Convertible fuels for smart home infrastructure. Part 1

Options for conversion of fuel mixtures and emulsions with a high level of dynamic homogenization in real time are considered.
Device for dynamic mixing and homogenization of liquid fuel and fuel blends, as well as for formation of gasified (compressible) fuel blends.
The industrial unit for homogenization of liquid fuels ranging from diesel fuel No.6 (black oil) to diesel fuel No.2 as well as for micro-minimization and optimization of dispersity at the injection of bio-fuels, methanol, ethanol and kerosene, obtained from the processing of plastics, automotive and other tires, the output, despite the small size, is 1000 liters per hour.

Aleksandr Gorbov is a specialist in technological equipment with digital software control including elements of artificial intelligence, a member of the Estonian Electronic Industry Association, a member of the New York Academy of Sciences, is an active inventor, author and owner of two integrative patents.

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Converted innovative fuels and fuel blends

Aleksandr Gorbov

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Convertible fuels for smart home infrastructure.

Conversion options for fuel blends and emulsions with a high level of dynamic homogenisation in real time are considered.

The book is in 4 parts.

Part 1, - Converted innovative fuels and fuel blends.

Annotation.

A device for the dynamic mixing and homogenisation of liquid fuels and fuel mixtures and for the formation of gasified (compressible) fuel mixtures.

The industrial plant for homogenisation of liquid fuels ranging from diesel fuel No 6 (black oil) to diesel fuel No 2, as well as for micro-minimisation and optimisation of dispersity at the injection of bio-fuels, methanol, ethanol and paraffin from waste plastics, car and other tyres; despite its small size, the plant has the capacity of 1000 litres per hour.

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Introduction

Any type of liquid hydrocarbon fuel and especially liquid hydrocarbon-based fuel compositions lose their homogeneity during storage, resulting in the formation of lumps, mainly on the bottom of the tanks in which the fuel or fuel mixture is stored.

Even more problematic is the homogeneity of all kinds of synthetic liquid fuels, especially those derived from recycling either old plastics or old car tyres.

This fuel contains many additional and unusual for standard fuel contaminants, such as - formaldehyde, which further increases the need for homogenisation, at least before injection into the combustion chamber or during the combustion process.

This heterogeneity can be eliminated most conveniently and effectively by applying a homogenization process with an innovative dynamic homogenization device that performs the homogenization process directly in the pipeline through which the fuel or fuel mixture flows.

IN-LINE, ON-BOARD, DYNAMIC HOMOGENISATION, MIXING, BLENDING AND EMULSIFICATION TECHNOLOGY.

A device for dynamic mixing and homogenisation of liquid fuels and fuel mixtures and for the formation of gasified (compressible) fuel mixtures . The pictures show a device with a working diameter of 40 mm and a capacity of 1000 litres per hour.

The industrial plant for homogenisation of liquid fuels ranging from diesel fuel No 6 (black oil) to diesel fuel No 2, as well as for micro-minimisation and optimisation of dispersity at the injection of bio-fuels, methanol, ethanol and paraffin from waste plastics, car and other tyres; despite its small size, the plant has the capacity of 1000 litres per hour.

The need for a homogenisation process.

Any type of liquid hydrocarbon fuel and especially liquid hydrocarbon-based fuel compositions lose their homogeneity during storage, resulting in the formation of lumps, mainly on the bottom of the tanks in which the fuel or fuel mixture is stored.

Even more problematic is homogeneity for all kinds of synthetic liquid fuels, especially those derived from recycling either old plastics or old car tyres.

This fuel contains many additional and unusual for standard fuel contaminants, such as - formaldehyde, which further increases the need for homogenisation, at least before injection into the combustion chamber or during the combustion process.

To eliminate this heterogeneity the most convenient and effective way is to apply a homogenization process with an innovative device for dynamic homogenization, which carries out a homogenization process directly in the pipeline through which the fuel or fuel mixture flows.

The process of dynamic homogenisation.

Firstly, a short introduction to the proposed technology, the features and the novelty of this technology:

The device for dynamic homogenisation of liquid fuels and fuel mixtures shall consist of an accelerating hydrodynamic section, transition and coaxial second hydrodynamic section with integrated vortex generator, transition to a hydrodynamic turbulence level booster connected to the high pressure pump inlet of the internal combustion engine.

All homogenized liquid fuel or fuel mixture in the device for dynamic homogenization of liquid fuels and fuel mixtures is divided into two flows, the first (60% of the total flow) at a pressure of (at least) 3 bar (45 psi) goes into the acceleration hydrodynamic section (acceleration is carried out under the influence of the device systems, initiating coaxial effects -Bernoulli), the second (40% of the total flow) at a pressure of (also at least) 3 bar (45 psi) enters the coaxial first, second hydrodynamic section:

In the device there is a dynamic process of sequential homogenization of the liquid fuel or fuel mixture flow, at the first stage - homogenization by the level of turbulence in the pipeline (such process does not exist in any other known homogenization devices and technologies, it is one of the main elements of technology novelty, confirmed in the basic intellectual property documents of the company - developer and technology owner);

The homogenised flow of liquid fuel or fuel mixture is then transformed into a hydrodynamic vortex tube (due to an integrated vortex generator) and sent to a high pressure pump or a diesel engine or any other internal combustion engine (pressure between 2000 and 3000 bar, or 2900043500 psi) where the second stage of dynamic homogenisation takes place, reducing the particle size of the homogenised flow to under one micron, in other words, it turns into a key flow parameter

The system works similarly in the fuel lines of boilers, boilers, turbines and other thermodynamic devices and thermodynamic equipment.

The homogenisation process takes place in less than 1 second and does not disturb any natural relationships in the homogenised liquid fuel or fuel mixture.

The homogenisation process takes place at a stable temperature or, in certain ratios, when the temperature of the combustible liquid or fuel mixture drops.

The entire dynamic homogenisation process takes place by creating special turbulent hydrodynamic conditions in the flow of liquid fuel or fuel mixture, without destroying the chemical and physical equilibrium between all its components.

Positive differences between the dynamic homogenisation process and the existing one:

- The existing technology does not have a dynamic homogenisation step in terms of turbulence level and means that the existing technology does not allow for a homogenisation process in the combustion engine fuel supply line:

- the second stage of the homogenisation process takes place at a pressure at least twice as high as that required for homogenisation at the nano-particle level:

- The size of particles (globules) in homogenised liquid fuel or fuel mixture using the proposed technology is homogeneous all within the range of 70-120 nanometres and has no tendency to stick together. The existing technology has a size scatter from the smallest to the largest - more than 10 times, from 0.2 to 2 microns;

- All dynamic homogenisation processes can be carried out in the fuel line of an internal combustion engine, for example from the fuel pump to the high-pressure pump, and do not require special modifications to the engine design (the same can be said for all other types of thermodynamic equipment):

- the temperature of the homogenised liquid fuel or fuel mixture does not rise during dynamic homogenisation:

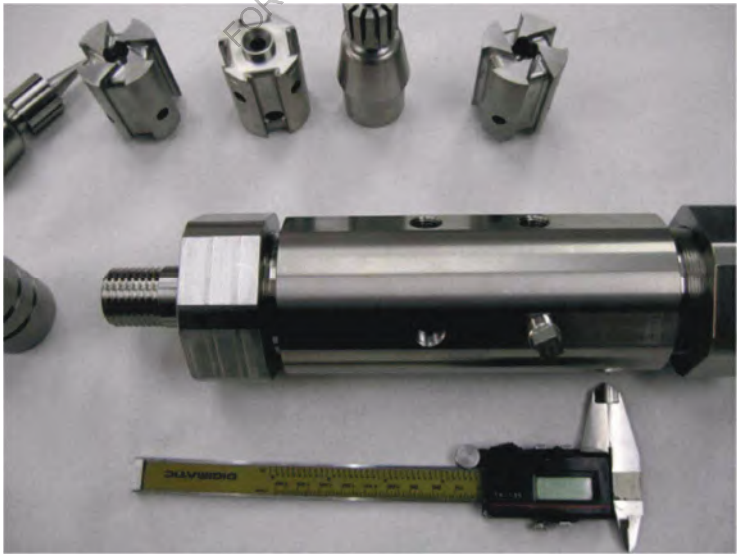
- In a dynamic homogenisation device, it is possible to homogenise a homogenised liquid fuel or fuel mixture with additional components (e.g. water or methanol or ethanol or synthetic paraffin) at the same time;

- The dynamic homogenisation unit has the smallest possible footprint and is easier to operate than known devices, with optimum installation and maintenance conditions:

- A device for the dynamic homogenisation of liquid fuels and fuel mixtures is much cheaper than existing equipment for the same purpose:

- The device for dynamic homogenisation of liquid fuels and fuel mixtures can be used for process homogenisation before the fuel or fuel mixture stream is introduced into the process equipment for the production of other hydrocarbon products;

As you can see from the pictures, the size of the unit is very small in relation to its capacity (the pictures show units with a capacity of 1,000 litres per hour).



The original device for dynamic homogenisation.

A device for the dynamic homogenisation of liquid fuels and fuel mixtures has been developed, manufactured and repeatedly tested.

All elements and parts of the unit are manufactured on standard numerically controlled machines without the use of special techniques or special cutting tools.

Stainless steel is used as a construction material, making it possible to install the unit and its systems in more corrosive areas, such as on ships:

The unit is extremely compact, with dimensions that enable it to be integrated into virtually any internal combustion engine, whether stationary (e.g. marine engines) or fitted to vehicles (e.g. cars of all types).

The unit does not require any additional elements or components for operation and can practically be installed on the combustion engine fuel line, after the fuel pump and before the engine high-pressure pump.

All input and output connections are standardised. No special preparation, tools or equipment are required to install the unit on an internal combustion engine.

The unit has no moving parts and can be manufactured in any required dimensional scale factor:

The device can be manufactured on digitally controlled serial production equipment, no special technology, materials and tools are required for the manufacture and assembly and quality control of the device.

The thermodynamic effect of using homogenised fuel (obtained with a dynamic homogenisation device).

After homogenisation, the fuel burns homogeneously and no local zones with larger dispersion fractions form in the fuel volume after injection.

This speeds up the combustion process by 35-40% and increases the effective heat extraction in the same proportion (results confirmed by over 300 test runs on a modern production diesel engine with a displacement of 2.5 litres).

The homogenisation technology works equally effectively on engines with standard equipment and on engines with exhaust gas recirculation systems.

In the event of unauthorised water entry into the fuel tank, dynamic homogenisation a few milliseconds before fuel enters the high pressure pump, ensures dynamic micro-emulsion formation and completely eliminates any harmful effects from water contained in the fuel emulsion on the engine and its operation; (results confirmed by over 60 test runs on a modern 2.5 litre production diesel engine).

Micro-emulsion, while maintaining the efficiency of the engine, significantly reduces the soot concentration in the exhaust gases (97% reduction) and the nitrogen oxide concentration (up to 35% reduction), shortens the complete combustion cycle and accelerates heat recovery (results confirmed by over 300 complete reversing cycles on a modern 2.5 litre production diesel engine).

The use of a homogenisation system in addition allows to obtain at 35-45 % less pressure the same atomisation dispersion which is obtained at 1600 - 2000 bar.

This phenomenon reduces the power required to run the high-pressure pump: As an example, the same phenomenon can be cited as a potential additional savings for turbines and turbo-generators with an injection pressure of 30 bar or more.

The environmental effect of using homogenised fuel

The use of a device for dynamic homogenisation of liquid fuels in the fuel system of internal combustion engines can significantly reduce the toxicity of exhaust gases and may enable compliance with environmental standards on older vehicles, including those that have been in use for a long time.

The process of consistent dynamic homogenisation in a modern diesel engine.

A device for dynamic homogenisation of the fuel and fuel mixture in a modern diesel engine is installed on the fuel line after the fuel pump and before the high-pressure pump.

The fuel flow after the fuel pump is divided into two streams, one of which has a flow rate equal to 60% of the total fuel flow and goes to the central axial inlet in the unit of dynamic fuel homogenisation, while the second stream, equal to 40% of the total fuel flow, goes to the integral inlet of the unit, consisting of four radial channels.

After homogenisation, the fuel burns homogeneously and no local zones with larger dispersion fractions form in the fuel volume after injection

This makes combustion 35-40% quicker and the effective heat extraction is accelerated to the same extent (results confirmed by more than 60 test runs on a modern production diesel engine with a displacement of 2.5 litres).

The homogenisation technology works equally effectively on engines with standard equipment and on engines with exhaust gas recirculation systems.

The process of consistent dynamic homogenisation in a modern petrol engine.

A device for dynamic homogenisation of the fuel and fuel mixture in a modern petrol engine is installed on the fuel line after the fuel pump and before the high-pressure pump.

The fuel flow after the fuel pump is divided into two streams, one of which has a flow rate equal to 60% of the total fuel flow and goes to the central axial inlet in the unit of dynamic fuel homogenisation, while the second stream, equal to 40% of the total fuel flow, goes to the integral inlet of the unit, consisting of four radial channels.

The homogenisation technology works equally effectively on engines with standard equipment and on engines with exhaust gas recirculation systems.

Application of the dynamic homogenisation process in internal combustion engines using a mixture of ethanol and petrol as fuel.

Ethanol, even of high quality, contains some water;

Prior to mixing (for example) with petrol, ethanol is quite stable and there is no separation of water and alcohol:

A mixture of ethanol and petrol is not completely stable and under certain circumstances (e.g. at low temperatures) water separates from the petrol/ethanol mixture.

If a dynamic homogenisation device is introduced into the engine system, water, under certain circumstances, separated from the main hydrocarbon fraction of the fuel mixture in the engine fuel tank, is dynamically mixed with the hydrocarbon fractions in the device, turning the resulting mixture into a micro or nano emulsion.

Emulsion combustion is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of the dynamic homogenisation process in internal combustion engines using a mixture of methanol and petrol as fuel.

Methanol, even of ordinary quality, contains virtually no water;

Before mixing (for example) with petrol, methanol is quite stable and once mixed with petrol it is virtually indistinguishable from petrol.

A mixture of methanol and petrol is not completely stable and is prone to formation of clots under certain circumstances (e.g. at low temperatures).

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of dynamic homogenisation process in internal combustion engines using a mixture of petrol and biofuel compositions as fuel (which is the most important and topical at present).

Since these thermodynamic systems use a mixture containing heavier bio-fuels and various types of viscous combustible bio-materials as fuels, the formation of clots is more intense in these types of composite fuels.

If a device for dynamic homogenisation is introduced into the thermodynamic system, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the rest of the hydrocarbon fractions, transforming the clotted mixture into a homogeneous system of micro or nano particles.

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of the dynamic homogenisation process in the feeding of fuel to burners of boilers, turbines and other thermodynamic devices.

Since these thermodynamic systems use heavier diesel fuels and different types of fuel oils as fuels, the formation of clots from the heavier, highly viscous fractions is more intense in these fuels.

If a device for dynamic homogenisation is introduced into the fuel supply and injection system of the combustion chamber, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the remaining hydrocarbon fractions with transformation of clotted mixture into micro or nano particles.

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

In individual cases and under certain conditions there are significant fuel savings.

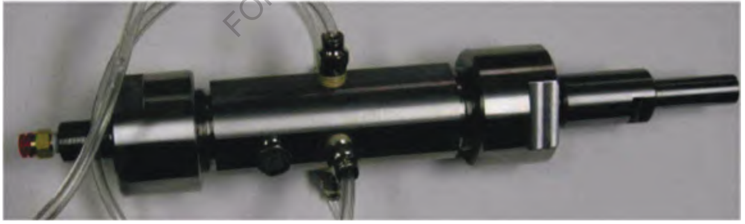
Potential for applications of the dynamic homogenisation process in marine engines and diesel generators.
Since these thermodynamic systems use heavier diesel fuels and different types of fuel oils as fuels, the formation of clots is more intense in these fuels.

