Gas Flow Formation in the Inertial Filtering (IF) Gas Separators Curvilinear Channels

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ABSTRACT

This paper deals with an up to date problem for oil and gas industry- separation of the gas -fluid fogs. Here is described the worked out physical model of the gas movement process in the sections of the inertial filtering (IF) gas separators. One can find the mathematical model for research of the fields of velocities and pressures in the inertial curvilinear channel. The main simplifications and assumptions are explained. This mathematical model has been made using mathematical program Maple and it is received the 3-d graphic of the distribution componential speed parts in the channel and also 2-d graphics at the channel sectional view when the flow is flat. The new method for gas - fluid systems separation is suggested.

Keywords: separation; modeling; velocity; gas; liquid; curvilinear channel; filter.

انشاء نموذج لتدفق الغاز في قناة منحنية الاضلاع لعوازل غازية تعمل بالقصور الذاتي مع الفلاتر

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قسم العمليات والمعدات للمصافي النفطية والبتروكيميائية
كلية النظم التقنية وتكنولوجيات كفاءة الطاقة
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الخلاصة

يتناول هذا البحث مشكلة ملحة لصناعة النفط والغاز وهي فصل رذاذ الغاز – السائل أو ما يسمى (بالضباب أو بخار الماء)حيث تم دراسة نموذج فيزيائي لحركة وتدفق الغاز داخل عوازل غازية تعمل بمبدأ القصور الذاتي مع المرشحات (الفلاتر).وبالتالي تم العمل على ايجاد ودراسة نموذج رياضي للبحث في مجالات السرعة والضغط داخل قناة منحنية الاضلاع تحت تاثير قوى القصور الذاتي .
ولتشخيص وتبسيط هذه المعطيات والافتراضات تم وضع هذا النموذج الرياضي ومعالجته باستخدام برنامج الMaple, من النتائج التي تم الحصول على مخطط بياني ثلاثي الابعاد يوضح توزيع قيم السرع على طول اجزاء القناة ,وكذلك تم الحصول على مخططات ثنائية الابعاد توضح مقاطع عرضية للقناة عندما يكون الجريان سطحي , بالاضافة الى مقترحات جديدة لانظمة فصل الغاز - السائل.

الكلمات الرئيسية: : فصل، نمذجة، السرعة، غاز، سائل، قناة منحنية الأضلاع، فلتر.

1. INTRODUCTION

Air dispersion systems which consist of solid and liquid particles weighted in the gas form play quite an important role in the nature and in humans life. But the problem of air dispersion systems separation is even more up to date in the science and techniques, **Poole, 2009**.

Many theoretical problems of air dispersion systems particles studying are of big mathematical hardships. It happens as a rule that their solution one finds using difficult mathematical formulas using which in practice needs immense calculating work. So in some of the cases it is reasonable to refuse from the exact solution and take the well known assumptions which make it much easier to get at least the rough idea about the examining phenomenon.

2. KEY ASSUMPTIONS AND PHYSICAL MODEL:

1. One finds out the hydrodynamic characteristics and separation elements constructive parameters making some simplifying assumptions which have the main features of the studying phenomenonin order to make practical calculations of the typical gas dynamical separation apparatus **Stepanov et al., 1986**.

2. First of all one neglects gas condensability and viscosity, flow turbulence and examine the settled (average as to time) ideal (no viscose) constant density fluid free-vortex movement. But it is possible only when there is a low viscous gas flow in the good profiled channels when the speeds are subsonic.

3. Then, the flow is considered to be 2-d which takes place in the layer which usually has variable thickness with the parameters depending only on two coordinates.,**Sinayskiy et al., 2002**.

4. But the real gas flow in the channels of louver inertial filtering gas separator generally is spatial and unsteady and that is why it is impossible to make its complete theoretical analysis **Barilovych, 2009; Lyaposchenko et al., 2005**; **Lyaposchenko, 2006**. Having such task considering limited demands to the gas parameters accuracy and approximate using model it is reasonable to apply quite simplified flow schemes and calculating formulas based on the further simplifying assumptions.,**Al Rammahi et al., 2011; and Lyaposchenko, 2006**. Solving such tasks it is enough to use equation indissolubility, vortex equation and impulse theory .,**Barilovych, 2009; and Lyaposchenko, 2006**. The stated above assumptions are of big help to make a qualitative modeling and to get rough results of calculating the gas flow in the IF gas separators louver boards.

