified. Below is a graphical representation of the air pressure "Uzhydrometcenter" and MMN-240 (5) -1.0 micromanometers (graph 4).

- PAT No. 016 and DMT-01.M (reference); - MMN-240 (5) -1.0 micromanometersThe air pressure on the vertical axis of the graph (ordinate) is at the top and bottom of the speed at the bottom. The horizontal axis of the graph MMH-240 (5) -1.0 micromanometers are located in the same range depending on the pressure and air flow rate. In the graph, the pressure and air velocity are expressed as curved lines placed on the values of K and MMH-240 (5) -1.0 micromanometers.

As can be seen from the connection, the pressure and velocity of the air flow line were measured with an MMH-240 (5) -1.0 millimeter with a reference plate, which indicates an improved accuracy of the MMH-240 (5) -1.0 micromanometer.

As can be seen from the graph, pressure and air flow rate are interrelated with MMH-240 (5) - 1.0 micromanometers.

Simultaneously, the pressure and the air flow rate were determined simultaneously.

For example: on graph O we pass a straight line at the value of l to L that intersects the curve at the top and bottom of the graph of some value K.

Together, we can simultaneously determine the pressure and airflow rate corresponding to the intersection values, passing horizontally along the vertical axis of the graph.

Air velocity was determined using the following expression.

$$\vartheta = 4{,}01 \cdot Д \cdot \sqrt{P_{дин}}, \qquad (7)$$

in which: D is the coefficient of the tube that regulates the air flow rate The value of the coefficient D was determined based on the value above the specified K: K = 0,2; D = 1,042; K = 0,3; D = 1,052; K = 0,4; D = 1,046; K = 0,6; D = 1,050; K = 0,8; D = 1,037.

To determine the total airflow through the MMH-240 (5) -1.0 micromanometers with improved tube, connect port I to the bushing (+) and disconnect the second port (-) from the clamp. As a result, MMH-240 (5) -1.0 micromanometer shows the total air flow pressure.

When determining the static pressure of the air flow, channel II is connected to the MMH-240 (5) - 1.0 micromanometer (+) socket, indicating the static pressure.

Analysis of the above graphs showed that the parameters of pressure and air flow rate of the installed MMH-240 (5) -1.0 mm microprocessor are very close to the control values, and their difference does not exceed the permissible limit.

**Findings.**

1. Developed and manufactured a modernized tube for determining the pressure and speed of the air flow generated by the fan.
2. The modernized tube connected to the MMN-240 (5) -1.0 micromanometer was verified in the laboratory "Uzhydrometcenter" of the State Standard and a certificate was issued (No. 170, 03/15/2017):
3. The values of the correction factors for determining the pressure C and the speed D of the air flow were determined for each value of the coefficient K, taking into account the inclined installation of the tube:

- to determine the air pressure: K = 0,2; C = 1,078; K = 0,3; C = 1,043; K = 0,4; C = 1,064; K = 0,6; C = 1,051; K = 0,8; C = 1,035;
- to determine the air speed: K = 0,2; Д = 1,042; K = 0,3; Д = 1,052; K = 0,4; Д = 1,046; K = 0,6; Д = 1,050; K = 0,8; Д = 1,037.

4. Micromanometer MMN-240 (5) -1.0 with an upgraded tube can be used to determine air velocity and air flow in other areas.

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