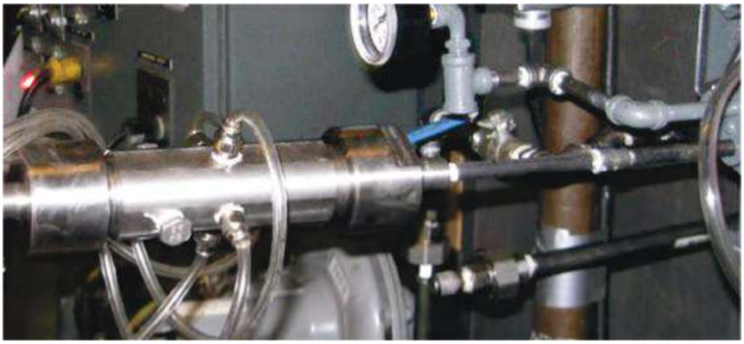
If a dynamic homogenisation device is introduced into the system of a marine engine or diesel generator, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the remaining hydrocarbon fractions, transforming the clotted mixture into micro or nano particles.

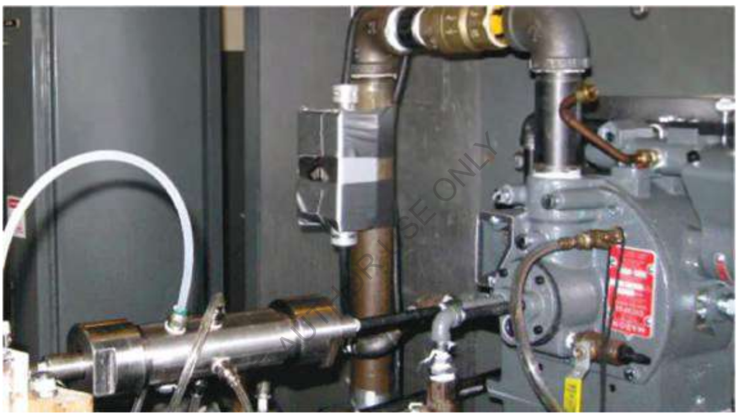
The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Potential for application of the dynamic homogenisation process in aircraft propulsion systems.

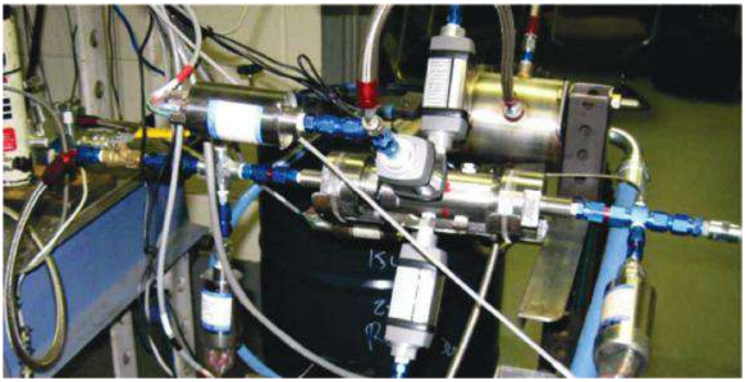
In view of recent reports on the experimental application of bio-fuels or fuel mixtures for aircraft engines, and knowing that fuel mixtures containing bio-fuel components tend to clump, the dynamic homogenisation of such fuel prior to injection into the combustion chamber could significantly improve the reliability of such engines and could pave the way for the use of fuel compositions in aircraft engines.







The use of a device with an operating diameter of 25 mm, designed to form an emulsion of diesel 2 and tap water in a ratio of 70% diesel to 30% water in a modern boiler.



Application of a device with a working diameter of 25 mm and a capacity of 250 litres per hour in the preparation of a gasified fuel composite (from No. 2 diesel and compressed air).

Application of a device with a working diameter of 25 mm and a capacity of 250 litres per hour in the preparation of a gasified fuel composite (from No. 2 diesel and compressed air).

The basic advantages of on-line technology for the homogenisation of liquids and the preparation of mixtures or emulsions as they flow through the pipeline.

Design advantages of a device for dynamic homogenisation and dynamic formation of a mixture or emulsion in the flow of its components.

The device for dynamic online homogenisation and dynamic formation of a mixture or emulsion in the flow of its components has minimum overall dimensions and a simple geometric shape in the form of a regular cylinder (for example, the device with a capacity of 50 gallons of emulsion per hour has a diameter of only 37 millimetres and an overall length of only 150 millimetres).

The unit can be built in any scale factor.

The device has a micro version (diameter 14 millimetres, length 60 millimetres).

The unit can have at least eight different versions with the same overall dimensions by changing the design and dimensions of its components (e.g. the presence or absence of a vortex generator).

Operational and installation advantages of the unit.

Only standard design elements are used when connecting or adapting the unit to the equipment being upgraded.

When connecting or adapting, practically nothing needs to be changed in the equipment being upgraded.

The device for homogenisation or dynamic formation of a mixture or emulsion in the flow of its components, depending on local conditions, requirements or limitations, can be made of any structural materials, including composites, any kind of ceramics or metal-ceramics.

A device for homogenisation or dynamic formation of a mixture or emulsion in the flow of its components can be introduced into automated production lines and easily integrated into their control and monitoring systems.

The device for the homogenisation or dynamic formation of a mixture or emulsion in a stream of its components may include built-in heating, magnetic treatment or resonance impedance control of the parameters of the mixtures or emulsions formed, as well as the degree and level of their homogeneity.

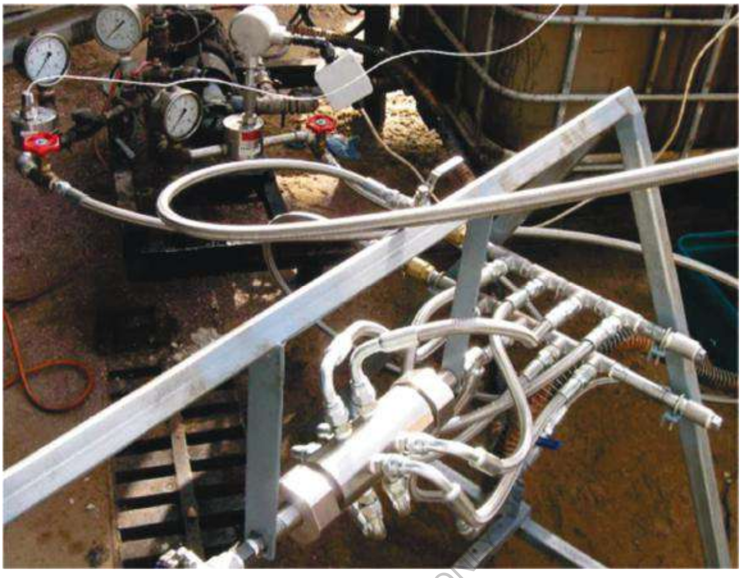
Unique properties and characteristics of the technology.

- homogenisation process, the mixture or emulsion is formed in a developed turbulent flow of components through the calculated combination and volumetric local combination of hydrodynamic effects, without mechanical action and without the use of any chemical activators or stabilisers

- homogenisation or mixture or emulsion formation time does not exceed 1 second.

- homogenisation process, a mixture or emulsion is formed in a developed turbulent liquid flow or base component of the mixture or emulsion, which is usually divided into two parts (e.g. 60% and 40% of the total weight of the liquid in the flows).

- The second part of the flow of the main base component of the mixture or emulsion is introduced into the unit by means of a special integrative inlet consisting of at least three radial channels.



- The formation of a mixture or emulsion simultaneously homogenises the flow in terms of turbulence level.

- For homogenisation of the liquid or base component or emulsion flow, the device uses coaxial conical ring channels with a flow thickness not exceeding 100 microns for the outer channel and 25 microns for the inner channel.

- the first part of the liquid flow or the main base component of the mixture or emulsion is introduced into the outer (encompassing) conical annular channel of the device.

- the second part of the liquid flow or the main base component of the mixture or emulsion is introduced into the inner (encompassed) conical annular channel of the device.

- The flow thickness in the encompassing (external) channel is usually at least two or more times (usually four times) greater than in the encompassed (internal) channel.

- at the outlet of each of the coaxial tapered ring channels, a local three-dimensional and intense variation of the Bernoulli effect is formed, combined with the cavitation effect and with local saturation of discontinuities from cavitation in the flows by static electricity.

- The mixture or water as an emulsion component is introduced at a point where a reduced pressure zone is formed by Bernoulli effects and the flows from the outer and inner ducts intersect according to a specially constructed geometry.

- The design allows up to eight different components to be introduced into a mixture or emulsion at the same time.

- homogenisation stage by turbulence level, if necessary, can be completed by the formation of a vortex tube followed by a sharp reduction of the cross-sectional area of the channel through which the homogenised liquid, mixture or emulsion is led out of the device to the second homogenisation stage, which is carried out under high pressure (over 2000 bar).

- as a rule, the pressure in the streams of the homogenising liquid or the main base component of the mixture or emulsion is the same and should be at least 3 bar.

- the liquid or mixture or emulsion in the device can optionally be subjected to pressure saturation with a gas, including an oxidising gas such as air or oxygen.

- The homogenisation or formation of a mixture or emulsion is usually controlled by varying the pressure in the flow of the emulsion components.

- the device for dynamic homogenisation or dynamic mixture or emulsion formation has no moving parts and consists only of 7 original parts.

- The device can be adapted to the dynamic formation of a microemulsion without the emulsion having to be exposed to high pressure: in addition, during the formation of the microemulsion, it is dynamically homogenised at the same time.

- The device can be adapted for dynamic nanoemulsion formation, whereby the micro-emulsion must be subjected to short-term high pressure (over 2000 bar), which is equivalent to a three-dimensional dimensional homogenisation process.

- the unit for homogenisation or dynamic preparation of a mixture or emulsion can have the following designs:

device for homogenisation and stationary preparation of micro-emulsion.

device for the homogenisation and stationary preparation of a nano-emulsion.

device for homogenisation and emulsion preparation in vehicles with direct direct injection into the combustion chamber.

Device for homogenisation and preparation of micro and nano emulsions, having an open nozzle at the outlet.

A device for homogenisation and preparation of micro- and nano-emulsions, having a closed nozzle at the outlet.

The homogeniser and mixture or emulsion preparation device in the vehicle can be operated with an exhaust gas recirculation system.

The linear velocity of the liquid components of the homogenising liquid or mixture or emulsion in the device depends directly on the viscosity of the liquid components of the emulsion and on the pressure (if the geometric dimensions of the channels of the device are equal).

As the liquid to be homogenised or the liquid components of the mixture or emulsion move through the channels of the device gradually increase their linear speed; for each value of viscosity and pressure there are limits to the flow thickness in all the channels of the device: for constant channel dimensions, to raise the linear speed the pressure must be increased: for each value of viscosity of liquid emulsion components there is a minimum flow thickness at which increasing the pressure does not increase the speed.

The device for homogenisation, dynamic activation and preparation of fuel mixtures or emulsions has a wide range of additional technological possibilities.

The device, with the same dimensions of the actuating elements, can have, for different variants of the end product, different capacities.

For the option of using the unit to produce compressed (gasified by compressed gas) mixtures or emulsions, the main material to form the mixture or emulsion, e.g. diesel fuel, is introduced into the unit at only one inlet, and on this basis, the liquid component capacity of the emulsion in this case will be minimal, e.g. 10 gallons per hour.

For variants using the device for homogenisation or production of incompressible classic liquid mixtures or emulsions, such as water to oil, the main material for homogenisation or formation of a mixture or emulsion, e.g. diesel fuel, is introduced into the device by two inlets - one centrally located in the longitudinal axis of the device, through which 60% diesel fuel is introduced, intended to fill the outer conical dispersion channel of the device with a distance between the conical surfaces forming the conical surfaces.

Examples of system with FAD (FLOW = 1000 LITER PER HOUR)

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Examples of system with FAD (FLOW = 1000 LITER PER HOUR)

Examples of system with FAD (FLOW = 1000 LITER PER HOUR)

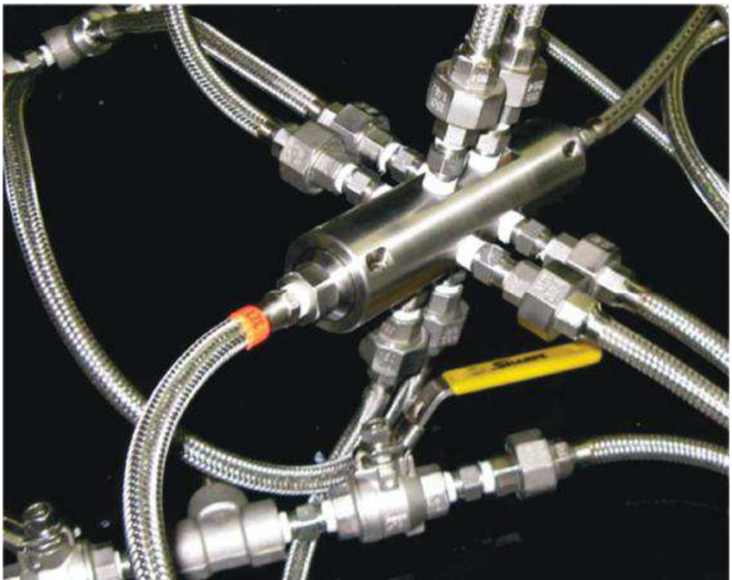
Annex 1

TECHNOLOGY FOR REAL TIME HOMOGENISATION, BLENDING, EMULSIFICATION AND ACTIVATION OF FLUIDS AND IMMISCIBLE LIQUIDS.

Technology of Dynamic, multi-component instant, cavitation based, mixing, homogenising and turbulent activation of fluids and immiscible liquids.

Technology of Dynamic immediate, cavitation based, homogenisation and turbulent activation of fluids and immiscible liquids.

Original installation systems of the technology:



Brief description of the system:
Brief description of the options for dynamic systems, instant, multicomponent homogeneous mixing, homogenizing and activation of liquids, gases and aerosols on the basis of three-dimensional, managed and adaptive real-time cavitation.

The technology can be adapted to existing equipment in two main variants:

- A system for pre-blending with subsequent reduction of quality and properties of the mixture after different storage periods.

- A system for insertion into the pipeline and mixing on-line in this pipeline; In turn, this system has two versions - recirculating mixture recycle stream and recycling without.

for assembly and mounting systems do not require any - that is special and original components, all the parts and elements of the systems are usually standard and not a pipe fitting or special modification.

As the device itself is a relatively small-sized, and it is extremely small-sized system that makes it convenient and easy to adapt them to the basic process equipment.

Brief description of the technology:

Technology of dynamic, instantaneous, multi-component uniform mixing, homogenizing and activation of liquids, gases and aerosols on the basis of three-dimensional, managed and adaptive real-time cavitation

Brief description of the dynamic, Snap Technologies, multicomponent homogeneous mixing, homogenising and activation of liquids, gases and aerosols in different combinations and proportions, based on the three-dimensional, managed and adaptive real-time cavitation.

The unique features and capabilities of this technology as of today do not have analogues in the world.

The following can be attributed to this kind of properties and characteristics:

- Extremely small size and weight of the device for the implementation of the technology, with respect to its performance.

- No need for additional energy consumption for the process.

- The ability to conduct and complete the process within the time interval is less than one second.

- The possibility of mixing liquids with liquids, liquids and gases, liquids.