In the **Fig.1**, it is shown the calculating zone geometrical configuration in the form of curvilinear channels which are formed by the louver board plates of the IF gas separator:

To analyze the physical model gas drop flow movement along the separation channel with filtering sections of the inertial filtering gas separator one should look through its separate pieces. **Fig.2.**

- gas drop flow movement along the inertial section of the curvilinear gas separation channel;

- penetration of the gas drop flow in the filtering section, dispersion particles ricochet or splashes carrying out in the separation channel depending on the angle which faces the “attack” by the layer filter flow;

- coalescence of the caught particles on the fibers in the filtering layer, the formation and withdrawal of the caught liquid pellicle to the drainage channels

Local gas flow speeds gradually rise after the rectilinear sections on the separation channel inlet on the transition from the curvilinear to linear (confusion) sections. After the rectilinear sections in the curvilinear section there is an inhibitory (diffusion) separation channel section with filtering sections which are situated on the inner surface of the crimping plates. In this section the dynamic force of the air decreases due to lower gas flow rate of fluid. This force pulls the dispersion particles in the gas stream, and it makes the particles inertial movement to the filter layer easier which makes separation effective. By the way pressure in the drainage channels of the double louver crimping plates rises and it makes the flowing and caught fluid withdrawal steady and filtering elements in the self-cleaning mode work effectively. When stationary regime is achieved stability, separation effectiveness, the liquid quantity in the filtering layer and liquid flowing from the layer remain constant in time when the filtering speed is permanent. In such a case the migrating liquid quantity is equal to the liquid quantity which gets into the filter layer. The boundary which divides separation channel inertial zones and filtering section is a conditional wall (free stream boundary) where the gas flow speed is constant which corresponds to the permanent pressure in the filter layer and drainage channels. On the transition from curvilinear to the linear (confusion) sections beginning from the inhibitory points of the gas flow which comes upon the speeds gradually rise again. The special attention was necessary to pay to the separation channel curvilinear section profiling where the biggest pressure losses and resistance are connected with the flow separation. Separating flow limits the pressure speed gradient on the separation channel walls.

5. The special attention was necessary to pay to the separation channel curvilinear section profiling where the biggest pressure losses and resistance connected with the flow separation. Separating flow limits the pressure speed gradient on the separation channel walls. As to the theoretical and experimental data to get the continuous flow one should lower the gas speed no more that on the 25% on the wall length, which is equal to the separation channel width. Moreover as to the recommendations general speed reduction must not be more than three-times.

3. MATHEMATICAL MODEL:

The motion of viscous gas flow in a curvilinear channel is conveniently described by the Navier-Stokes equations in cylindrical coordinates. Turbulent gas flow can be accounted for by replacing the kinematic viscosity (ν) on the coefficient of turbulent viscosity (ε), that for the ax symmetric vortex flows can in some cases to obtain analytical solutions of the set of hydrodynamic problems. To close this system of Navier-Stokes equations complemented by the continuity equation of the fourth. The result is a system of four Eqs. (1)-(4) with four unknowns (the projection of the velocity of the gas flow on the three axes and the magnitude of the pressure):

$$V_r\frac{\partial V_r}{\partial r}+\frac{V_\phi}{r}\frac{\partial V_r}{\partial \phi}+V_z\frac{\partial V_z}{\partial z}-\frac{V_\phi^2}{r}=-\frac{1}{\rho}\frac{\partial P}{\partial r}+$$
$$+\varepsilon\left(\frac{\partial^2 V_r}{\partial r^2}+\frac{1}{r^2}\frac{\partial^2 V_r}{\partial \phi^2}+\frac{\partial^2 V_r}{\partial z^2}+\frac{1}{r}\frac{\partial V_r}{\partial r}-\frac{2}{r^2}\frac{\partial V_\phi}{\partial \phi}-\frac{V_r}{r^2}\right); \quad (1)$$

