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EXPERIMENTAL STUDY OF THE INTERACTION OF TWO SPEED COUNTER, SHIFTING SWIRLING JET

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Summary. the results of experimental researches of a field of velocity are given at interaction of colliding, displaced twisted gas jets shown stability of gained structure owing to action of a precessing vortex core, and also the optimum relation between an offset value and distance between fitting pipes is spotted.

Key words: The twirled stream, vortical kernel, field of speed.

INTRODUCTION

Development of new energy-saving techniques and design solutions to reduce fuel consumption in the decentralized heat supply systems, localization of heat sources of low power and dispersion of pollutants in the air, along with theoretical research requires obtaining experimental data on the aerodynamics of interacting swirling flows. Performing such studies is also due to the fact that the theoretical model of job demand variables are measured in industrial conditions is difficult (for example, the kinematic viscosity of the medium, the oscillation frequency of the vortex core and other data), so the availability of experimental data in the appropriate range will develop a methodology for determining the conditions of stability of swirling flow interaction with a heat source, the engineering methods of calculating the velocity fields with different types of interaction swirling jets.

OBJECTS AND PROBLEMS

Thus, the task of experimental investigation of the resulting velocity fields and obtaining data for the regression equations in engineering calculations with speed counter, biased in the horizontal plane. To solve this problem was developed and manufactured an experimental test bench for aerodynamic research, which is based on connections with tangential supply of connected flexible ducts with fan. The experimental setup consists of two nozzles, with a diameter of 100 mm, with a tangential supply of the flow, flexible ducts, a fan of high pressure valves to regulate air flow.

To perform measurements of the speed setting termoelektroanemometrom equipped with a spherical probe and the coordinate grid to determine the direction of velocity. Measuring the gas flow was carried out using the method of variable torque diaphragm pressure drop. Before the measurements performed termoelektroanemometra connect to the network, checking the device and installation of nozzles for the investigated species interactions swirling flows. Continue to perform the installation of a grid on the nozzle exit, and determined the number of points to be measured. After turning on the fan be measured axial, tangential and radial velocity in this section, further grid was transferred to a distance corresponding to the next section with subsequent measurements.

Experimental data interaction counter shifted in the horizontal plane of swirling flows, the distance between the feeding pipes 4 caliber of radial, tangential and axial velocity components, after assessing their validity, are presented in the form of graphic dependences in Fig. 1-3.

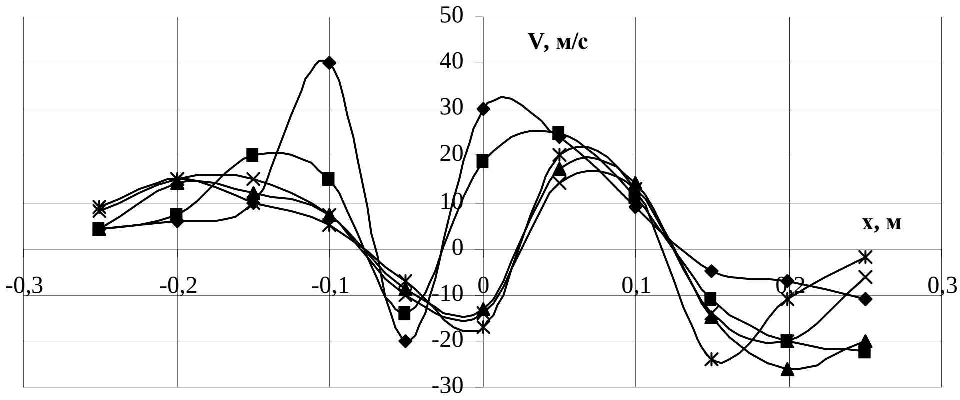

Fig.1. The distribution of radial velocity in cross sections (offset 0,15 m): ♦ - at a distance of 0,1 m from the outlet pipe; ■ - at a distance of 0,15 m; ▲ - at a distance of 0,2 m; x - at a distance of 0,25 m x-distance 0,3 m

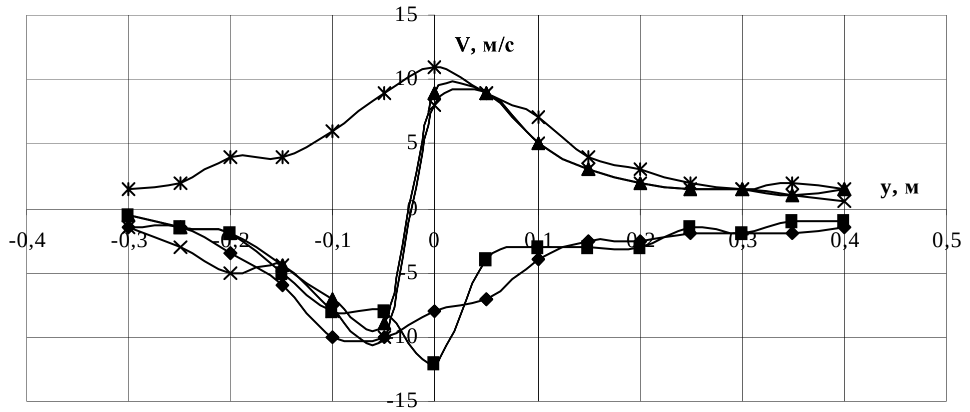

Fig.2. Distribution of tangential velocity in cross sections (offset 0,25 m): ♦ - at a distance of 0,1 m from the outlet pipe; ■ - at a distance of 0,15 m; ▲ - at a distance of 0,2 m; x - at a distance of 0,25 m x-distance 0,3 m