- Possibility of forming a flow of compressible fluids and mixtures of fluids.

- The possibility to conduct homogenization of the mixture in a stream of several liquids.

- The ability to simultaneously and uniformly mix to homogenise the various liquids 8.

- The possibility to regenerate the emulsion mixture and after a few months of preparation.

- The possibility to conduct the dissolution of gases in liquids at - fly, that is in fluid flow, including the dissolution of gases in liquid combustible fuel and oxygen in water.

- Mixing in the apparatus goes with the formation of multi-level micro - capsules in which the capsule core is a less viscous fluid mixture or emulsion, - e.g., methanol or water, and the capsule shell is formed from, for example - diesel.

- The use of encapsulated fuel mixture in the combustion chambers of the thermodynamic devices, can dramatically increase the yield of the evaporation energy and reduce the required level of high-pressure injection, for example a diesel engine from 1600 bar to 930 bar and at the same time receive a significant reduction in fuel consumption and pollutant concentrations in the exhaust gases.

- Extremely short cycle mixing or emulsion, can be adapted to any technology without modifying the plant in.

Brief description of the FAD:

The device has no moving parts.

All parts of the device worked constructively and made on machine tools with numerical control without any adjustments to the device design provides extremely accurate assembly within minutes.

In preparation for the test and during the test system for dynamic mixing of the fuel mixture components showed the following technical advantages:

- Full readiness to work immediately after the assembly, without any setup or calibration.

- Reliable and easy connection to the fuel system of the boiler system and the tanks with fuel components.

- High reliability operation and no need for adjustment during operation.

- The ability to effectively purge vapour at work with fuel oil, without stopping the boiler.

- Convenience and exceptional ease-of-service.

- Reliable and stable performance in different types of boiler load.

- Simplicity and reliability of the transition from one fuel to another.

FAD-30, CONNECTED TO THE SYSTEM

FAD have two general design and use versions:

Version with linear collector and linear output of the blend/composite.

Different advantage, - minimum back pressure.

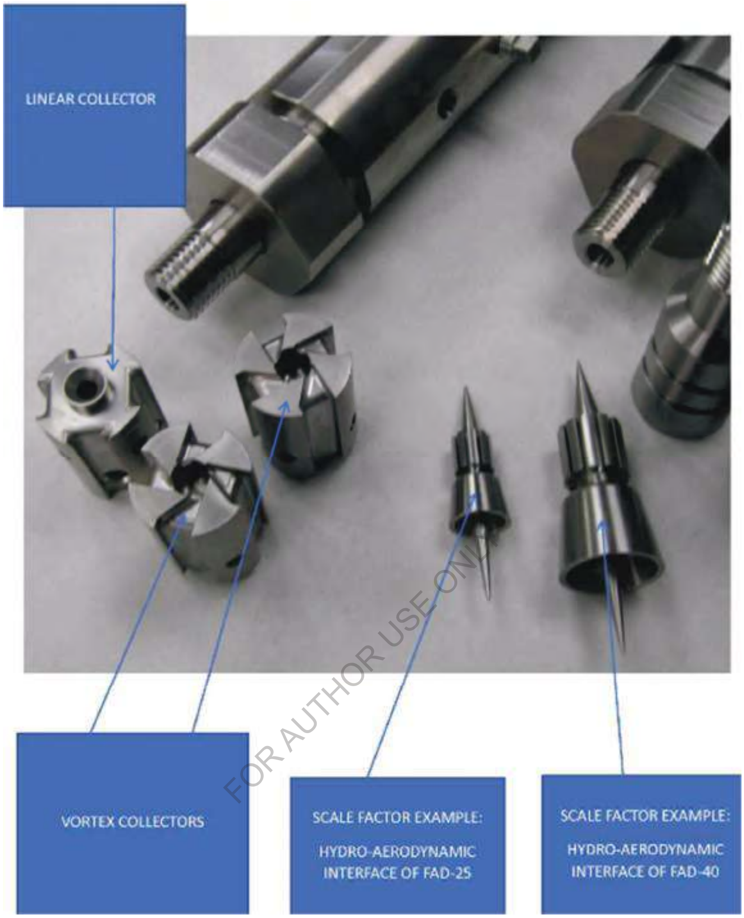
Version with vortex collector and vortex output of the mix/blend/composite.

Different advantage: output in the form of vortex tube, with high level of turbulence.

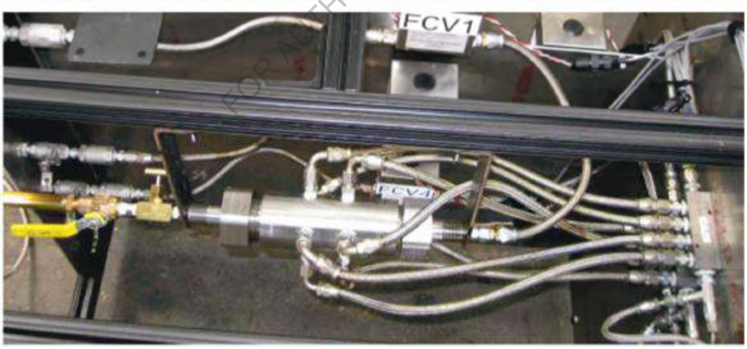

FAD -25, - MAX.FUEL COMPOSITIONS FLOW, = 100 LITER PER HOUR
MAIN FUEL COMPOSITION COMPONENT INPUT
FAD-30, - MAXIMUM FUEL COMPOSITIONS FLOW, - 200 LITER PER HOUR


EACH FAD MAKE UP A SET WITH LINEAR AND VORTEX COLLECTOR
Linear collector
Vortex collector
FAD HOUSING – CALIPER FOR ORIENTATION AND PRECISE POSITIONING
FIXATION PIN (for assembly only)

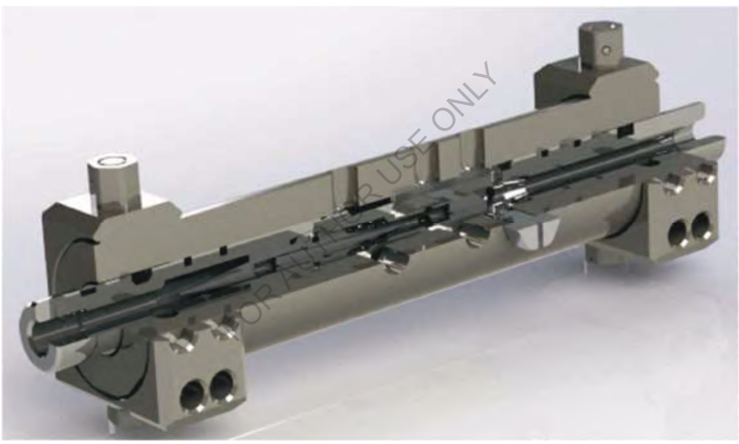

VORTEX COLLECTOR
LINEAR COLLECTOR
HYDRO-AERODYNAMIC INTERFACE
FAD-40, - MAX.FUEL FLOW = 250 LITER PER HOUR
INPUT OF MAIN FUEL COMPOSITION COMPONENT
FIXATION ELEMENT FOR ASSEMBLY ONLY


LINEAR COLLECTOR
VORTEX COLLECTORS
SCALE FACTOR EXAMPLE:
HYDRO-AERODYNAMIC INTERFACE OF FAD-25
SCALE FACTOR EXAMPLE:
HYDRO-AERODYNAMIC INTERFACE OF FAD-40

System for producing of fuel emulsions or fuel blends not in-line [pre-mix]



THE SYSTEM FOR IN-LINE INSTALLATION.



PROGRAMME AND METHODOLOGY FOR PRE-TESTING THE TECHNOLOGICAL PRINCIPLE OF FUEL MIXTURE ACTIVATION BEFORE FEEDING INTO THE COMBUSTION CHAMBER.

1. A brief description of the activation method.

In the device for testing the method of fuel mixture activation, it is proposed to use a real design of aerodynamic jet gripper connected to a compressor and inserted into a pipe with petrol of a certain configuration; being in a pipe filled with petrol, the aerodynamic jet gripper foams it and the foam rises up through the pipes, where it can be taken for analysis and experiments; in the said device it is possible to adjust the most important parameters forming the properties of activated

2. A brief description of the principle of the simulation method.

The simulation of the aerodynamic fuel mixture activation method, is a process of controlled delivery of compressed air into a closed volume of fuel mixture in the pipework of the testing device; the design of the device involves a pipework design that has a connection to the atmosphere in vertical sections of the pipework;

3. Basic checks on the mixing ratio of the fuel mixture components.

The principle of aerodynamic mixing of the various components of the fuel mixture can be applied to the appliance, by opening the control valve to one-eighth, one-fourth, one-second and three-fourths of its full open position at the same compressed air pressure value; the activated foam mixture at each position of the control valve is taken for analysis, a certain time is left for reactivation, after which the volume and weight proportions between the components of the fuel mixture are measured;

4. Basic checks on the dependence of the volume proportions of fuel mixture components on compressed air pressure;

For this test, with one of the adjustment valves, the compressed air pressure is varied within the following limits: 4 bar; 5 bar; 6 bar; 7 bar; 8 bar; with each pressure a sample of the activated fuel mixture is taken, kept for a certain time to reactivate, then the volume and weight proportions between the components of the fuel mixture are measured;

5. Basic checks on the duration of the foam stability of the fuel mixture, depending on the compressed air pressure;

For this series of tests, prepare the fixture as in step 4, take a sample of the activated fuel mixture and measure the time required for complete reactivation;

6. Basic checks on the duration of the foaming stability of the fuel mixture, depending on the proportions of the component contents;

For this series of tests, the proportions between the components of the fuel mixture are changed by adjusting the tap and adjusting the compressed air pressure, a sample of the activated fuel mixture is taken for each case and the time required for its complete reactivation is measured;

7. Basic checks on the duration of the foaming stability of the fuel mixture, depending on the temperature of the components;

For this series of tests, components with temperatures of such values are poured into the fixture: 20 degrees: 30 degrees; 40 degrees; 50 degrees; all Celsius temperatures; for each temperature value, a sample of the activated fuel mixture is taken and the time required for its complete reactivation is measured;

8. Basic checks on the calorific value of the fuel mixture at different compressed air pressures;

For this test, the fixture is adjusted and tuned according to point 4, a sample of the fuel mixture is taken, burned in the laboratory reactor and the calorific value, timing parameters are determined according to the technical specification of the laboratory equipment;

9. Basic checks on the calorific value of a fuel mixture at different concentrations of its organic components;

For this test, various organic components of the fuel mixture - such as petrol, ethanol, diesel fuel - are mixed, the mixture is activated and the calorific value of the fuel mixture is tested according to the procedure set out in point 8;

10. Basic checks on the calorific value of a fuel mixture at different proportions of mixing its organic and inorganic components;

For this check prepare a device for changing proportions between the components of the fuel mixture, for each proportion take a sample of activated fuel mixture, burn it in the laboratory reactor and determine the parameters of calorific value of the fuel mixture by the method and in accordance with the instructions for work on the specified laboratory equipment; for mixing provide mixing of the main component - gasoline, ethanol, diesel fuel with auxiliary component - water, in which case water must for each

11. Basic parameter checks on points 3 to 10 for various variants of the aerodynamic activator body design:

There may be variable parameters in the design of the aerodynamic activator body that can change the output characteristics and parameters of the entire aerodynamic activator; these parameters include:

- the diameter of the holes in the body;
- the number of holes in the body;
- diameter of the body face on which the diaphragm is fitted;

The diameter of the holes in the body can vary between: 1 mm; 1.5 mm; 2 mm;

The number of holes in the body can vary within the range: 6 holes; 8 holes; 12 holes;

The diameter of the casing face on which the diaphragm is fitted can vary within the range: 15mm; 20mm: 25mm;

12. Basic fuel mixture parameter checks on points 3 - 10, with different aerodynamic activator diaphragm designs;

The design of the aerodynamic activator diaphragm may contain variable parameters that change its functionality; these parameters include:

- membrane thickness;
- is the distance from the diaphragm to the aerodynamic activator body;
- diaphragm diameter;
- the active area of the membrane;

All these parameters affect the performance of the membrane and the entire aerodynamic activator to a greater or lesser degree, and by varying them, different levels of foaming efficiency and different fuel mixture parameters can be obtained for points 3 to 10;

Parameter values:

Membrane thickness,- 0.25 mm; 0.35 mm; 0.5 mm; 0.75 mm;

Distance from diaphragm to aerodynamic activator body,- 0.05mm; 0.1mm; 0.15mm; 0.2mm;

Diaphragm diameter,- 15mm; 20mm; 25mm;

Active membrane area,- 30%;40%;50%;

13. Verification of NOx gas concentration remaining after combustion of a portion of the fuel mixture, under different test device design options and different parameters and results of the fuel mixture activation process;

For each option, the concentration of the specified gas remaining after combustion of the activated fuel mixture sample shall be determined using laboratory equipment;

14. Check the concentration of NOx gas remaining after combustion of a portion of the fuel mixture at various proportions of mixing organic and inorganic components of the fuel mixture;

- Petrol,- 95%; water,- 5%:
- Petrol,- 90%; water,- 10%;
- Petrol,- 80%; water,- 20%;

For each mixing ratio, an activated fuel mixture sample is taken and its concentration after combustion of the activated fuel mixture is checked using laboratory gas concentration analyser sensors.

15. Check the concentration of NOx gas remaining after combustion of a portion of the fuel mixture at various proportions of the organic components of the fuel mixture;

The check is similar in method to the check in item 14;

List of references, patent and licence information.
List of references and patent materials.

Annex 1-1

United States Patent Application | **20100193445**
Kind Code | **A1**
August 5, 2010

FOAMING OF LIQUIDS

Abstract

Methods and systems for processing of liquids using compressed gases or compressed air are disclosed. In addition, methods and systems for mixing of liquids are disclosed.

Annex 1 - 2

United States Patent Application | **20150130091**
Kind Code | **A1**
May 14, 2015

FOAMING OF LIQUIDS

Abstract

A foaming mechanism configured to receive a plurality of streams of gas and generate a foamed liquid, having an aerodynamic component and an aerodynamic housing disposed around at least a portion of the aerodynamic component. The aerodynamic housing includes a plurality of first channels and a plurality of second channels connected to the plurality of first channels at regular intervals on a distributed plane. The distributed plane is about perpendicular to the plurality of first channels, wherein the plurality of first channels and the plurality of second channels are configured to transform an axial stream of the gaseous working agent into a plurality of radial high-speed streams of the gaseous working agent by channeling the gaseous working agent through the plurality of first channels and

into the plurality of second channels on the distributed plane. A hydrodynamic conical reflector and a hydrodynamic housing form a ring channel in an area between the hydrodynamic conical reflector and the hydrodynamic housing. An accumulation mechanism is configured to disperse the plurality of radial high speed flows of the gaseous working agent into the ring channel and create turbulence to foam the liquid.

Annex 1 - 3

United States Patent Application	**20160207013**
Kind Code	**A1**
	July 21, 2016

Device For Mixing Fluids

Abstract

A device is provided for mixing similar or dissimilar fluids into a homogenous fluid mixture. The device operates without consuming additional energy.

Annex 1 - 4

United States Patent Application	**20100224506**
Kind Code	**A1**
	September 9, 2010

PROCESS AND APPARATUS FOR COMPLEX TREATMENT OF LIQUIDS

Abstract

Methods and apparatus for complex treatment of contaminated liquids are provided, by which contaminants are extracted from the liquid. The substances to be extracted may be metallic, non-metallic, organic, inorganic, dissolved, or in suspension. The treatment apparatus includes at least one mechanical filter used

to filter the liquid solution, a separator device used to remove organic impurities and oils from the mechanically filtered liquid, and an electroextraction device that removes heavy metals from the separated liquid. After treatment within the treatment apparatus, metal ion concentrations within the liquid may be reduced to their residual values of less than 0.1 milligrams per liter. A Method of complex treatment of a contaminated liquid includes using the separator device to remove inorganic and non-conductive substances prior to electroextraction of metals to maximize the effectiveness of the treatment and provide a reusable liquid.