$$V_r\frac{\partial V_\phi}{\partial r}+\frac{V_\phi}{r}\frac{\partial V_\phi}{\partial \phi}+V_z\frac{\partial V_z}{\partial z}+\frac{V_rV_\phi}{r}=-\frac{1}{\rho r}\frac{\partial P}{\partial \phi}+$$
$$+\varepsilon\left(\frac{\partial^2 V_\phi}{\partial r^2}+\frac{1}{r^2}\frac{\partial^2 V_\phi}{\partial \phi^2}+\frac{\partial^2 V_\phi}{\partial z}+\frac{1}{r}\frac{\partial V_\phi}{\partial r}+\frac{2}{r^2}\frac{\partial V_r}{\partial \phi}-\frac{V_\phi}{r^2}\right) \quad (2)$$

$$V_r\frac{\partial V_z}{\partial r}+\frac{V_\phi}{r}\frac{\partial V_z}{\partial \phi}+V_z\frac{\partial V_z}{\partial z}=-\frac{1}{\rho}\frac{\partial P}{\partial r}+$$
$$+\varepsilon\left(\frac{\partial^2 V_z}{\partial r^2}+\frac{1}{r^2}\frac{\partial^2 V_z}{\partial \phi^2}+\frac{\partial^2 V_z}{\partial z^2}+\frac{1}{r}\frac{\partial V_z}{\partial r}\right); \quad (3)$$

$$\frac{\partial V_r}{\partial r}+\frac{1}{r}\frac{\partial V_\phi}{\partial \phi}+\frac{\partial V_z}{\partial z}+\frac{V_r}{r}=0. \quad (4)$$

To transform the system of equations, in order to get the form in which it was possible to find an analytical solution, we introduce a number of simplifying assumptions.

Due to the fact that the basic movement of the gas flow occurs along a curved louver dripping, we assume that overflows the height of the louver channel in its magnitude is much less than the gas velocities along the channel ($V_z \approx 0$). A change in other components of the velocity and pressure at an altitude of louver elements also occurs ($\partial / \partial z \approx 0$). This allows you to exclude from the above system of differential equations of the third equation and of the remaining equations of the system to exclude all terms that contain the axial component of the total gas flow rate. In addition, we assume that due to the small width of the curved channel the pressure across the width of the channel is changed slightly, but the main change occurs along the channel $\partial P / \partial r \approx 0$. That is to say. We obtain the following system of differential equations in partial derivatives. To simplify the recording is without the function of the radius and circumferential coordinates.

$$V_r \frac{\partial V_r}{\partial r} + \frac{V_\varphi}{r}\frac{\partial V_r}{\partial \varphi} - \frac{V_\varphi^2}{r} = \varepsilon \begin{pmatrix} \frac{\partial^2 V_r}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2 V_r}{\partial \varphi^2} + \\ + \frac{1}{r}\frac{\partial V_r}{\partial r} - \frac{2}{r^2}\frac{\partial V_\varphi}{\partial \varphi} - \frac{V_r}{r^2} \end{pmatrix}; \quad (5)$$

$$V_r \frac{\partial V_\varphi}{\partial r} + \frac{V_\varphi}{r}\frac{\partial V_\varphi}{\partial \varphi} + \frac{V_r V_\varphi}{r} = -\frac{1}{\rho r}\frac{dP}{d\varphi} + \varepsilon \begin{pmatrix} \frac{\partial^2 V_\varphi}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2 V_\varphi}{\partial \varphi^2} + \frac{1}{r}\frac{\partial V_\varphi}{\partial r} + \\ + \frac{2}{r^2}\frac{\partial V_r}{\partial \varphi} - \frac{V_\varphi}{r^2} \end{pmatrix}; \quad (6)$$

$$\frac{\partial V_r}{\partial r} + \frac{1}{r}\frac{\partial V_\varphi}{\partial \varphi} + \frac{V_r}{r} = 0. \quad (7)$$

In the Eqs (5) and(7) consists of only two velocity components. These radial and circumferential velocity components of the gas stream. Set up a system of two Eqs (8) and (9) with two unknowns, which try to solve analytically.

