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(54) METHOD FOR PRODUCING A TWO-PHASE GAS-DROPLET JET AND A DEVICE FOR CARRYING OUT SAID METHOD

(57) The proposed invention relates to technique for obtaining of highly concentrated jets, featuring long range and finely dispersed structure of drops. Such jets may be used in fire extinguishing equipment, in agriculture for watering and in other fields where finely dispersed and long-range gas-drop jets are required.

The aims of the proposed group of inventions are as follows: extending the jet range due to more rational use of energy of fluid and its utmost transformation in kinetic energy of ordered motion due to design features of the device.

The technical result in the proposed invention is reached by creating a method for shaping a gas-drop jet where, according to the present invention, the biphasic gas-drop stream after mixing is divided in, at least, two streams and which are accelerated separately in one direction until the reach identical values of the output speed and the pressure at the nozzle outlet.

The technical result in the proposed invention is also reached by creating a device for creating a gas-drop jet where according to the present invention, the nozzle is made as at least, double-ring, coaxial device, and each ring forms a profiled channel designed for creating identical values of the output speed and the pressure at the nozzle outlet, and wherein the channels are unidirectional.

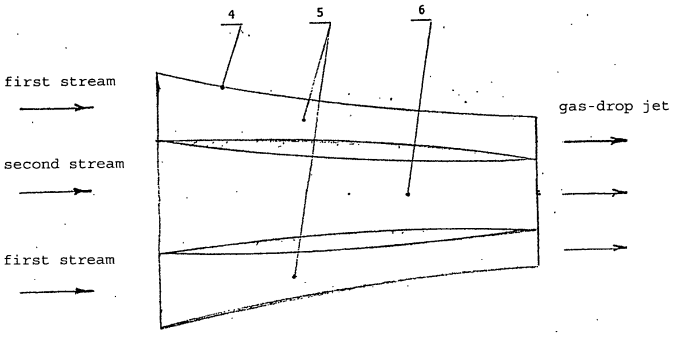

Fig.1

A method for shaping a biphasic gas-drop jet and a device for its implementation

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Description

[0001] A method for shaping a biphasic gas-drop jet and a device for its implementation.

[0002] The proposed group of inventions relates to technique for obtaining highly concentrated jets, featuring a long range and finely dispersed structure of drops. Such jets may be used in fire extinguishing equipment, in agriculture for watering and in other fields where finely dispersed and long-range gas-drop jets are required.

[0003] There are known methods for creating fluid jets, one of them provides the long range of jet due to increase of pressure in the fluid supply system, while the others - due to supplying the gas stream to the installation nozzle.

[0004] There is a known method for creating a gas-drop jet which consists in using the ejecting effect of the gas jet supplied to the gas-jet nozzle orifice of the nozzle, for dispersing the liquid and increasing the jet range (certificate of authorship N° 380279, Cl. A01G 25/00,1973).

[0005] There is a known installation for creating a gas-drop jet, including a fluid supply system a gas-dynamic nozzle with central gas-jet orifice (certificate of authorship № 380279, Cl. A01G 25/00, 1973).

[0006] The method most close from the point of view of technical essence to the offered engineering solution is the method for creating a gas-drop jet, including supply of liquid and gas stream, dispersion of liquid, mixing the dispersed liquid with the gas stream and acceleration of the obtained biphasic gas-drop stream (RF Patent N° 2243036, Cl. B05B 7/10, 2002).

[0007] The known method has the following drawbacks:

limited nature of used ways for shaping the biphasic stream;

lowering the efficiency of a gas-drop jet, in particular, because of losses of kinetic energy of liquid in the axial direction due to significant radial components of speed when shaping the jet of gas-drop structure.

[0008] The closest engineering solution to the proposed one is the device for realization of a method of creation of the gas-drop jet, including a chamber for shaping a biphasic gas-drop stream with inlets for supplying liquid and gas and a gas-dynamic nozzle connected to it (RF Patent N° 2243036, Cl. B05B 7/10, 2002) .

[0009] The known design has a drawback of decrease in gas-drop jet range because of a dilative shape of the nozzle channel in its outlet portion since the emanating jet has radial components that improves mixing the jet with the environment and its promotes its faster braking.