Annex 1 - 5

United States Patent Application	**20100224497**
Kind Code	**A1**
	September 9, 2010

DEVICE AND METHOD FOR THE EXTRACTION OF METALS FROM LIQUIDS

Abstract

A volume-porous electrode is provided which increases efficiency and production of electrochemical processes. The electrode is formed of a carbon, graphitic cotton wool, or from carbon composites configured to allow fluid flow through a volume of the electrode in three orthogonal directions. The electrode conducts an electrical charge directly from a power source, and also includes a conductive band connected to a surface of the electrode volume, whereby a high charge density is applied uniformly across the electrode volume. Apparatus and methods which employ the volume-porous electrode are disclosed for removal of metals from liquid solutions using electroextraction and electro-coagulation techniques, and for electrochemical modification of the pH level of a liquid.

Annex 1 - 6

United States Patent Application **20110056457**

Kind Code **A1**

March 10, 2011

SYSTEM AND APPARATUS FOR CONDENSATION OF LIQUID FROM GAS AND METHOD OF COLLECTION OF LIQUID

Abstract

The present disclosure generally relates to an apparatus for the condensation of a liquid suspended in a gas, and more specifically, to an apparatus for the condensation of water from air with a geometry designed to emphasize adiabatic condensation of water using either the Joule-Thompson effect or the Ranque-Hilsch vortex tube effect or a combination of both. Several embodiments are disclosed and include the use of a generator to extract water and unburned hydrocarbons from exhaust of combustion engines, to collect potable water from exhaust of combustion engines, to use the vortex generation as an improved heat process mechanism, to mix gases and liquid fuel efficiently, and an improved generator with baffles and external condensation.

Annex 1 -7

United States Patent Application **20120102736**

Kind Code **A1**

May 3, 2012

MICRO-INJECTOR AND METHOD OF ASSEMBLY AND MOUNTING THEREOF

Abstract

The invention relates to a compact device for producing a composite mixture made of two or more fluids, and for aerating and energising the composite and injecting it into a volume, and more specifically a micro-fuel injector mixing water, air, or any other types of fluid before it is injected into a volume such as a

combustion chamber of an engine made of stackable mechanical elements, and the method of assembly and mounting thereof.

Annex 1 - 8

United States Patent **5,871,814**

February 16, 1999

Pneumatic grip

Abstract

A device for shaping a vacuum includes a housing having a primary passageway which includes an inlet. A fluid shaping mechanism is disposed in the primary passageway in fluid communication with the inlet for changing the shape of a fluid flow into a planar fluid flowing radially outwards from a central point. The fluid shaping mechanism includes a conically-shaped portion disposed within the primary passageway, a plurality of secondary passageways extending through the housing from a periphery of the cone-shaped surface to outlets at a bottom surface of the housing, and a reflector adjacent to and spaced from the bottom surface for uniformly reflecting the fluid from the secondary passageways radially outwards to create a vacuum adjacent thereto.

Annex 1 - 9

United States Patent **6,139,714**

October 31, 2000

Method and apparatus for adjusting the pH of a liquid

Abstract

A process for adjusting the pH of an aqueous flowable fluid includes an electrochemical mechanism for adjusting the pH of an aqueous flowable fluid and a mechanism for then electrochemically stabilizing the adjusted pH of the fluid. A device for performing the process is also included. The device includes an inlet and a channel in fluid communication with the inlet. The channel has the appearance and properties of a U-shaped connected vessel. The U-shaped

connected vessel includes an inlet accumulating passage in fluid communication with an active zone between two spaced electrodes wherein the active zone has a small volume relative to the passage for accelerating fluid flow from the passage through the active zone complying with the physics of connected vessels.

Convertible fuels for smart home infrastructure. Part 2

Options of fuel mixtures and emulsions with a high level of dynamic homogenization in real time are considered.
Modern engines with a high-pressure pump can be equipped with a system of dynamic homogenization of the fuel mixture without minimal modifications to the fuel system.
Dynamic homogenization system can be installed on stationary combustion engines as well as on internal combustion engines installed in vehicles.
The dynamic homogenization system can be equipped with an additional system for the formation of fuel emulsions of two types - compressible emulsion and incompressible emulsion.
The dynamic homogenization system allows efficient emulsification of up to eight additional components in an emulsion.
The system of dynamic homogenization without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary combustion engines and on internal combustion engines installed in vehicles.

Aleksandr Gorbov is a specialist in technological equipment with digital software control including elements of artificial intelligence, a member of the Estonian Electronic Industry Association, a member of the New York Academy of Sciences, is an active inventor, author and owner of two integrative patents.

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OUR KNOWLEDGE
PUBLISHING

OUR KNOWLEDGE
PUBLISHING

Convertible fuels for smart home infrastructure. Part 2

Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

Aleksandr Gorbov

Aleksandr Gorbov

Convertible fuels for smart home infrastructure. Part 2

Aleksandr Gorbov

Convertible fuels for smart home infrastructure. Part 2

Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

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Convertible fuels for smart home infrastructure

Options for fuel blends and emulsions with a high level of dynamic homogenisation in real time are considered

Book in 4 parts

Part 2, - Converted innovative fuels and fuel blends in the form of emulsion or fluid vortex tube

Annotation

Modern engines with a high-pressure pump can be equipped with dynamic homogenisation of the fuel mixture with absolutely no modifications to the fuel system

The dynamic homogenisation system can be fitted to both stationary internal combustion engines and internal combustion engines mounted on vehicles.

The dynamic homogenisation system can be equipped with an additional system for the formation of two types of fuel emulsions, a compressible emulsion and an incompressible emulsion.

The dynamic homogenisation system allows up to eight additional components to be effectively emulsified.

A dynamic homogenisation system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines fitted to vehicles.

Keywords: liquid fuel; heavy fuel oil; complex dynamic homogenisation; hydrocarbon fuel blends; internal combustion engines; vortex mixing; vortex tube;

Table of Contents

Introduction:

Possible applications of complex dynamic homogenisation technology for hydrocarbon fuel mixtures in internal combustion engines

Possible applications of technologies for complex dynamic homogenisation of hydrocarbon fuel mixtures in internal combustion engines

Types of internal combustion engines in which comprehensive technology for dynamic homogenisation of fuels and fuel mixtures can be applied.

The dynamic homogenisation system has minimal overall dimensions and optimum geometry;

The fluid inlets and outlets of the homogenised liquid are absolutely standard and therefore the Dynamic Fuel Mixture Homogenisation system can be fitted to any internal combustion engine

Modern engines with a high-pressure pump can be equipped with dynamic homogenisation of the fuel mixture with absolutely no modifications to the fuel system

The dynamic homogenisation system can be fitted to both stationary internal combustion engines and internal combustion engines fitted to vehicles

The dynamic homogenisation system can be equipped with an additional system to form two types of fuel emulsions, a compressible emulsion and an incompressible emulsion

The dynamic homogenisation system allows up to eight additional components to be effectively emulsified

A dynamic homogenisation system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines fitted to vehicles

Types of hydrocarbon liquid fuels that can be subjected to dynamic homogenisation.

All types of liquid hydrocarbon fuels can be treated using dynamic homogenisation technology.

All types of fuel mixtures based on petrol, all types of diesel and fuel oil can be processed using dynamic homogenisation technology.

All types of liquid biofuels can be processed using dynamic homogenisation technology.

All kinds of biological -fuel compositions can be processed using dynamic homogenisation technology.

DYNAMIC FUEL HOMOGENISATION WITHOUT IMPURITIES

In hydrocarbon liquid fuels, fuel lumps can occur during storage which can later cause problems with injection and homogeneous combustion.

The higher the viscosity of the fuel, the greater the likelihood of clumping and other fuel inhomogeneity.

The dynamic fuel homogenisation system is mounted in the engine fuel system on the fuel line between the engine fuel pump and the engine high-pressure pump.

During the passage of the fuel through the dynamic homogenisation system, homogenisation occurs in the turbulence level flow, followed by the completion of the dynamic homogenisation process in the volume and dimensional factor in the three-dimensional coordinate system in the high-pressure pump.

The dynamic fuel homogenisation system does not require any additional energy sources or design elements.

The dynamic fuel homogenisation system can also be used in processes and apparatuses for homogenisation in parallel with the recirculation of fuel in storage tanks during fuel production and storage at petrol stations.

DYNAMIC HOMOGENISATION OF PETROL-BASED FUEL BLENDS

Gasoline-based fuel blends, such as gasoline-ethanol blends and gasoline-methanol blends, can have the effect of gravitational separation of water from the hydrocarbon part of the fuel blend when stored for long periods of time.

The dynamic homogenisation system in petrol engines using a petrol/ethanol blend or a petrol/methanol blend as fuel is installed between the fuel pump and the engine high-pressure pump.

During the passage of the fuel mixture in which water is separated from gasoline through a system of dynamic homogenization, homogenization occurs in the flow on the level of turbulence, after which in the high pressure pump the process of dynamic homogenization is completed in volume and dimensional factor in the three-dimensional coordinate system.

During the homogenisation process, water in the form of microdroplets is homogeneously distributed in the volume of the hydrocarbon fuel mixture, and the mixture is then transformed into a micro or nano-emulsion.

According to the test results of the emulsion obtained with the dynamic homogenisation system, the concentration of soot in the exhaust gas is reduced by 97% and the level and rate of heat realisation increased by at least 35%.

To mount the dynamic homogenisation system on a petrol engine, no original accessories are required and no structural modifications need to be made to the engine itself.

DYNAMIC HOMOGENISATION OF DIESEL-BASED FUEL BLENDS

It is extremely difficult to prepare fuel mixtures from diesel fuel and ethanol or methanol because of the great difference in viscosity between these materials.

A dynamic homogenisation system for fuel blends can prepare a high-quality and homogeneous blend of diesel fuel and ethanol or methanol within fractions of a second, directly in the pipeline and in any desired proportion.

The dynamic homogenisation system in diesel engines using a diesel-ethanol blend or a diesel-methanol blend as fuel is fitted between the fuel pump and the diesel engine high-pressure pump.

During the passage of the fuel mixture in which water is separated from gasoline through a system of dynamic homogenization, homogenization occurs in the flow on the level of turbulence, after which in the high pressure pump the process of dynamic homogenization is completed in volume and dimensional factor in the three-dimensional coordinate system.

During the homogenisation process, water in the form of microdroplets is homogeneously distributed in the volume of the hydrocarbon fuel mixture, and the mixture is then transformed into a micro or nano-emulsion.

According to the test results of the emulsion obtained with the dynamic homogenisation system, the concentration of soot in the exhaust gas is reduced by 97% and the level and rate of heat realisation increased by at least 35%.

The dynamic homogenisation system on the diesel engine does not require any original accessories and does not require any structural modifications to the engine itself.

DYNAMIC HOMOGENISATION OF FUEL MIXTURES BASED ON HEAVY FUEL OIL

It is extremely difficult to prepare fuel mixtures of heavy fuel oil and ethanol or methanol because of the great difference in viscosity between these materials.

A dynamic homogenisation system for fuel blends can prepare a high-quality and homogeneous blend of heavy fuel oil and ethanol or methanol within fractions of a second, directly in the pipeline and in any desired proportion.

The dynamic homogenisation system in heavy duty diesel engines using a heavy duty diesel/ethanol or heavy duty diesel/methanol mixture as fuel is mounted between the fuel pump and the engine high pressure pump (if fitted); If the high pressure pump is not part of the engine, the dynamic homogenisation system is mounted on the fuel line after the fuel pump.

During the passage of a fuel mixture in which either water has separated from heavy fuel oil or lumps of heavy fuel oil have formed, through a dynamic homogenisation system, homogenisation occurs in the flow at turbulence level, after which the high pressure pump or nozzles complete the process of dynamic homogenisation in volume and dimension factor in the three-dimensional coordinate system

During the homogenisation process, water in the form of microdroplets is homogeneously distributed in the volume of the hydrocarbon fuel mixture, and the mixture is then transformed into a micro or nano-emulsion.

According to the test results of the emulsion obtained with the dynamic homogenisation system, the concentration of soot in the exhaust gas is reduced by 97% and the level and rate of heat realisation increased by at least 35%.

For the installation of a dynamic homogenisation system on an engine using heavy fuel oil, no original accessories are required and no structural modifications need to be made to the engine itself.

DYNAMIC HOMOGENISATION OF FUEL MIXTURES BASED ON FUEL OIL

Fuel mixtures of fuel oil and ethanol or methanol are extremely difficult to prepare because of the great difference in viscosity between these materials and because of the heterogeneity of fuel oil.

A dynamic homogenisation system for fuel blends can prepare a high-quality and homogeneous blend of fuel oil and ethanol or methanol within fractions of a second, directly in the pipeline and in any desired proportion.

In the case of particularly high levels of fuel oil heterogeneity, the structural simplicity of the system, allows its staged use with the formation of a gradual (step-by-step) sequential scheme of fuel mixture preparation on the basis of fuel oil.

The dynamic homogenisation system in large engines using a fuel mixture of fuel oil and ethanol or a fuel mixture of fuel oil and methanol is mounted between the fuel pump and the downstream engine fuel system component.

During the passage of the fuel mixture in which water separated from fuel oil or in which clumps and lumps formed in the flow of fuel oil, through a system of dynamic homogenization homogenization occurs in the flow on the level of turbulence, after which the nozzle or injector completes the process of dynamic homogenization in the volume and dimensional factor in three-dimensional coordinate system.

During the homogenisation process, water in the form of microdroplets is homogeneously distributed in the volume of the hydrocarbon fuel mixture, and the mixture is then transformed into a micro or nano-emulsion.

According to the test results of the emulsion obtained with the dynamic homogenisation system, the concentration of soot in the exhaust gas is reduced by 97% and the level and rate of heat realisation increased by at least 35%.

The dynamic homogenisation system on the engine does not require any original accessories and no structural modifications are required to the engine itself.

PREPARATION OF FUEL BLENDS IN REFINERIES

In refineries, a system for the dynamic homogenisation of hydrocarbon liquids must include a high-pressure pump operating on the principle of a diesel engine high-pressure pump.

This integrated system can be used as a fuel-mixing pump or as a fuel-mix recirculation system for storage tanks.

Such systems can be installed on existing equipment without modification or upgrade, but in this case the system must include pumps to feed the mixture components into the system.

One of the options for the use of dynamic homogenization system in refineries is the option of forming the fuel mixture by feeding the components of the fuel mixture into the transport tank; Since the time of preparation of fuel mixture in the system is a fraction of a second, preparing the mixture when fed into the transport tank, allows you to have no special containers for storage of fuel mixture.

PREPARATION OF FUEL MIXES AT PETROL STATIONS

At petrol stations, the system for dynamic homogenisation of hydrocarbon liquids must include a high-pressure pump working on the principle of a diesel engine high-pressure pump.

This integrated system can be used as a fuel-mixing pump or as a fuel-mix recirculation system for storage tanks.

Such systems can be installed on existing equipment without modification or upgrade, but in this case the system must include pumps to feed the mixture components into the system.