$$V_r \frac{\partial V_r}{\partial r} + \frac{V_\varphi}{r}\frac{\partial V_r}{\partial \varphi} - \frac{V_\varphi^2}{r} = \varepsilon\left(\frac{\partial^2 V_r}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2 V_r}{\partial \varphi^2} + \frac{1}{r}\frac{\partial V_r}{\partial r} - \frac{2}{r^2}\frac{\partial V_\varphi}{\partial \varphi} - \frac{V_r}{r^2}\right); \quad (8)$$

$$\frac{\partial V_r}{\partial r} + \frac{1}{r}\frac{\partial V_\varphi}{\partial \varphi} + \frac{V_r}{r} = 0. \quad (9)$$

Of the variety of possible solutions to choose the most appropriate solution. This solution, which is obtained in the field of real numbers

$$V_r(r,\phi) = \frac{r^2 C_1 \cdot \sin(2\phi) + r^2 C_2 \cdot \cos(2\phi) + C_3}{r} \quad (10)$$

$$V_f(r,\phi) = \frac{1}{r}(-r^2 C_2 \cdot \sin(2\phi) + r^2 C_1 \cdot \cos(2\phi) + +(r^4 C_1 \cos(2\phi)^2$$
$$+ r^4 C_1{}^2 \cdot \sin(2\phi)^2 + r^4 C_2^2 - C_3^2)^{0.5}) \quad (11)$$

To determine the changes in the law, for example, the radial component of the velocity of the gas flow is necessary to determine the integration constants C1, C2, and C3. This can be done from the condition not overflow gas through the surface, which are limited to the radii R1 and R2. In addition, we assume that at some angular coordinate is the known value of the radial component of velocity equal to V_{r1}.

$$0 = \frac{R_1^2 C_1 \cdot \sin(2\phi) + R_1^2 C_2 \cdot \cos(2\phi) + C_3}{R_1} \quad (12)$$

$$0 = \frac{R_2^2 C_1 \cdot \sin(2\phi) + R_2^2 C_2 \cdot \cos(2\phi) + C_3}{R_2} \quad (13)$$

$$V_{r1} = \frac{r^2 C_1 \cdot \sin(2\phi_0) + r^2 C_2 \cdot \cos(2\phi_0) + C_3}{r} \quad (14)$$

Graphically, the solution can be obtained in the form of a curved surface.

4. THE INFLUENCE OF LOCAL VELOCITIES IN THE CHANNEL IF GAS SEPARTORS ON ITS GEOMETRY

To reach the separation high effectiveness one needs to create high intensive hydro dynamical flows movement regimes in the gas separation apparatus. By experimental research of the created physical model of the separation channel with filtering sections inertial filtering gas separator (regimes$2300 \leq Re \leq 100000$) it is proved that in the transition regime the gas flow viscously continuously flows around the lugs and hollows and almost exactly copies geometrical curvilinear separation channel configuration. Maximal speed is a feature of the gas flow core. Laminar layers near the channels walls especially in the hollow places have minimal gas movement speeds. At some of them reverse currents and vortex flows can occur. When the turbulent flow stream is high ($Re \geq 10000$) one can see the local gas flow speeds increase in two times in the lugs of the curvilinear channel walls (at $\theta=70^0$). These are the zones of potential pellicle dispersion of the caught liquid pellicle and secondary spray carrying out **Fig.3**.

After observation and analysis of the gas flow local speeds distribution along the curvilinear separation channel one strictly determined the geometrical zones where it is reasonable to place the filtering elements in the separation channel hollows, closely to the louver walls, local speeds here are minimal, but on the other hand they are limited with the equal speeds lines, $|v|$=const with the speeds which are equal to the gas flow speed on the curvilinear channel inlet and the angle is $\theta=60^0$-110^0 **Fig.4**.

The fibrous filters (drop catchers) work peculiarity is in the coalescence of the caught high dispersion particles (fluid drops) when contacting with the fibers surface and creation the fluid pellicle on them which is removed as it is accumulated from the layer in the form of the squirts or big water drops which move in the layer under their own weight force or they are caught by the gas flow or capillary forces.