[0010] The aims of the proposed group of inventions are as follows: extending the jet range due to more rational use of the energy of the liquid and its utmost transformation in kinetic energy of ordered motion due to design features of the device.

[0011] The technical result in the proposed invention is reached by creating a method for shaping a gas-drop jet including delivery of liquid and gas stream, dispersion of liquid, mixing the dispersed liquid with the gas stream and acceleration of the resulting biphasic gas-drop stream where, according to the invention, a biphasic gas-drop stream after mixing is divided, at least, to two streams and is accelerated separately in one direction till obtaining identical values of output speed and pressure at the nozzle outlet.

[0012] This allows to lower the radial components of the stream at the nozzle outlet due to reduction of geometrical influence on the stream: several channels instead of one, and to extend the reach of the created gas-drop jet. In this case, the nozzle becomes a multi-ring device.

[0013] The technical result in the proposed invention is reached by creating a device for the creating a gas-drop jet including a chamber for shaping a biphasic gas-drop stream with inlets for supplying liquid and gas and a gas-dynamic nozzle connected to it where, according to the invention, the nozzle is made as at least, double-ring, coaxial device, and each ring has a profiled channel designed for creating identical values of output speed and pressure at the nozzle outlet, and the channels are unidirectional.

[0014] The presence of two (or more) coaxial channels allows to extend the reach of the obtained gas-drop jet. All the above allows to draw a conclusion: the proposed inventions raise the efficiency of a gas-drop jet.

[0015] The patent research has shown that there are no known engineering solutions with the specified set of essential features, in similar methods for creating a gas-drop jet and devices for their implementation, i.e. the group of proposed solutions corresponds to the novelty criterion.

[0016] After analyzing the known analogues and the prototype there we no revealed proposals with the set of essential features stated in the claims of the invention that means that for the experts engaged in methods for creating a gas-drop jet and devices for their implementation, they obviously do not follow from the state of the art and, hence, meet the criterion of the "level of invention".

[0017] The authors believe that the information stated in the materials of the application is enough for practical implementation of the group of inventions.

[0018] The proposed group of inventions is explained using the following description and the figures, where:

[0019] In Fig. 1 the installation diagram of the device for implementing the method for creating gas-drop jet with coaxial, e.g., a double-ring nozzle is shown.

[0020] In Fig. 2 the sectional view of a gas-dynamic double-ring nozzle is shown. The device for creating a gas-drop jet includes the chamber 1 for shaping a biphasic gas-drop stream with inlets for supplying liquid 2 and gas 3, a multi-ring coaxial gas-dynamic nozzle 4 connected to the said device.

[0021] The multi-ring coaxial gas dynamic nozzle 4,

consists of two (or more) unidirectional channels: the external channel 5 and 6 of the internal channel 6 and is designed for accelerating the gas-drop stream having a disperse structure and obtaining a gas-drop jet.

[0022] The multi-ring coaxial gas-dynamic nozzle 4 may be double-ring or multi-ring for compacting the jet.

[0023] The inlets for supplying liquid 2 and gas 3 are connected to devices for supplying liquid 7 and gas 8.

[0024] The proposed method for creating a gas-drop jet is implemented as follows:

[0025] The working media: gas (e.g. air) and water are supplied to the chamber for shaping the biphasic gas-drop stream 1 where the liquid is dispersed and a biphasic stream of the gas-drop structure is created.

[0026] The biphasic gas-drop stream shaped in the chamber for shaping the biphasic gas-drop stream is divided, for example, to two (or more) streams, each of those streams is supplied to the corresponding channel of the nozzle 4 where they are accelerated in one direction for getting identical speed and pressure at the nozzle outlet.

[0027] The first stream is supplied to the external ring 5, the second stream is supplied to the internal ring or circle 6. At the outlet of the double-ring nozzle 4 the gas-drop jet having minimal radial components is shaped. This allows to reduce the radial expansion of the jet, or to compact it. In both cases, the jet range extends.

[0028] A turboblower station may be used as a gas source.

[0029] The turboblower station may be equipped with a pump for maintaining the required parameters of the liquid.