One of the applications of dynamic homogenization system at service stations is the option of forming the fuel mixture by feeding the components of the fuel mixture directly into the fuel tank of a car or other vehicle. Since the time of preparation of fuel mixture in the system is a fraction of a second, the preparation of mixture by feeding the tank of the vehicle, allows businesses to not have special fuel mixture storage tanks.

PREPARATION OF FUEL MIXTURES DIRECTLY IN THE COMBUSTION ENGINE

In the event that an additional tank for a second fuel mixture component can be fitted to the vehicle, the fuel mixture can be prepared by a dynamic homogenisation system directly in the fuel line.

The possibility of such a variant was tested on a production diesel engine and as a result of such a test (a water-in-oil fuel emulsion was produced, i.e. diesel fuel was emulsified with plain tap water).

This use of emulsion has reduced the soot concentration in exhaust gases by 97% (mixing ratio in the emulsion, - 20% water to 80% diesel).

INSTALLATION OF A DYNAMIC HOMOGENISATION SYSTEM ON A NEW INTERNAL COMBUSTION ENGINE BEING MANUFACTURED

No new engine components are required for the installation of a dynamic homogenisation system on a newly manufactured combustion engine.

A system is introduced into the fuel line after the fuel pump, the outlet from which is connected to the high-pressure pump inlet or, if there is none, to the inlet in the structural member following the fuel pump.

INSTALLATION OF A DYNAMIC HOMOGENISATION SYSTEM ON AN INTERNAL COMBUSTION RETORT MOTOR

No new engine components are required to install the dynamic homogenisation system on an internal combustion engine that is being repaired or modified.

A system is introduced into the fuel line after the fuel pump, the outlet from which is connected to the high-pressure pump inlet or, if there is none, to the inlet in the structural member following the fuel pump.

INSTALLATION OF A DYNAMIC HOMOGENISATION SYSTEM IN INDUSTRIAL FUEL BLENDING PLANTS

The system can be supplied from the manufacturer in modular form.

The composition and functions of the system can be modified at the manufacturer's premises without the need for further planning.

The system has no restrictions or elements that prevent it from being installed on any industrial equipment.

INSTALLATION OF A DYNAMIC HOMOGENISATION SYSTEM ON FUEL MIXTURE TANKS AT PETROL STATIONS

The system can be supplied from the manufacturer in modular form and has the ability to be manufactured in any required scale factor.

The composition and functions of the system can be modified at the manufacturer's premises without the need for further planning.

The system has no restrictions or elements that prevent it from being installed on any industrial equipment.

COMPRESSIBLE LIQUIDS FUEL COMPOSITIONS

AEROSOLS OF LIQUID FUEL COMPOSITIONS

FIGURE 1

Flame pattern when using normal fuel for this burner - diesel No.4 ; Fuel flow rate, fuel line pressure, type nozzles, air flow rate, air flow pressure are completely identical for all tests.

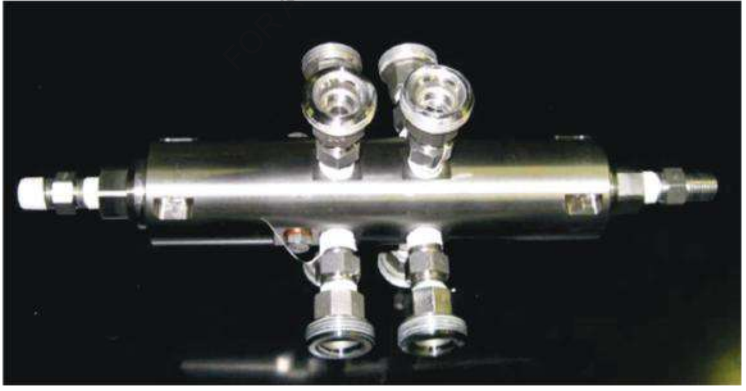
FIGURE 2

Shape of the flame when using as fuel, - diesel fuel #4, mixed online with water (tap water, 15% by weight) and compressed air (3% of stoichiometric proportion, pressure 5-6 bar); Flame volume increased, flame temperature 20% higher, sharp reduction in soot, carbon, carbon monoxide and nitrogen oxides.

FIGURE 3

Shape of the flame when using as fuel, - diesel fuel #4, mixed online with water (20% by weight) and compressed air (3% of stoichiometric proportion, pressure 5-6 bar); Flame volume increased, flame temperature 25% higher, sharp reduction in soot, carbon, carbon monoxide and nitrogen oxides.

FIGURE 4



Experimental device for mixing fuel mixture components; Especially flexible hoses are used in the system; The device has extremely small dimensions; The capacity of the device, - 150 litres of fuel mixture or emulsion per hour.

FIGURE 5

Devices with a working diameter of 30 mm; Top without fittings, bottom with fittings; All pipe connections are standard; The devices are exceptionally compact and when forming a system for installation on thermodynamic equipment can use extra flexible tubing for connection; This facilitates a more convenient and adaptive connection.

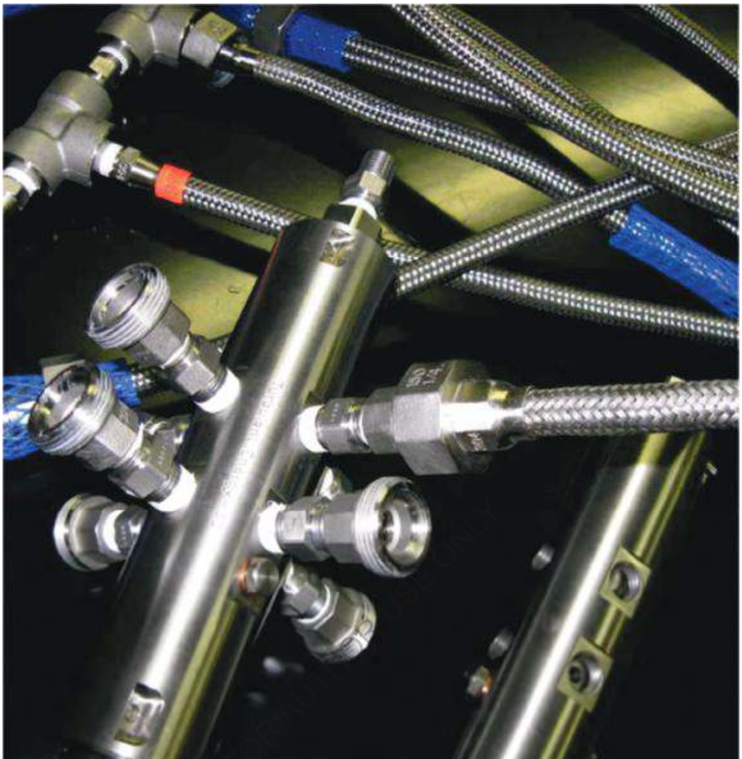
FIGURE 6

Devices with a working diameter of 30 mm; Devices can be manufactured on commercially available numerically controlled machine tools without the need for special metal-cutting tools; All connections, piping and sub-assemblies are made from standard parts; All piping includes all necessary parts, fittings and piping components;

As mandatory elements the pipelines include control valves, control - regulating valves, non-return valves etc.

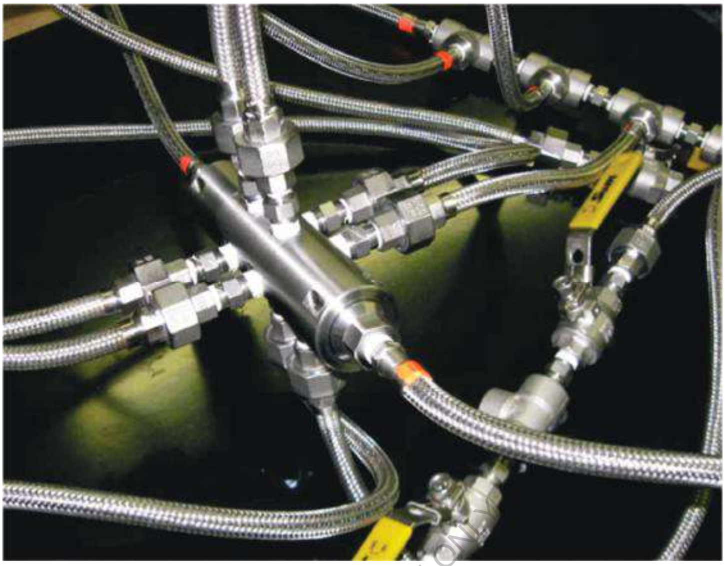
All incoming hoses are externally coated with stainless steel and are extremely flexible.

FIGURE 7



All fittings enable manual assembly, with little or no use of tools.

FIGURE 8

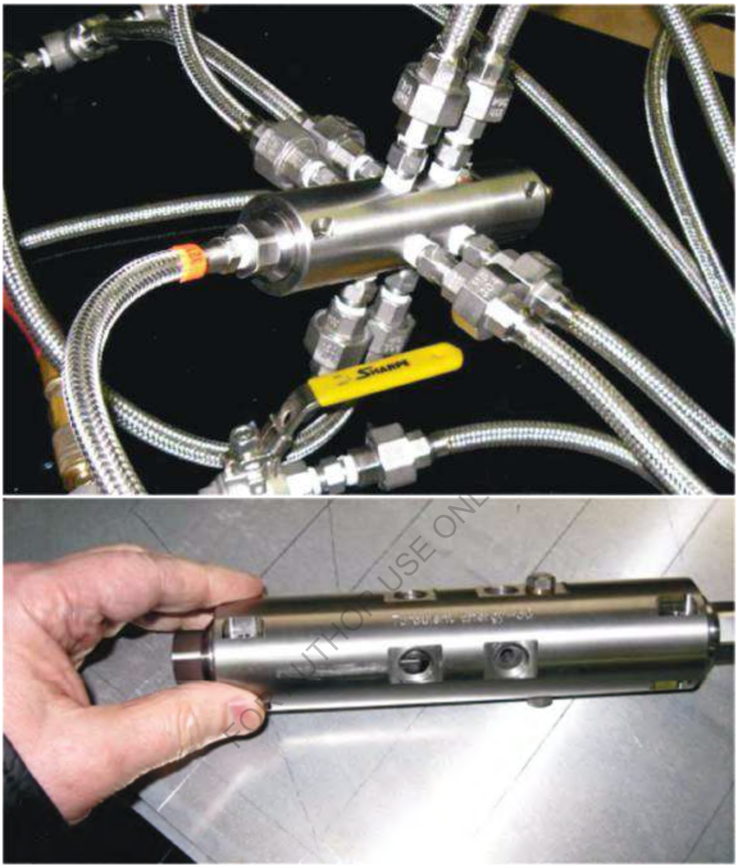


The increased flexibility of all pipework ensures a high degree of customisation of the system, including the emulsion forming unit and its on-line gasification;

The system has all the necessary components and elements for integration into the fuel system of any thermodynamic equipment.

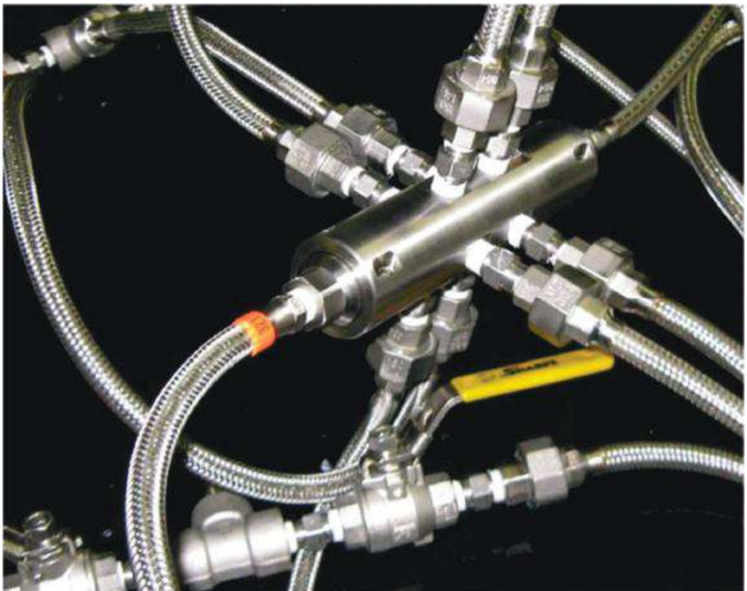
Additional units and mechanisms can be integrated into the system, if required, for on-line control of the composition and proportions of the formed emulsion or blend.

FIGURE 9



The device is extremely small, allowing its integration without any significant modifications to the fuel system of the thermodynamic equipment.

FIGURE 10



The device has several basic configurations due to the different dimensions of the shaping inner channels;

Internal parts can be replaced without special tools at the installation site on thermodynamic equipment.

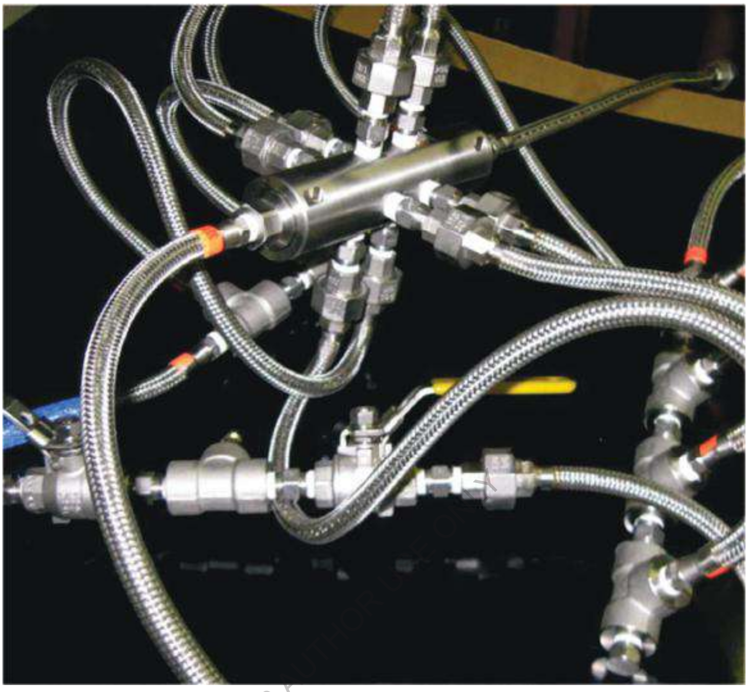
The piping and its fittings are designed in such a way that different types and types of liquid fuel as well as gaseous fuel can be fed into the unit.

Pipelines and their fittings are designed and tested for the supply of methanol, ethanol, steam, various synthetic fuels and fuels recovered from industrial waste, including those recovered into fuel from old plastics and waste tyres.

FIGURE 11

FIGURE 12

FIGURE 13



Annex 1

Integrated technology of in-line vortex mixing of gaseous fuel components with compressed air, with receiving of the vortex tube from gaseous fuel components and air.

Integrated technology of in-line vortex mixing of gaseous fuel components with steam, including - superheated steam, with receiving of the vortex tube from gaseous fuel components and steam.

First step of the feasibility study test

Technical task for the test.

Purpose and procedure of testing.

The purpose of the test is to verify in real nature the impact of the vortex tube of gaseous fuel components in-line mixed with compressed air or steam, including - super heated steam, for all basic parameters of the combustion process.

As an object, which is supposed to carry out the test, the boiler must be provided with a power output of at least - 50 kilowatts.

The gaseous fuel mixture is assumed to be prepared in-line from the flow of fuel gas mixed in the process of supplying the combustor with compressed air or steam, including - superheated steam.

The mixing and the formation of a vortex tube of fuel and compressed air or steam, including superheated steam is supposed to lead to a special vortex mixing device (which must be supplied by the Turbulent Energy) and is connected to compressed air supply system or steam supply system, with additional version of use of superheated steam generator, which also has to put the Technion Team.