While creating the separation channel with filtering sections inertial filtering gas separator model one used as filtering element needle punched fabric made of polypropylene fibers. It is due to that polypropylene fibers apart from their universal chemical resistance also have good hygroscopic properties and so they are very effective for hydrogen particles from the condensation fog catching.

After gas fluid flow gets into the filtering sections fluid drop catching is accompanied with the difficult secondary processes in the filter layer as a result of which its structure changes greatly. Caught with the fiber drops spread about their surface creating a pellicle the thickness of which rises becomes unstable and ruins on the separate drops which flow down along the fibers in the places where they are bent and cross themselves under the gravitation forces and frontal friction in the gas flow. As a result of the capillary forces activity neighboring fibers can cling together and so separate small fibers disappear and make bigger pores. At the same time some little pores are filled with fluid which increases the real gas speed in the bigger pores. In such a way the first liquid accumulation leads to essential change of the fiber layer pattern and structure. Fluid accumulation continues till the filtering layer does not set off the self purification stationary regime. After that as it is stated above the caught liquid quantity in the filtering layer and the quantity of the liquid flowing from it remains constant in time when the filtering speed and particles in the gas flow concentration parameters do not change.

Along with it the following sedimentation particles on the fibers mechanisms are possible. Touching effect (clutching) takes place when the gas flow current lines with which the particles move come over the surface of the barrier (fiber) on the distance equal to the particle radius or closer. Inertial contact takes place when particle mass or its movement speed are so considerable that it cannot move with gas flow completely along its current lines which roughly bend round the barriers. That is why the particles due to the inertial force continue their movement along the more linear trajectories and go off the current lines. High dispersion Brownian motion is a result of the gas molecules contact with the particles surface and is like mass changing based on molecular diffusion. Taking into consideration that inertial filtering separation apparatus are quite effective at catching fluid drops of the sizes $1 \geq 2R \geq 5\mu m$ from the gas fluid flows .,**Lyaposchenko, 2006.** one understands that it is not necessary to speak about the catching drops based on the Brown diffusion which becomes visible for the particles of the sizes $2R \leq 0.1$. In the result of the experimental research one found out that the most permeating (hard to catch) are the particles of the sizes $2R=0.3\text{-}1.0\mu m$, as the diffusion coefficient for them is small and inertial effect does not have the considerable influence yet.

Besides that the basic separation process can be actively accompanied with the following processes when non stationary filtering regimes take place. As the following processes one means the phenomena which cause change of the separation effectiveness and resistance in course of time. The non stationary filtering phase (which is characterized with the filtering environment structure changes) in the conditions of many industrial manufactures exploitation has the significant practical meaning because of short duration of the stationary filtering phase. Because the following processes are complicated and versatile the non stationery filtering phase has been much worse studied.

The caught fluid drops are distributed along the fibers uneven. As the drops accumulate the new ones sediment on the old sediment drops and form the chains which emerge on the sides and when develop they continually turn into the tree-like branching which fill the pores. The phenomenon of mudding makes the filter efficiency much higher. Sometimes thanks to insignificant resistance increasing. Filtering layer structure heterogeneities smooth out due to it and the particles aggregates fill the big pores. Capillary phenomena are very important for the fog filtering and are difficult processes which include: the sediment drops spreading out with the following connection them into big drops or with the liquid pellicle formation on the fibers; liquid accumulation in the places of the fibers crossings; capillary water steam condensation in the places where the caught particles contact with the fiber or with each other; neighboring fibers clinging because of capillary forces influence when soaking the fibers which leads to the small drops disappearing in the filters that are not enough hard and the formation of the bigger intervals to the increasing the heterogeneity of the layers structure.

It is worth noticing that flow speed increasing can lead to the following drops carrying away, which is connected with the taking them from the fibers surface. So fiber filtering element is characterized with two critical speeds: first speed limits the size of the drops caught with fiber and is defined with the Stokes criterion, the second one is the beginning of the secondary drops carrying away thanks to the fluid pellicle firmness loss that flow down the fibers.