[0030] The proposed device may be mobile if necessary.

[0031] For this purpose it is supplied with a vehicle, for example, a car, a helicopter, an aircraft, water transport. (not shown in the figure).

[0032] The parameters of the device for implementing the proposed method, such as pressure P_{CH} in the chamber for shaping the biphasic gas-drop stream 1, throughput weight of liquid G_L and gas G_G; initial pressure of fluid P_L and distribution of throughput between the streams are to be chosen according to the condition of obtaining the set extent of jet reach.

[0033] The estimation of implementation of the proposed method for obtaining a gas-drop stream, e.g., in a double-ring nozzle allows to extend the jet range by 10-30% other conditions being equal.

[0034] The proposed device is set to a starting position. The multi-ring coaxial gas-dynamic nozzle 4 with the stream of gas-drop structure is directed towards the target object where the gas-drop jet is to be supplied.

[0035] Researches have been made with the following parameters:

P_{CH}= 5x 10^5 Pa - the pressure in the mixing chamber;
G_L= 140 kilogram-force - mass flow of fluid;
G_G=3.5 kilogram-force - mass flow of gas;
P_L=10 x 10^5 Pa - liquid pressure.

[0036] The flow of biphasic stream was distributed between the rings or circles as one to five relationship (internal circle to the external ring).

[0037] The jet range as compared to that of the single-circle nozzle design extends under the given conditions by 15%.

[0038] The obtained results of distribution of a gas-drop jet testify that the parameters chosen according to the above-stated conditions and obtaining the jet according to the proposed method, allow to raise the efficiency of the obtained biphasic gas-drop jet due to fuller use of fluid energy.

[0039] In particular, the jet range extended by 15% as compared to the prototype under equal boundary conditions.

[0040] The test results confirm the possibility of implementation of the proposed method for creating a gas-drop jet and the device for its implementation, and the possibility of achievement of the technical result consisting in raising the efficiency of the gas-drop jet.

[0041] Use of the group of inventions in fire fighting equipment is the most effective for suppressing fires in the sites where the use of minimum quantity of fluid with maximum efficiency (for minimizing the damage from the process of extinguishing), in climate systems for agriculture, medicine, environment protection, etc.

Claims

1. A method for creating a the gas-drop jet, including supplying a liquid and a gas stream, dispersing the liquid, mixing the dispersed liquid with the gas stream and accelerating of the obtained biphasic gas-drop stream in a nozzle, wherein after mixing the gas-drop stream it is divided in at least two streams being accelerated separately in one direction until they reach identical values of the output speed and the pressure at the nozzle outlet.

2. A device for creating a the gas-drop jet, including a chamber (1) for forming a biphasic gas-drop stream with inlets for supplying a liquid (2) and a gas (3) and a gas-dynamic nozzle (4) connected to it, wherein the nozzle (4) is made as an, at least, double-ring, coaxial, device and each ring is made with a profiled channel (5,6), designed for creating identical values of the output speed and the pressure at the nozzle outlet, and wherein the channels are unidirectional.