Preliminary dimensioning of the steam generator, based on the parameters of the present Furnace with an output of at least 50 kilowatts in the test should perform the Executor-partners of the test-project.

To form the baseline is assumed to perform basic tests on the Furnace with the same gaseous combustible material (fuel) which is intended to be mixed with steam in a test device for a vortex mixing.

Basic tests are expected to perform at small, medium and peak loads of the Furnace.

When basic tests required precise control and accurate measurement of the maximum possible concentration of substances in the exhaust gases in accordance with applicable standards; All devices for measuring should be placed an Executor-partners of the test project.

When basic tests must be extremely precise measurement of the parameters of the combustion process in the combustion chamber of the Furnace, - including fuel consumption, air consumption, consumption of excess air, the flame temperature, exhaust gas temperature, the resulting output power, thermal losses, the flame temperature, the ambient temperature, humidity, atmospheric pressure, the gas pressure in the pipeline; All devices for measuring and monitoring should put Performer - partners of the test project.

At baseline test separately checked the operation of the compressed air supply system, the steam supply system including the superheated steam generator and its parameters are measured; All devices for measuring should be put an Executor- partners of the test project.

All instruments and control equipment must be certified.

It is desirable to be able to photograph the flame in the scale factor.

It is desirable to be able to check the combustion parameters by using different types of nozzles and spray method, taking pictures for different spray pattern nozzles and flame torches for different combinations of the fuel and additives.

All tools and equipment for this the Executor - partners have to put in place for the test project.

The first stage of the test pilot - project (mandatory).

All the above operations should be repeated with a control test, when applying the same fuel but mixed with compressed air or steam or superheated steam in different proportions mixed with gaseous fuel in the same proportions for any type of load, low, medium and high.

The second stage of the test pilot - project (optional).

All the above operations should be repeated with a control test, when applying the same fuel but mixed with compressed air mixed with gaseous fuel in the same proportions for any type of load, low, medium and high.

According to the results of control tests should be made a test protocol with comparative charts, negotiated and signed by all participants of the test project (required).

According to the results of tests must be prepared an analytical report, agreed and signed by all participants of the test project (optional).

Technical requirements for the test.

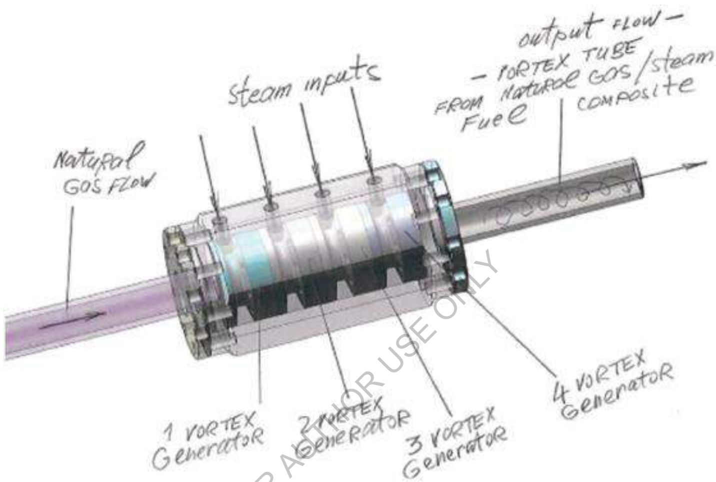
All necessary technical requirements must be in full concordance with present

International Technical Standards and related US and Israeli technical and environmental standards.

Test set-up diagrams

DIAGRAM 1

General view of the vortex mixing device for creation of the vortex tube from gaseous components in in-line installation in thermodynamic equipment.



The minimum device size is - 15 mm diameter of the central hole for natural gas flow [or different fuel gases, like sin-gas or other fuel gases or mixture of the fuel gases;

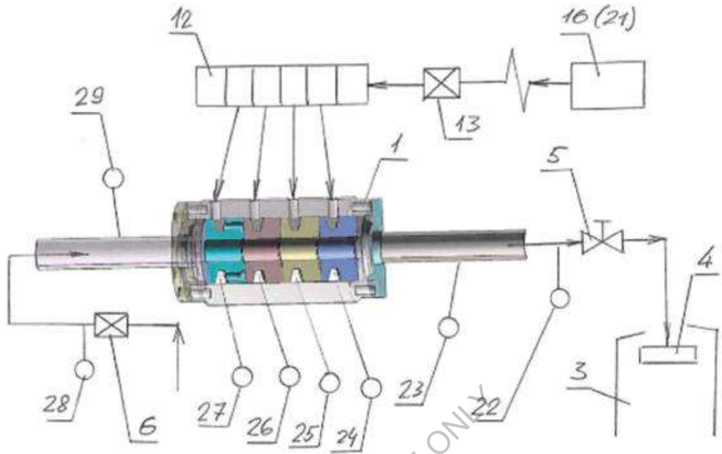
This device consist of - 4 original vortex generators [all of the vortex generators have independent input of fluids, - in test version it can be steam or compressed air or superheated steam].

If it use all types of steam, the device has heating of the gas flow effect, if use compressed air - the device has a gas flow - cooling effect.

The vortex generators of the minimum size of the device producing - 32 vortex spirals of the output vortex tube from gaseous fuel composite.

DIAGRAM 2

Temperature control points in any configuration of the test set-up.



1 - device for vortex mixing

3 - Furnace combustion chamber

4 - nozzle

5 - control valve

6 - check valve

12 - Distribution divider-manifold or receiver

13 - check valve

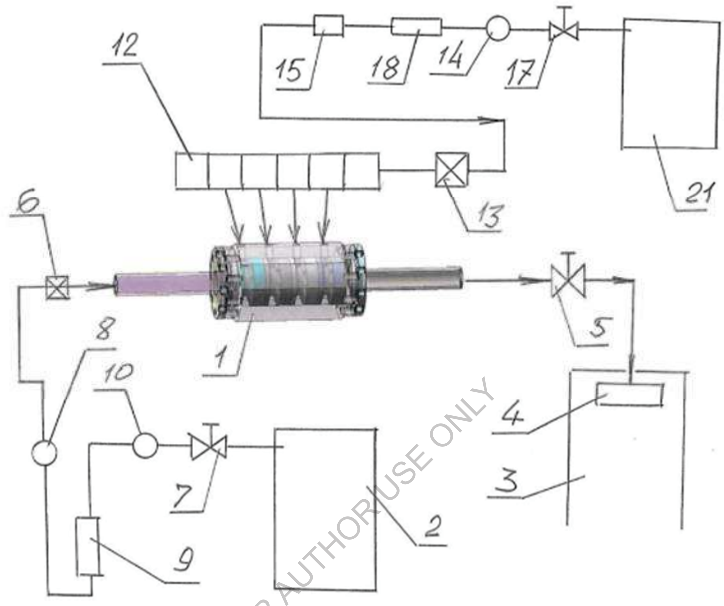
16 - compressor [or present compressed air line]

21 - steam generator [or other source of superheated steam]

22- 29 - temperature control points

DIAGRAM 3

Test set-up, if the additive is steam



1 - device for vortex mixing

2 - natural gas source

3 - Furnace combustion chamber

4 - nozzle

5 - control valve

6 - check valve

7 - control valve

8 - manometer

9 - flow meter

10 - line thermometer

12 - Distribution divider-manifold or receiver

13 - check valve

14 - manometer

15 - check valve

17 - control valve

18 - flow meter

21 - steam generator

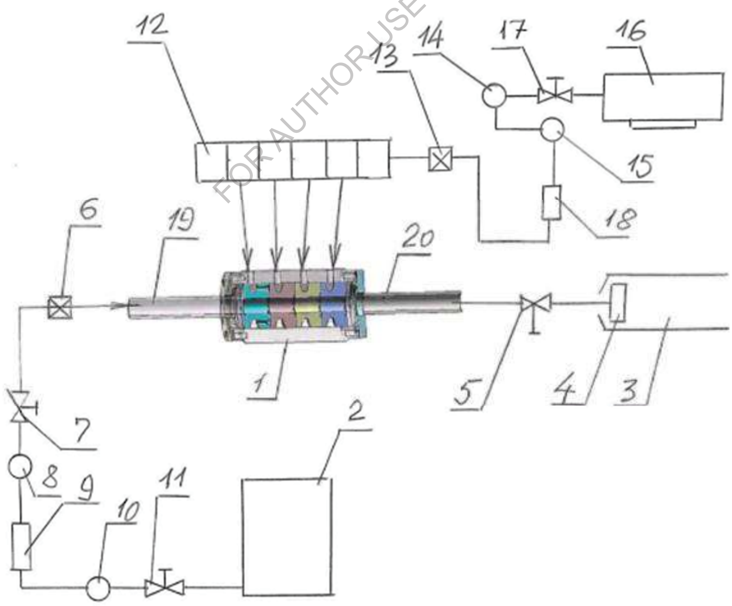
All the specifications and dimensions of the connection elements of the test set - up to the Executor - partners will represent for the control partner [possible IEC]

After this the partner [TE] will create a detailed design of the test set-up components in collaboration with [Technion]

Partner [TE] will also represent the vortex mixing device operational instructions for partner [Technion]

DIAGRAM 4

Test set-up, if the additive is compressed air



1 - device for vortex mixing

2 - natural gas source

3 - Furnace combustion chamber

4 - nozzle

5 - control valve

6 - check valve

7 - control valve

8 - manometer

9 - flow meter

10 - line thermometer

11 - control valve

12 - Distribution divider-manifold or receiver

13 - check valve

14 - manometer

15 - line thermometer

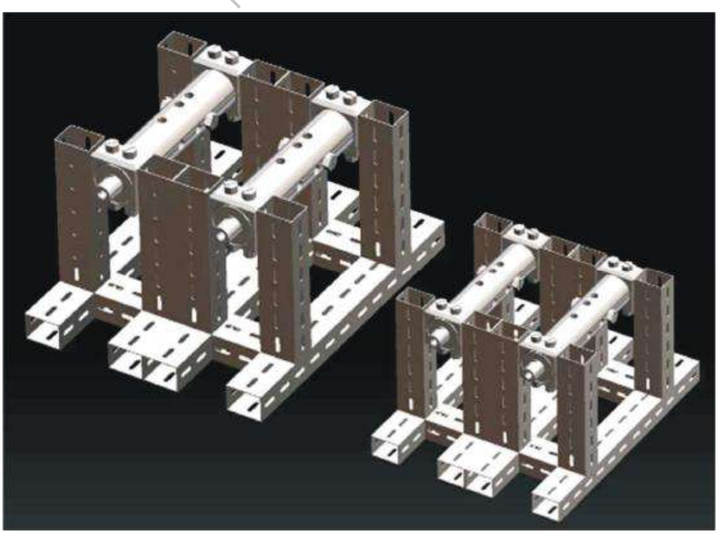
16 - compressor

17 - control valve

18 - flow meter

19 - input pipe system

20 - output pipe system



Annex 2

APPENDIX 1

IP, Related to the integrated technology of in-line vortex mixing of gaseous fuel components with receiving in the output flow - of the vortex tube from gaseous fuel components:

United States Patent	**9,708,185**
***Livshits*, et al.**	**July 18, 2017**

Device for producing a gaseous fuel composite and system of production thereof

Abstract

The invention relates to a gaseous fuel composite, a device for producing the gaseous fuel composite, and subcomponents used as part of the device for producing the gaseous fuel composite, and more specifically, to a gaseous composite made of a gas fuel such as natural gas and its oxidant such as air for burning as part of different systems such as fuel burners, combustion chambers, and the like. The device includes several vortex generators each with a curved aerodynamic channel amplifier to create a stream of air to aerate the gas as successive stages using both upward and rotational kinetic energy. Further, a vortex generator may have an axial channel with a conical shape or use different curved channel amplifiers to further create the gaseous fuel composite.

United States Patent	**9,400,107**
***Livshits*, et al.**	**July 26, 2016**

Fluid composite, device for producing thereof and system of use

Abstract

The current disclosure relates to a new fluid composite, a device for producing the fluid composite, and a method of production therewith, and more specifically a fluid composite made of a fuel and its oxidant for burning as part of different systems such as fuel burners, where the fluid composite after a stage of intense molecular interaction between a controlled flow of a liquid such as fuel and a faster flow of compressed highly directional gas such as air results in the creation of a three dimensional matrix of small hallow spheres each made of a layer of

fuel around a volume of pressurised gas. In an alternate embodiment, external conditions such as inline pressure warps the spherical cells into a network of oblong shape cells where pressurised air is used as part of the combustion process. In yet another embodiment, additional gas such as air is added via a second inlet to increase the proportion of oxidant to carburant as part of the mixture.

United States Patent **9,399,200**

***Livshits*, et al.** **July 26, 2016**

Foaming of liquids

Abstract

A foaming mechanism configured to receive a plurality of streams of gas and generate a foamed liquid, having an aerodynamic component and an aerodynamic housing disposed around at least a portion of the aerodynamic component. The aerodynamic housing includes a plurality of first channels and a plurality of second channels connected to the plurality of first channels at regular intervals on a distributed plane. The distributed plane is about perpendicular to the plurality of first channels, wherein the plurality of first channels and the plurality of second channels are configured to transform an axial stream of the gaseous working agent into a plurality of radial high-speed streams of the gaseous working agent by channeling the gaseous working agent through the plurality of first channels and into the plurality of second channels on the distributed plane. A hydrodynamic conical reflector and a hydrodynamic housing form a ring channel in an area between the hydrodynamic conical reflector and the hydrodynamic housing. An accumulation mechanism is configured to disperse the plurality of radial high-speed streams of the gaseous working agent into the ring channel and create turbulence to foam the liquid.

United States Patent **9,310,076**

***Livshits*, et al.** **April 12, 2016**

Emulsion, apparatus, system and method for dynamic preparation

Abstract

The invention relates to a fluid composite, a device for producing the fluid composite, and a system for producing an aerated fluid composite therewith, and more specifically a fluid composite made of a fuel and its oxidant for burning as part of different systems such as fuel burners or combustion chambers and the like. The invention also relates to an emulsion, an apparatus for producing an emulsion, a system for producing an emulsion with the apparatus for producing

the emulsion, a method for producing a dynamic preparation with the emulsion, and more specifically to a new type of a stable/liquid emulsion in the field of colloidal chemistry, such as a water/fuel or fuel/fuel emulsion for all spheres of industry.

United States Patent	**8,715,378**
***Livshits*, et al.**	**May 6, 2014**

Fluid composite, device for producing thereof and system of use

Abstract

The current disclosure relates to a new fluid composite, a device for producing the fluid composite, and a method of production therewith, and more specifically a fluid composite made of a fuel and its oxidant for burning as part of different systems such as fuel burners, where the fluid composite after a stage of intense molecular interaction between a controlled flow of a liquid such as fuel and a faster flow of compressed highly directional gas such as air results in the creation of a three dimensional matrix of small hallow spheres each made of a layer of fuel around a volume of pressurised gas. In an alternate embodiment, external conditions such as inline pressure warps the spherical cells into a network of oblong shape cells where pressurised air is used as part of the combustion process. In yet another embodiment, additional gas such as air is added via a second inlet to increase the proportion of oxidant to carburant as part of the mixture.

United States Patent	**8,746,965**
***Livshits*, et al.**	**June 10, 2014**

Method of dynamic mixing of fluids

Abstract

Methods are provided for achieving dynamic mixing of two or more fluid streams using a mixing device. The methods include providing at least two integrated concentric contours that are configured to simultaneously direct fluid flow and transform the kinetic energy level of the first and second fluid streams, and directing fluid flow through the at least two integrated concentric contours such that, in two adjacent contours, the first and second fluid streams are input in opposite directions. As a result, the physical effects acting on each stream of each contour are combined, increasing the kinetic energy of the mixture and

transforming the mixture from a first kinetic energy level to a second kinetic energy level, where the second kinetic energy level is greater than the first kinetic energy level.