5. RESULTS AND DISCUSSION

When modeling of the received mathematical systems for the curvilinear channel sizes with radiuses $R_1=50mm$, $R_2=25mm$ and the initial radial V_{r1} equal to 1 we got the 3-d graphic **Fig.5.**

This graphic dependence shows that when gas flow movement along the curvilinear channel near the walls radial speed component is zero, when rising the angle φ first the speed component value decreases to the minimal one and then after the redistribution and passing the maximal wide section it begin to increase. This phenomenon occurs because of the sufficient inertial force presence which let the drops be caught in the filtering element, which is situated in the louver hollows. The above stated ideas and research results of the fields speeds and pressure motivated us to invent a new mode of the high dispersion drop liquid separation from the gas fluid flow and to create a model of the high effective inertial filtering drop catcher with the low hydraulic resistance ., **Sklabinskiy et al., 2009**. Speed pressure in the windy zone of the separation channel lug is enough to create the pressure drop (motive power) on the both sides of the double louver from the different channels sides for getting through the net louver but not in the thick filtering material layer between the channels. **Fig.6**. Besides in this section of the double louver from the other channel side there is a low pressure zone (pocketing zone) or the vortex zone, it depends on the intensiveness of the hydrodynamic regime entire rushing phase movement along the separation.

6. CONCLUSIONS

1. On the basis of the processes which take place in the IF gas separation channel the main assumptions are made which can be used for the mathematical model creation.
2. One selected and simplified the main mathematical dependences taking into consideration the taken assumptions and limit conditions Mathematical modeling is made in the program complex Maple and one received the 3-d graphic which shows the pole speed in the channel.
3. There are worked out the theoretical basis of the separation process in the IF separator and the main recommendations as to the fog separation using the new method.

REFERENCES

Al Rammahi Mustafa, Logvin A.V., 2011. *Lyaposchenko O.O./Physical Model Gas liquid Flows Movement in the Separation Channels and Filtering Sections of the Inertial Filtering Gas Separators* , Oil and Gas Energetic.. - №2(15), P.5-11.

Barilovych V.A., 2009. *The Main Principles of the Thermal Gas Dynamics in Two Phase Flows and Their Numeral Values: Study Guide* -SPb.: Polytechnical University Printing, 425 p.

Lyaposchenko O.O. 2005.*Increasing Effectiveness Separation Apparatus for the Gas and Oil Industry Compression Units*, Lyaposchenko O.O., Sklabinskiy V.I., Sumy State University Visnuk. Series “Technical Studies”, №1(73), P.58-68.

Lyaposchenko O.O. 2006. *Hydrodynamics of the Inertial Filtering Separation Apparatus for the Natural Gas Depuration:dissertation.* Associate of Technical Science : 05.17.08 : reported 18.05.06 : approved. 04.07.06 , Lyaposchenko Oleksandr Oleksandrovych, Sumy, 152 p. Bibliography.: p. 137–149.

Poole C.F., 2000 and *Cooke M., Wilson I.D. Encyclopaedia of Separation Science*. Academic Press, UK, 4927 p.

Sinayskiy E.G., 2002. *Lapiga E., Zayzev U.V, Multi Phase and Multi Components Systems Separation.* M.: Nedra-Business center, 621 p.: pic.

Sklabinskiy V.I., , 2009 L*yaposchenko O.O.,Logvin A.V., Mischenko O.S.,* Patent of Invention №*88558* C2 Ukraine, МПК B01D45/04. *The Method for High Dispersion Liquid Catching from the Gas Fluid Flow and The Apparatus For I*t. /№200802372; declared 25.02.2008; published 26.10.2009, bulletin №20. Stepanov G., Zitser I.M. 1986. *Inertial Air Cleaners*. – M.: Mashino stroyeniye,184 p .

Table.1. List of symbols

Symbol	Description	Unit
R_1, R_2	Raduius corrugations of the separation channel	m
ε	The coefficient of turbulent viscosity	m^2/sec
V_r, V_φ, V_z	The components of the gas velocity (the radial, tangential, axial)	m/sec
V_{r1}	The initial radial velocity of the gas	m/sec
C_1, C_2, C_3	The constants of integration	-
P	Pressure	Pa
θ	Angle of corrugation	rad
ρ	Density of gas	kg/m^3