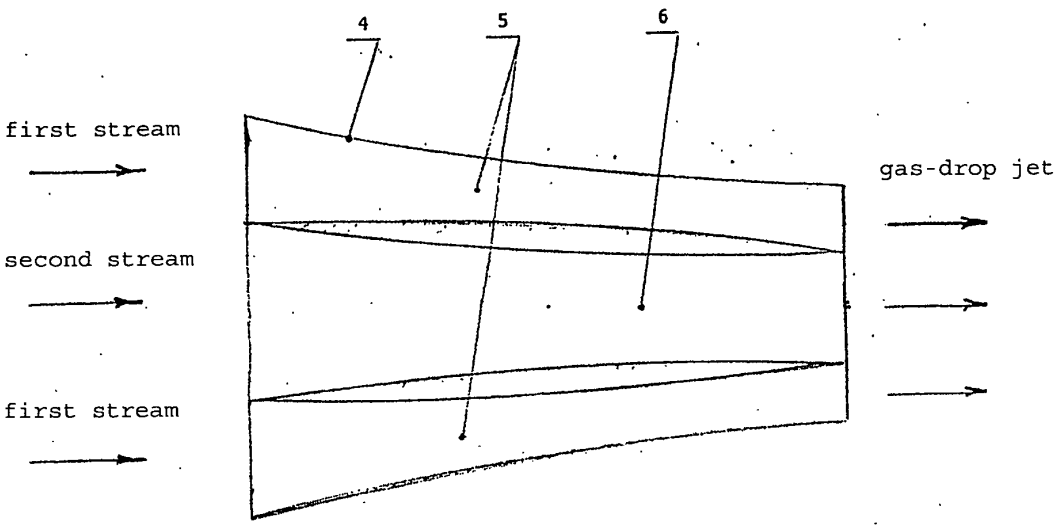

Fig.1

A method for shaping a biphasic gas-drop jet and a device for its implementation

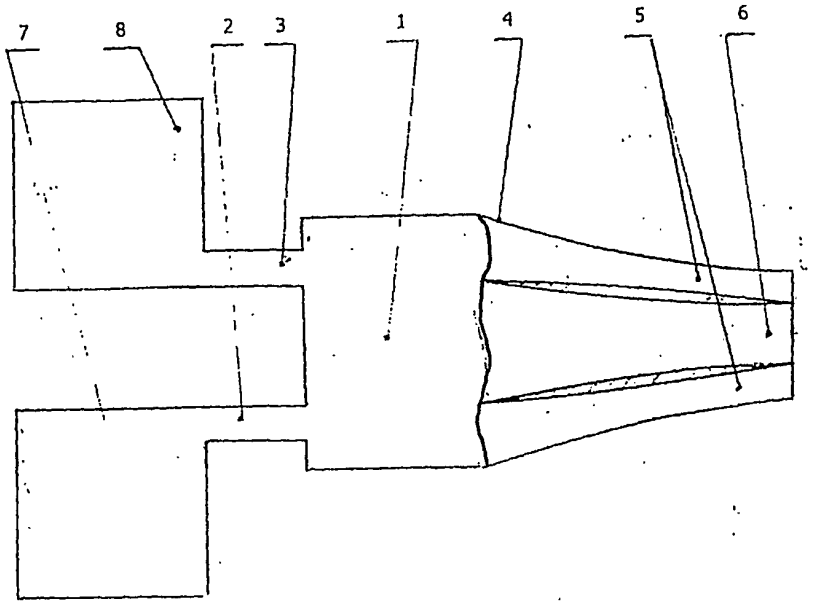

Fig.2

A method for shaping a biphasic gas-drop jet and a device for its implementation

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU2006/000258

A. CLASSIFICATION OF SUBJECT MATTER

B05B 7/00 *(2006.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B05B 7/00-7/32, A62C 31/00-31/07, A01G 25/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PAJ, USPTO DB, Esp@cenet, Depatisnet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2243036 C1 (ZAKRYTOE AKTSIONERNOE OBSCHESTVO "SILEN") 27.12.2004	1-2
A	RU 2107554 C1 (NAUCHNO-ISSLEDOVATELSKY INSTITUT NIZKIKH TEMPERATUR PRI MOSKOVSKOM GOSUDARSTVENNOM AVIATSIONNOM INSTITUTE (TEKHNICHESKY UNIVERSITET) 27.03.1998	1-2
A	RU 21221390 C1 (NAUCHNO-ISSLEDOVATELSKY INSTITUT NIZKIKH TEMPERATUR PRI MAI (MOSKOVSKOM GOSUDARSTVENNOM AVIATSIONNOM INSTITUTE - TEKHNICHESKY UNIVERSITET)) 10.11.1998	1-2
A	WO 2004/096446 A1 (ZAKRYTOE AKTSIONERNOE OBSCHESTVO "SILEN") 11.11.2004	1-2
A	DD 233490 A1 (TECHNISCHE HOCHSCHULE MAGDEBURG "OTTO V. GUERICKE") 05.03.1986	1-2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 October 2006 (10.10.2006)	26 October 2006 (26.10.2006)
Name and mailing address of the ISA/	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2243036 A **[0006] [0008]**