United States Patent	**9,144,774**
***Livshits*, et al.**	**September 29, 2015**

Fluid mixer with internal vortex

Abstract

The present disclosure generally relates to a fluid mixer, a system for mixing fluids utilizing the fluid mixer, and a method of mixing fluids using the fluid mixer or the system for mixing fluids, and more specifically, to a compact static mixing device with no moving parts and capable of mixing any fluid, such as air, nitrogen gas, water, oil, polluted water, and the like. A first pressurized, incoming fluid is accelerated locally by a section reduction, is split into streams, and then is released into a second fluid found in a closed volume or an open volume after a period of stabilization. The directed and controlled first fluid slides along an insert up to directional and angled fins at a vortex creator where suction forces from a self-initiating vortex in an internal cavity draws in at least part of the first fluid to fuel the vortex. The compactness and simplicity of the fluid mixer with internal vortex can be used alone within a closed volume in a conduit, in a sprayer, or within a fixed geometry to direct the mixing vortex to specific dimensions. One or more fluid mixers can also be used in an open volume such as a reservoir, a tank, a pool, or any other fluid body to conduct mixing. The technology alone, as part of a multi-mixer system, or as a method of mixing using the fluid mixer with internal vortex is contemplated to be used in any field where mixing occurs.

United States Patent Application	**20110126462**
Kind Code	**A1**
***Livshits; David*; et al.**	**June 2, 2011**

Device for Producing a Gaseous Fuel Composite and System of Production Thereof

Abstract

The invention relates to a gaseous fuel composite, a device for producing the gaseous fuel composite, and subcomponents used as part of the device for producing the gaseous fuel composite, and more specifically, to a gaseous

composite made of a gas fuel such as natural gas and its oxidant such as air for burning as part of different systems such as fuel burners, combustion chambers, and the like. The device includes several vortex generators each with a curved aerodynamic channel amplifier to create a stream of air to aerate the gas as successive stages using both upward and rotational kinetic energy. Further, a vortex generator may have an axial channel with a conical shape or use different curved channel amplifiers to further create the gaseous fuel composite.

United States Patent Application	**20170184055**
Kind Code	**A9**
***Livshits; David*; et al.**	**June 29, 2017**

Device for Producing a Gaseous Fuel Composite and System of Production Thereof

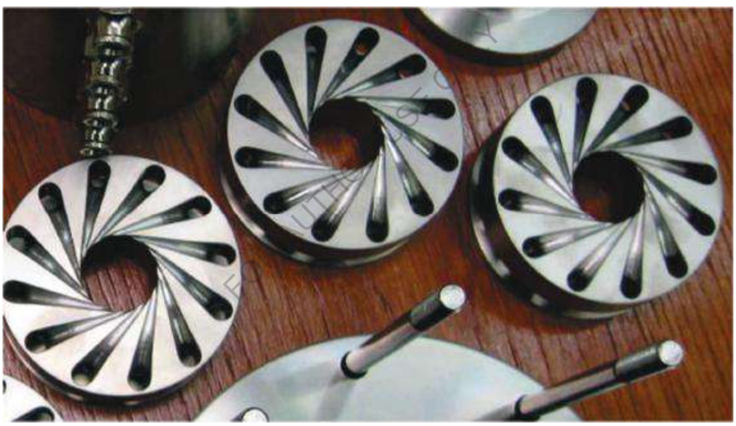
Abstract

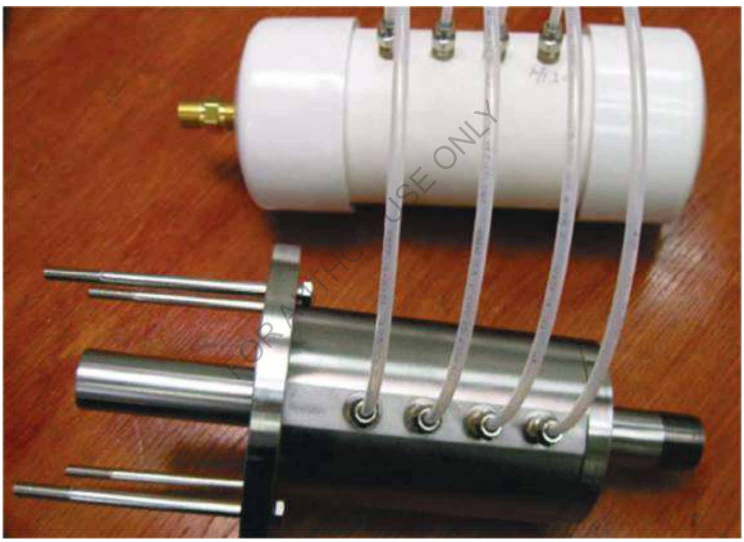
The invention relates to a gaseous fuel composite, a device for producing the gaseous fuel composite, and subcomponents used as part of the device for producing the gaseous fuel composite, and more specifically, to a gaseous composite made of a gas fuel such as natural gas and its oxidant such as air for burning as part of different systems such as fuel burners, combustion chambers, and the like. The device includes several vortex generators each with a curved aerodynamic channel amplifier to create a stream of air to aerate the gas as successive stages using both upward and rotational kinetic energy. Further, a vortex generator may have an axial channel with a conical shape or use different curved channel amplifiers to further create the gaseous fuel composite.

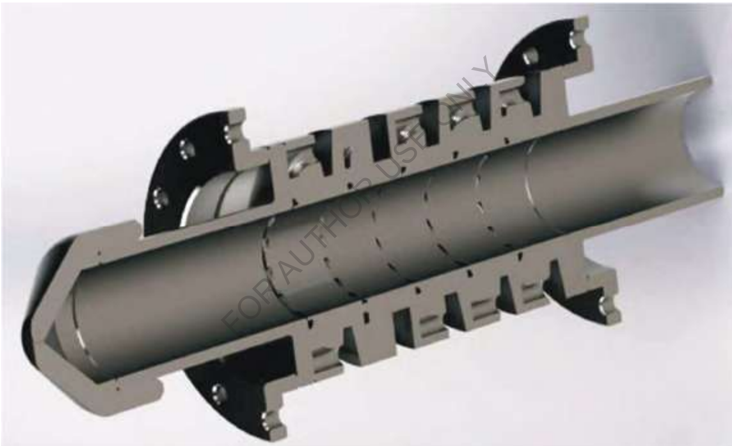
Annex 3

APPENDIX 2

Devices for vortex mixing of gaseous fuel components for industrial boilers







Annex 4

Dynamic technology of in-line multi-spiral vortex mixing of gaseous fuels flow with gaseous or steam or fluids additives.

Dynamic technology also includes versions of vortex injection of liquids in gaseous agents flow.

In relation to the most effective existing on today burner, the tested TE Vortex mixing device or burner has the following technical and operational advantages:

Compared with the most effective modern thermodynamic systems (burners) use natural gas as fuel, which have a uniform system of supply of natural gas in the combustion zone, the same system, using the TE device for the vortex mixing flow of natural gas and air, at the test demonstrated the following repeatable advantages:
Natural gas consumption for similar parameters and combustion products was reduced by at least **19.9%.**

Total air flow necessary for the combustion process and to maintain a stable state of the combustion process, declined by at least **23.6%.**

The total volume of the exhaust gases emitted during the combustion process was reduced by at least **23.6%.**

The amount subject to implementation and possible implementation of useful energy in the overall energy balance of the combustion process, increased to at least **19.9%.**

exhaust gas temperature at the outlet of the combustion process has decreased by at least **14.22%.**

The total amount of atmospheric fresh air required for combustion, reduced at least by **23%.**

The total amount of fresh intake air from the atmosphere to the combustion process, including the loss of fresh air from mixing with the exhaust gases at the outlet of the combustion process, decreased at least by **47.2%.**

Common energy loss resulting from the combustion of natural gas consumed in the combustion process for exhaust heat, decreased at least by **23%.**

Overall thermal radiation level in the room in which it has a vortex mixing thermodynamic device (burner) declined by at least **48.5%.**

The concentration of carbon monoxide (CO) in all modes of operation of the thermodynamic unit (burner) in an amount equal to the stoichiometric air, equal to **0 ppm.**

The concentration and the amount of carbon dioxide (CO2) in exhaust gases has decreased at least by **23%.**

Complete manufacturing cost, assembly and installation of the thermodynamic unit (burner) system with vortex mixing natural gas with air is less than that of a conventional power (estimated) **5 times.**

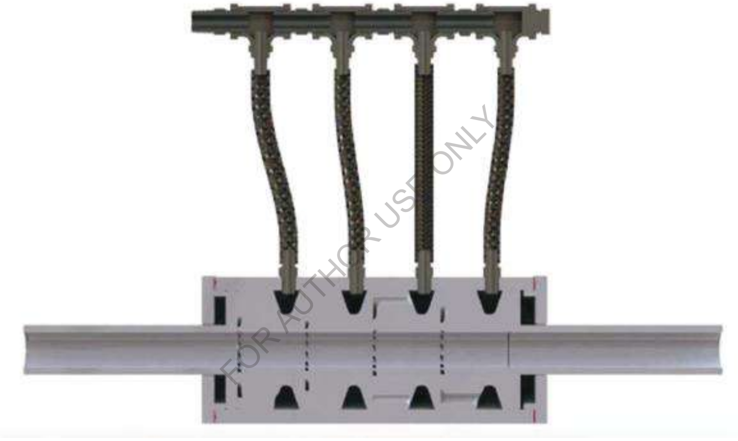
All designs of TE Vortex mixing devices related to installation in burners are taken out for the limits of the chamber of combustion that gives:

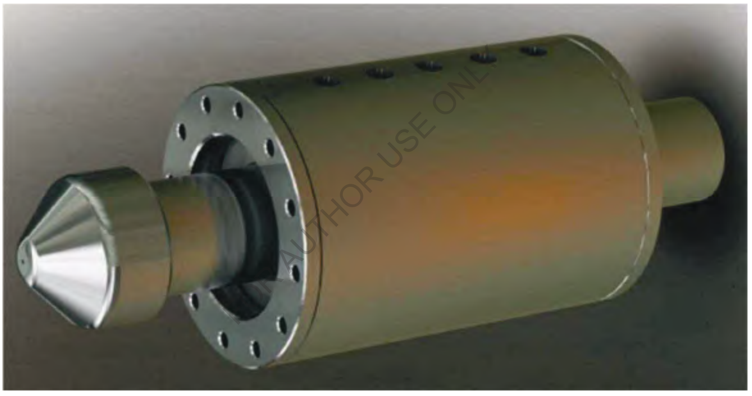
- Higher reliability **(at least on 50% above)**

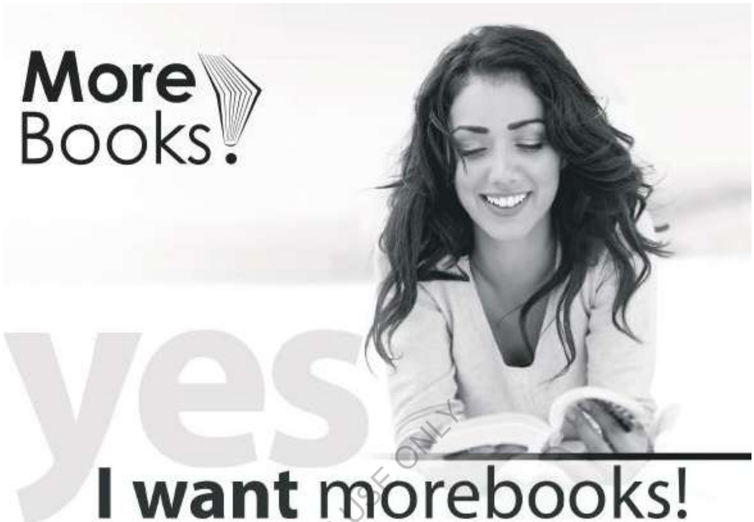
- Higher durability **(at least on 50% above)**

Thermodynamic vortex mixing device (burner) to the system vortex mixing natural gas with air, has a (calculated value) reliability parameters, durability, thermal stability and combustion stability at least **50%** higher than conventional devices of the same type, but without the vortex gas mixing system air.

Maintenance costs for the vortex thermodynamic device (burner) to the mixing vortex system of natural gas (or other fuel gas) and air is reduced by at least **50%.**



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Convertible fuels for smart home infrastructure. Part 3

Options of fuel mixtures and emulsions with a high level of dynamic homogenization in real time are considered.
Modern engines with a high-pressure pump can be equipped with a system of dynamic homogenization of the fuel mixture absolutely without minimal modifications to the fuel system.
Dynamic homogenization system can be implemented on stationary combustion engines and internal combustion engines installed on vehicles.
The dynamic homogenization system can be equipped with an additional system for forming fuel emulsions of two types, - compressible emulsion and incompressible emulsion.
The dynamic homogenization system enables up to eight additional components to be effectively emulsified in an emulsion.
The dynamic homogenization system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines mounted on vehicles.

Aleksandr Gorbov is a specialist in digitally controlled technological equipment with elements of artificial intelligence, a member of the Estonian Electronic Industry Association, a member of the New York Academy of Sciences, an active inventor, author and owner of two integrative patents.

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Convertible fuels for smart home infrastructure. Part 3

Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

Aleksandr Gorbov

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Convertible fuels for smart home infrastructure. Part 3

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Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

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Convertible fuels for smart home infrastructure.

Options for fuel blends and emulsions with a high level of dynamic homogenisation in real time are considered.

Book in 4 parts

Part 3, - Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube.

Annotation.

Modern engines with a high-pressure pump can be equipped with dynamic mixture homogenisation without any fuel system modifications at all.

The dynamic homogenisation system can be fitted to both stationary internal combustion engines and internal combustion engines mounted on vehicles.

The dynamic homogenisation system can be equipped with an additional system for the formation of two types of fuel emulsions, a compressible emulsion and an incompressible emulsion.

The dynamic homogenisation system allows up to eight additional components to be effectively emulsified.

A dynamic homogenisation system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines fitted to vehicles.

Keywords: liquid fuel; heavy fuel oil; complex dynamic homogenisation; hydrocarbon fuel blends; internal combustion engines; vortex mixing; vortex tube;

Table of Contents

Introduction :

Innovative elements in the operating principle and design of devices for the instant preparation of emulsions in a dynamic flow of its components.

A general description of the emulsions that can be produced by an innovative device for dynamic mixing and hydrodynamic activation of liquids in a developed turbulent flow.

- Emulsions can be produced in the dynamically active flow of one of the fluids making up the emulsion; no process vessels need to be used to make the emulsion, the emulsion preparation device is part of the pipeline.
- There is no need to use high or extra high pressure to prepare the emulsion.
- there is no need to use ultrasonic technology to make the emulsion.
- emulsion preparation time does not exceed fractions of a second.
- emulsion parameters, including the particle size of its components, are

determined by the geometry of the relevant sections and parts of the device for dynamic activation of liquids in a developed turbulent flow.

- the emulsion preparation process occurs at the same time as homogenisation, not only in terms of the particle size of the emulsion components, but also in terms of the level of turbulence in the flow.

1. General properties of emulsions in which the content of organic components exceeds that of inorganic components and which are obtained using a device for the dynamic activation of liquids in a developed turbulent flow.

Such an emulsion is called, - emulsion type, - water - in - oil; These types of emulsions are mainly used for fuel blends and include different types of diesel fuel as the organic component.