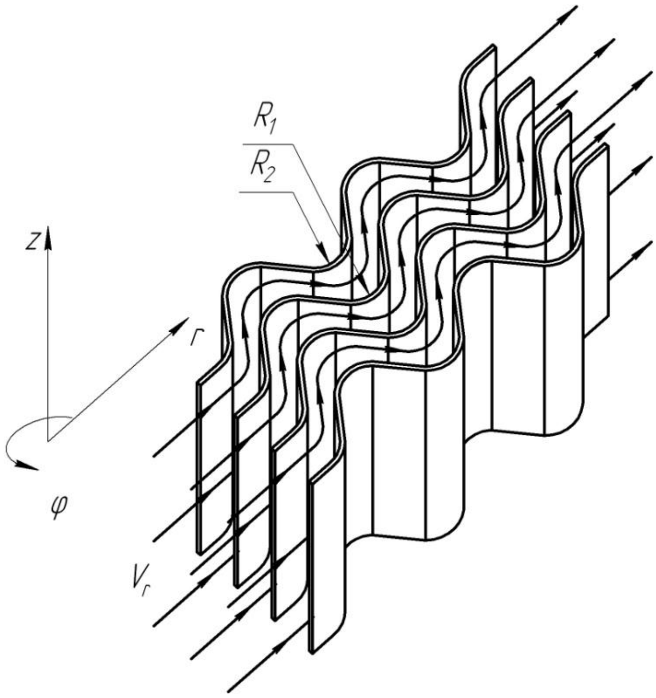

Figure. 1. The calculating scheme of the purifying gas movement through the IF separator louver board.

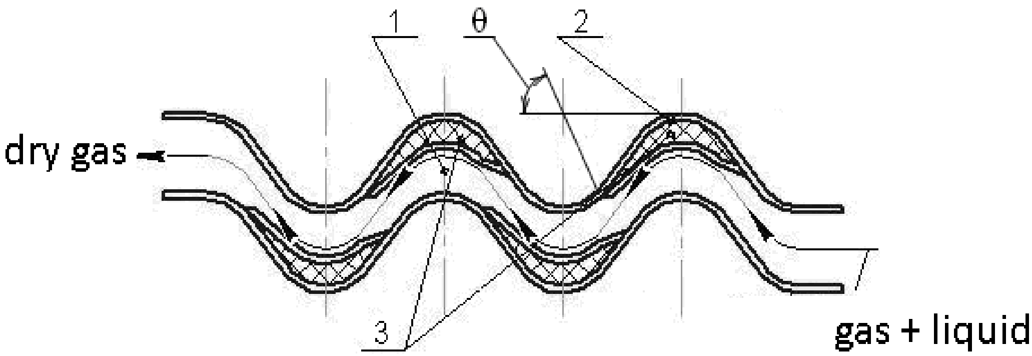

Figure.2. Calculating scheme of the gas liquid drop flow movement along the separation channel with filtering sections IF separation apparatus: 1. - separation channel; 2- double louver crimping plates; 3- filtering sections.

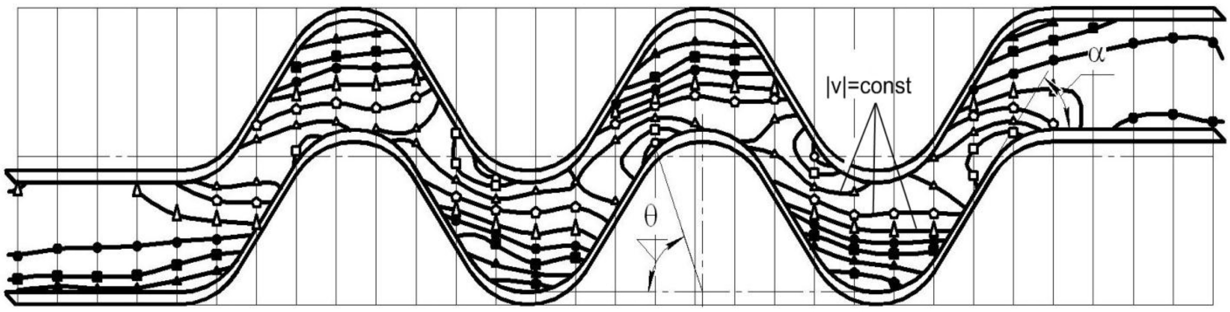

Figure.3. Local speeds distribution.
v, m/s, gas flow movement along the inertial separation channel section of the inertial filtering gas separator physical model
(Re=50000): ○ – v=7,0 m/s м/c; □ – v=6,00 m/s; Δ – v=4,0m/s; ■– v=2,0 m/s; ▲– v=1,5 m/s; ● – v=1,0 m/s.