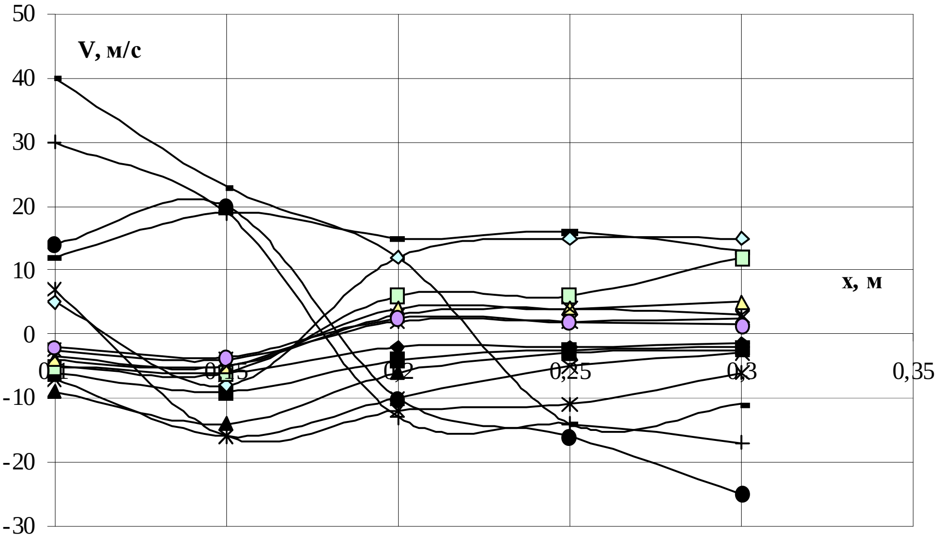

Fig.3. Distribution of axial velocity (displacement 0,25 m):
♦ - at a distance Z = -0,3 m from the jet axis; ■ - at a distance Z = -0,25 m; ▲ - at a distance Z = -0,2 m; x-at a distance Z = -0,15 m ; Well - at a distance Z = -0,1 m; • - at a distance Z = -0,05 m + - on the jet axis; ▬ - at a distance Z = 0,05 m; ▬ - at a distance of Z = 0, 1 m; ◊ - at a distance Z = 0,15 m; □ - at a distance of Z = 0,2 m; Δ - at a distance Z = 0,25 m; x - at a distance of Z = 0,3 m, f - in distance Z = 0,35 m; ○ - at a distance Z = 0,4 m

CONCLUSIONS

Analysis of the distributions of velocity components, formed by the interaction of counter-shifted in the horizontal plane swirling jets showed that the displacement of the axes of jets increases, the interaction region of the radial velocity component, and the location of the maxima and minima in different cross sections revealed the presence of alternating areas of synergy and the displacement of jets in each other, with This occurs mirroring the resulting field of the radial velocity component with increasing displacement axes (velocity field with a displacement 0,25 m corresponds to the field with the displacement of 0,2 m and displacement of 0,3 m - 0,15 m). That is, with small amount of displacement interaction occurs between the outer boundary of a jet and the inner boundary of the reverse currents of another thread, but with increasing distance to the interaction of the two outer layers come swirling jets. Distribution of the tangential component of velocity showed that the addition of the jet velocity starts with a displacement of 1 diameter, while the obtained distribution agrees qualitatively with the distribution of the interaction of counterpropagating self titled swirling flows that might at interaction internal to the zone of reverse currents of single layers of the jet with the external layers of the other. Distribution of axial velocity component in the interaction of jets showed the presence of changing the direction of the axial velocity, with the maximum (minimum) falls on the curve equidistant from the nozzle zone, but is itself a field of axial velocity component is a clear distinction between the internal layers (outer layers of the jets) and the outer layers of the resulting flow.

Comparison of the studied species interactions with other types (at an angle, competing, parallel swirling flows) led to the conclusion that this form of the interaction region where the addition of a swirling jet velocity is much higher than the area for any other types of interaction.

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ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ПОЛЯ СКОРОСТИ ВЗАИМОДЕЙСТВУЮЩИХ ЗАКРУЧЕННЫХ ПОТОКОВ

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Аннотация. Приведены результаты экспериментальных исследований скорости при взаимодействии закрученных газовых потоков, показаны условия стабилизации полученной структуры.

Ключевые слова: закрученный поток, вихревое ядро, поле скорости