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On air flows speed measurements by anemometers of new generation

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The article analyzes the methods used to measure speed, substantiates the method of measuring "in the center of the cross-section" of the development, proposes measures aimed at creating safe working conditions in mines.

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REVIEW for the article A. Meshcheryakov "On air flows speed measurements by anemometers of new generation"

The article is devoted to a very topical issue for coal mines, namely, the issue of ensuring safe working conditions in them. Undoubtedly, one of the ways to ensure such conditions is the high-quality ventilation of the mine workings, and here the method of measuring the speed of air flows is very important, providing minimal errors when making measurements.

A. A. Meshcheryakov analyzed the recommended measurement methods and proposed a new method - "in the center of the section", which provides a smaller measurement error.

The author of the article has extensive experience in resolving issues of airing mines, he worked in the mines of Donbass for more than 20 years, of which 15 years - as the head of the VSU section and the chief engineer of the mine. While serving as the head of the VSU site, he defended his thesis on the development of ways to improve the efficiency of mine ventilation. It is noteworthy that in the list of references to the article his publication is indicated in the journal "Coal of Ukraine" for 1971. The article is called "On the issue of determining air flow by measuring speed at one point", that is, the author has been dealing with this problem for more than 40 years, and his conclusions about the necessity of the method of measuring "in the center of the section" can be trusted.

For almost 20 years, the author has been dealing with another important problem for the coal industry - with his active participation, the APR-2 anemometer with which coal mines are equipped was developed and mastered in serial production. For the development of serial production of APR-2, A. A. Meshcheryakov was awarded the prize named after academician A. A. Skochinsky. A few years ago he received a patent for a mine anemometer APR-2m, which currently has no analogues in its technical capabilities.

Taking into account the above, I consider the publication of an article by A. A. Meshcheryakov in the "Ugol" journal very useful and timely, the article is aimed at solving a very important problem - improving work safety.

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Monitoring the speed of air flow in the mine workings is an indispensable condition for creating safe and comfortable working conditions in them. In this case, the choice of the method of measuring speed is very important, since the accuracy of measurements, and, consequently, the state of the dust and gas regime of the mines, largely depends on it.

For many decades, traditional measurement methods have been recommended: "in cross section", "in front position" and "point by point". The first is most common - "in section" and less applicable - "by points", since it is the most labor-intensive, requiring at least 40-60 minutes to conduct just one measurement. The same method is also less accurate, since significant fluctuations in the air supply can occur during the measurement, introducing a significant error in determining the average speed. When measuring air flow in a mine, this method, as well as the method of measuring "in front position", are used extremely rarely.

More than 80 years ago, one of the founders of mine aerology in Russia, prof. M. M. Protodyakonov: "... having once studied in detail the location of the velocities over the cross section, in the future we can be content with measuring only at one point, because all other velocities vary in proportion to this. Obviously, it is most convenient to choose a point corresponding to the average speed of a given section, and to constantly measure in it "/ 1 /.

It is very difficult to determine the point corresponding to the average speed each time you measure, since for this you need to carry out a complex of measurements, which takes a long time. The author of the article, having carried out a large volume of measurements, came to the conclusion that it is permissible to take measurements of the average speed in the center of the working section / 2 /. At the same time, the place of measurement can be taken not as a geometric point in the center of the cross section of the mine, but as the core of the air flow moving at maximum speed, which greatly simplifies measurements.

In workings with a cross-sectional area of up to 8 square meters maximum speed is observed on an area of 30-40% in the center of the cross section of the mine. As the cross-sectional area that currently has a place in most mines increases, the area of the flow core increases at maximum speed, which facilitates the production of measurements and increases their accuracy.

The determination for all sections of one measurement site eliminates the need to determine the average velocity measurement point in each individual case. When determining the average speed *Vcp* across speed *Vц* in the center of the working section *Vcp* = 0,85 *Vц*, m/s.

The error of measurements made by the method "in the center of the cross-section" is significantly lower than the error of measurements "in the cross-section", since the error caused by the uneven contour of the device over the cross-section is excluded. When making measurements using the "in cross-section" method, in workings with a height of 3 m or more, it is impossible to ensure a uniform contour of the device over the entire cross-section, since the device in an outstretched arm can be raised to a height of about 2.5 m, and in many cases workings 3 m and more.

In such workings, it turns out that the measurement is supposedly carried out using the "in cross-section" method, but in fact it is a method of measurement "in the center of the section", and we do not use a reduction coefficient, which leads to an overestimation of speed readings.

Measurements made by the APR-2m anemometer in an unventilated room by uniformly circling its cross-section showed that the speed with such measurements is 0.2-0.3 m / s, since the impeller of the device is very sensitive to moving it in space, that is why the speed indicated is actually proportional to the speed of movement of the device over the cross section. And this situation is typical not only for APR-2m, but also for other types of highly sensitive devices. For example, when using hot-wire anemometers, which are based on the principle of cooling a heated string, it is also unacceptable to measure the average speed using the "cross-section" method, since the string cooling in this case occurs not only from the air flow velocity, but also from the speed of movement instrument when measuring. The same problems arise when using acoustic devices, here also an additional error arises due to the movement of the device along the production cross section.

Given the introduction of a new generation of anemometers, such as APR-2m and others, it should be recognized as the most reliable way to measure at one point - "in the center of the section." The method of measuring at one point is currently used when installing stationary sensors; there is no other way for them. However, inertia of thinking, as well as the lack of an organization that has taken responsibility for deciding whether to use this measurement method for new generation anemometers, prevents us from using portable anemometers for measuring in the center of the section.

In the "Operation manual" of the SRSV 01 air flow rate sensor developed by InGorTech, in paragraph 2.6, the methodology for calculating air flow when installing stationary sensors / 3 / is given. The methodology described in the Manual fully coincides with the methodology for portable anemometers proposed by the author of the article.

The only difference is that when installing stationary sensors in the zone of reduced speeds, at a distance of 20 cm from the support of the mine, an increasing coefficient is used to determine the average speed, and when measuring using APR-2m portable anemometers in the "center of section" method, a decreasing coefficient should be used .

In our opinion, the Manual should recommend the use of an APR-2m anemometer with the same initial measurement threshold of 0.1 m/s as a control device. It would be methodologically correct to indicate in the Manual that the air flow in the mine is determined by the method of measuring the APR-2m anemometer "in the center of the section" of the mine (*Vц*) , and not "in cross-section", as it is now said, after which the same anemometer measures the speed at the installation site of the stationary speed sensor (*Vд*) , then the coefficient N is determined, taking into account the position of the stationary speed sensor , equal to $N = 0{,}85\,Vц/Vд$.

Mining anemometer APR-2m

The APR-2m anemometer, unlike other types of instruments that provide only the measurement of air flow in manual mode, also allows measurement of speed, pressure and temperature in automatic and remote modes, while it provides speed measurement in the range from 0.1 to 50 m/s. The measurements made by the APR-2m anemometer are stored in the memory of the device and can later be printed on a computer. With the cost of automatic air control systems of tens of millions of rubles, the presence of portable anemometers in the mines, which can be used to automatically monitor ventilation networks, is a very promising area both in order to save material resources and ensure safer working conditions .

Safety rules in coal mines should provide a method of measuring "in the center of the section", as well as the standards for calculating anemometers for mines, approved by the Gosgortekhnadzor (04-35 / 314 of 11/11/1996), which will increase the safety of work in mines.

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