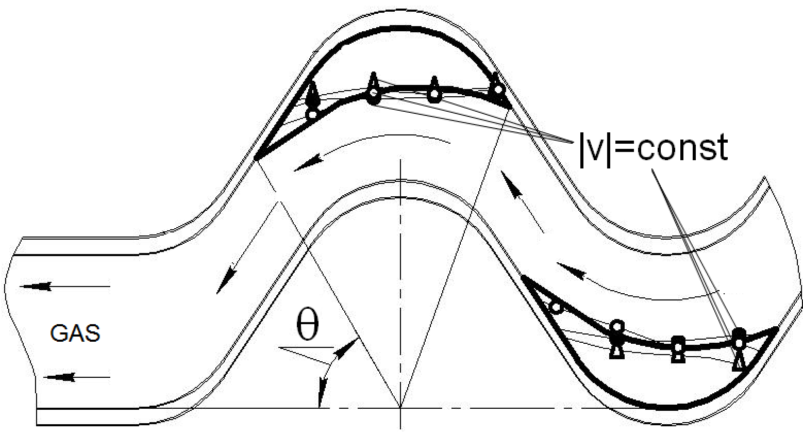

Figure.4. Geometrical zones of the filtering sections in the separation channel of the louver inertial filtering gas separator disposition. (Re≥10000).

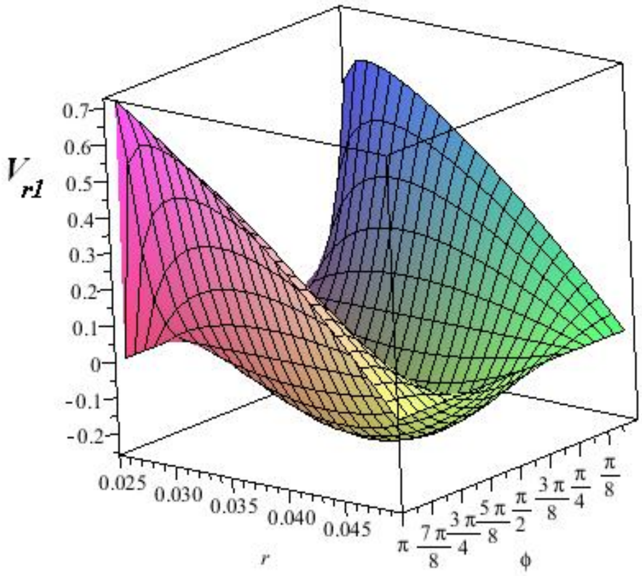

Figure.5. The example of the graphic results for calculation the changes of the radial component for the gas flow speed along curvilinear channel with sizes R_1=50mm, R_2 =25mm and the radial component of the gas flow speed atφ_0=0 equal toV_{r1}=1 m/sec.

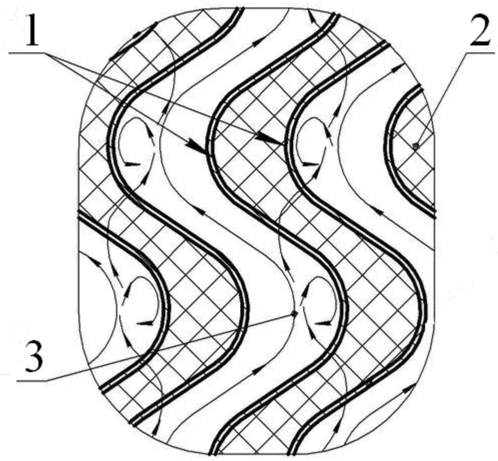

Figure 6. the gas fluid movement along the separation board of the IF drop catcher scheme:
1 – double louver crimped plate made of net, 2 – filtering element, 3 – gas fluid flow.