As more and more attempts have been made recently to obtain additional evaporation energy from emulsion combustion, water is mixed with methanol in varying proportions before emulsion production (methanol has the highest evaporation energy).

The combustion of such an emulsion produces a significant reduction in the concentration of pollutants in the exhaust gases, especially nitrogen oxides.

In addition, the methanol impurity reduces the concentration of sulphur in the exhaust gases in proportion to the concentration of methanol mixed with water.

2. General properties of emulsions in which the organic content is less than the inorganic content and which are obtained using a device for the dynamic activation of liquids in a developed turbulent flow.

Such an emulsion is called an oil-in-water emulsion; these types of emulsions are mainly used in the pharmaceutical, cosmetics, food industries and, more recently, as an irrigation agent in greenhouses, including hydroponic systems.

These emulsions require the use of chemicals and stabilisers.

3. General properties of emulsions in which the content of organic and biological components exceeds that of inorganic components and which are obtained using a device for the dynamic activation of liquids in a developed turbulent flow.

Such an emulsion is also called, - emulsion type, - water - in - oil; These types of emulsions are mainly used for fuel blends and, as an organic component, usually include different types of diesel fuel.

This emulsion is produced in a developed, dynamic flow of components

The emulsion obtained in this way has developed and stable properties for the reconstituted emulsion form and has a well-developed three-dimensional encapsulated structure.

No chemicals are required to prepare the emulsion and, in addition, the internal properties and conditioning of the emulsion are very homogeneous.

4. General properties of emulsions with less organic and biological components than inorganic components and obtained using a device for dynamically activating fluids in a developed turbulent flow.

Such an emulsion is called an oil-in-water emulsion; these types of emulsions are mainly used in the pharmaceutical, cosmetics, food industries and, more recently, as an irrigation agent in greenhouses, including hydroponic systems.

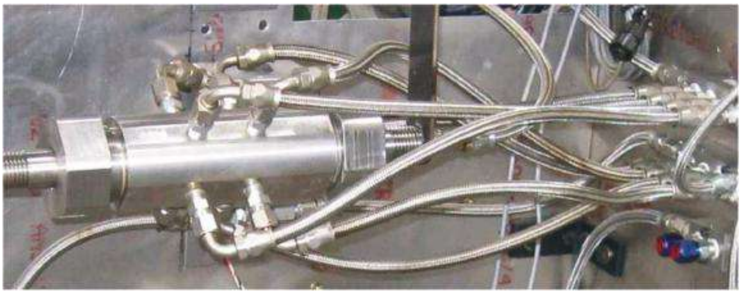
Chemical agents and stabilisers are not necessary to produce these emulsions.

This emulsion is produced in a developed, dynamic component flow, and the number of components can be 4 or more.

The emulsion obtained this way has the developed and stable properties of a restored re-homogenised emulsion and has a well-developed three-dimensional encapsulated structure.

No chemicals are required to prepare the emulsion and, in addition, the internal properties and conditioning of the emulsion are very homogeneous.

The new version of emulsion preparation technology in general and fuel emulsions in particular is as follows



The main difference between the proposed version of emulsion production is that

- The emulsion is formed in the device for dynamic mixing and activation of liquids and gases, in a dynamic flow of 60 per cent of one of the emulsion components, in which 40 per cent of the same emulsion component is injected in the opposite direction as a dynamic flow, and after that the second component of the emulsion, also in the form of a dynamic flow, is introduced where 60 and 40 per cent of one of the emulsion components meet;

- the flows of 60 and 40 per cent of one of the emulsion components are coaxial and coaxial in the three-dimensional space in which these flow fragments are moving;

- with linear flow velocities from 40% of one of the emulsion components at least 4 times higher than the linear flow velocities from 60% of the same emulsion component;

- The physical conditions at the junction of these flows, including concentric Bernoulli effects in each of the flows, ensure homogenisation of the turbulence of the combined flow (turbulent homogenisation);

- The dynamic flow of the second emulsion component is introduced into a zone where turbulent homogenisation has already taken place;

- the integrated flow of the resulting emulsion becomes homogenised with a turbulence level throughout the integrated flow at all points of the flow cross section;

- The time it takes for this process to form a homogenised turbulence level emulsion is calculated to be less than 0.1 second;

- The output of the device for dynamic mixing and activation of liquids and gases in the integrated unit is directly connected to the inlet of the standard high-pressure pump (used on any modern internal combustion engine, both diesel and petrol);

- The time interval required for the primary emulsion with a homogenised turbulence level to enter the high-pressure pump's working cylinders is also calculated to be less than 0.1 second;

- In a high-pressure pump, an emulsion with a homogenised turbulence level is compressed to over 2000 bar, suggesting that, following the definition of a nano-emulsion, at this compression level another cycle of emulsion homogenisation occurs, arising from its compression in an enclosed volume, which may qualify as a nano-emulsion process with all the properties and advantages of a nano-emulsion;

- Since no more than 0.2 seconds elapse between the homogenisation by turbulence and the homogenisation by compression, given the inertia of these processes in the fluid flow, the complete homogenisation process can be assumed to be completely homogeneous;

- This integral process of double and three-dimensional homogenisation in an uninterrupted dynamic homogeneous turbulent flow of mixing liquids into an emulsion can thus be considered as a continuous process of emulsion homogenisation and its transition at the end of the process into the category of nano-emulsions;

According to this method, the research team, with the participation of the author of this publication, formed an emulsion of diesel fuel and tap water in a stream, which when burned in the combustion chamber of a diesel engine showed unusual performance, not found in publications, and not noted in published results of scientific experiments and studies; This suggests that during the above experiments, exactly nano-emulsion was obtained, which is indirectly confirmed when analyzing emulsion photographs under a microscope;

An integrated device consisting of a mixing and homogenisation system for the turbulence level of the emulsion, linked directly to a high pressure pump as the object of dimensional geometric homogenisation of the emulsion under pressure, for extremely short time between homogenisation steps, with maximum homogeneity of particle distribution of one emulsion component in the volume of the turbulence level homogenised second emulsion component, qualifies the serial emulsion formation process as new and allows for p

These facts indicate that the described process and the integral device for its implementation are new and not obvious to any medium-skilled person in the field;

What's invented in this series of innovative technical solutions

- a new kind of nano-emulsion with double three-dimensional homogenisation in dynamic flow, both in terms of the level of turbulence and the geometry of the particles in its volume;

- A new type and configuration of apparatus for sequential homogenisation in a developed dynamic flow of liquid emulsion components.

MORE ABOUT THE PROPERTIES OF THE NEW EMULSION

Emulsions in which components of organic origin are mixed with water; In these emulsions, components of organic origin are introduced into the water; Components of organic origin can be hydrocarbon liquids, liquids containing high concentrations of fat, oil, aromatic hydrocarbons, organic fertilisers, etc.

In emulsions of this type, the organic content of the water does not exceed 50% of the weight of the total emulsion, but in most cases it is 10 - 20% of the weight of the total emulsion.

The most important parameters for such emulsions:

- the size of particles or droplets of an organic liquid in water.

- the uniformity of the distribution of particles of organic origin in the water.

- The stability of the size of particles or droplets of an organic liquid, the repeatability of these sizes and the period of time during which the uniform distribution of these particles in the volume of water is maintained.

Emulsion tests of this type can be direct measurements, where emulsions are formed on the Emulsion Shaper and the resulting emulsion is examined for measurement:

- the size of particles or droplets of a liquid component of organic origin in water.

- The uniformity and homogeneity of the distribution of particles of organic origin in water.

- the duration of the period of stability of particles or droplets of organic origin, the maintenance of geometric repeatability of these sizes over a certain period of time, and, the period of time during which the uniformity of the distribution of these particles in the volume of water is maintained.

EMULSIONS AND HOW THEY DIFFER ACCORDING TO DIMENSIONAL FACTORS

The smaller the particle size, the better the quality of the emulsion; The production of emulsions by technology and dynamic mixing, homogenisation and activation device, results in minimum particle size values; This parameter is essential when qualifying an emulsion as a mini emulsion, as a micro emulsion and as a nano emulsion;

The first tests of the emulsion preparation process on the dynamic mixing, homogenisation and activation device showed signs of multi-level preparation of capsules from component particles; this factor requires more detailed and detailed verification in subsequent tests.

Emulsions and how they differ depending on the uniformity of the particles of the additional (non-dominant component) in the volume of the dominant component.

Emulsions and their differences depending on the homogenisation method:

In classical emulsion preparation technologies different chemical reagents are used for homogenisation; When an emulsion is prepared using a dynamic mixing, homogenisation and activation device both steps of homogenisation are performed by the device geometry alone without any chemical reagents, improving the basic properties and quality of the emulsion.

Emulsions and how they differ according to successive homogenisation steps:

In emulsions of the classical type there is no homogenisation by turbulence level.

The device for dynamic mixing, homogenisation and activation has the exclusive advantage that during emulsion preparation it is also possible to homogenise the emulsion according to the level of turbulence.

Reasons for the importance of homogenisation by turbulence level :

One of the most important properties in the working cycle of a dynamic mixing, homogenising and activation device is the ability to create a homogeneous turbulence background in the emulsion formation zone across the entire cross section of the emulsion component flows.

In addition to the fact that a homogeneous turbulence background forms a homogeneous particle size background, the same hydrodynamic conditions in the preparation zone of the emulsion reduce the time required for complete preparation of the emulsion, which is very important when forming an emulsion in a dynamic flow of its components.

Reasons for the importance of homogenisation with high pressure:

The ability to operate the dynamic mixing, homogenisation and activation device in series with the high-pressure pump enables exceptional homogenisation conditions under high pressure, as the high-pressure pump receives the emulsion with a homogeneous turbulence background throughout the volume.

The originality of high-pressure emulsion processing in a stream;

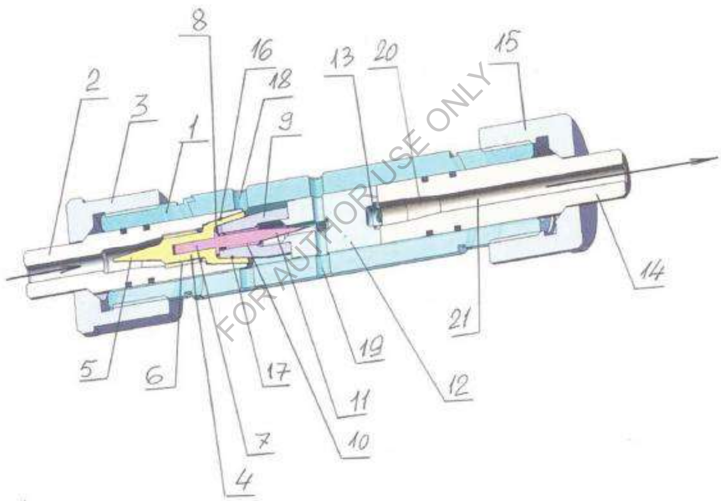
The importance of minimising the time delay between successive homogenisation cycles:

The time pause between turbulence homogenisation and pressure homogenisation, due to the properties of the device for dynamic mixing, homogenisation and activation, is no more than 10 milliseconds.

This short time interval allows the sequential homogenisation process to be considered as continuous and ensures the stability and quality of the double homogenisation process.

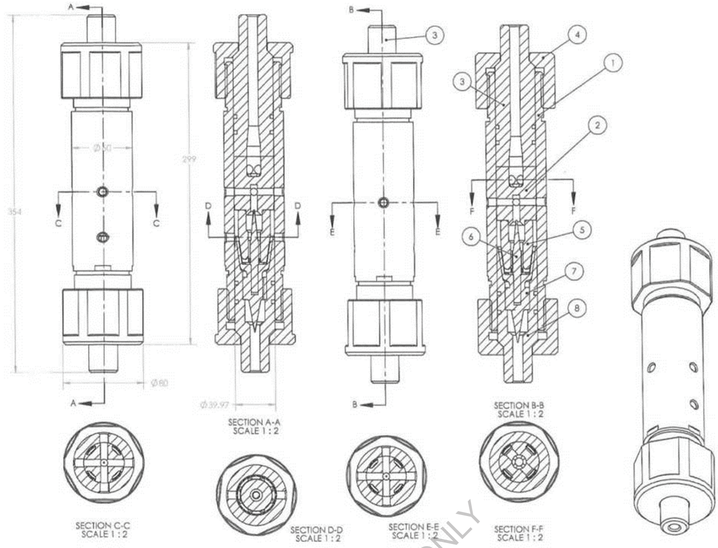
The importance of multiplication of velocity or pressure in the flow between in successive cycles of homogenisation:

The first tests on the dynamic mixing, homogenising and activating device during emulsion formation have shown that the introduction of a hydraulic resistance stimulator into the channel through which the emulsion exits the dynamic mixing, homogenising and activating device allows the emulsion preparation process to be intensified.



1- housing- caliper of the device
2- first hydrodynamic section
3- first fixation nut
4- first part of the hydrodynamic interface-transformer
5- first conical reflector of the integrated interface-transformer
6- multi-channel section of the first conical reflector of the integrated interface-transformer
7- orientation pin of the integrated interface-transformer
8- flange-distance caliper of the first and second hydrodynamic sections of the device
9- second hydrodynamic section of the device

10- multi-channel section of the second conical reflector of the integrated interfacetransformer
11- second conical reflector of the integrated interface-transformer, opposite to first conical reflector of the integrated interface-transformer
12- collector
13- vortex generator of the integrated collector
14- output section of the device
15- second fixation nut
16- outer conical channel of the device
17- inner conical channel of the device
18- inputs for methanol
19- inputs for second portion of diesel fuel
20- conical channel,- for emulsion created in the device, collection
21- output channel of the device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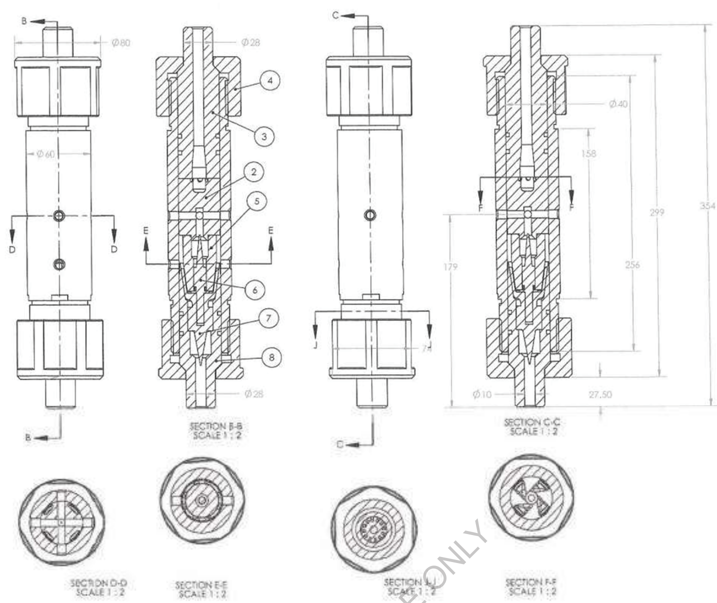


As can be seen from the model and the drawings, the device is designed in such a way that the housing of device 1 (hereinafter all signs according to the model) with internal diameter of 40 millimetres fulfils a very important function of positioning and orienting all elements of the device, which have an external diameter of 40 millimetres;

Housing 1 also serves as the linear positioning of all the elements of the unit in relation to the inlet openings for the mixture or emulsion components;

In housing 1, all elements are free to rotate independently around their axes and, once the three-dimensional orientation of all elements in relation to each other has been completed, they are locked in place using locking nuts 3 and 15;

When assembling the device, the first hydrodynamic section 2 is placed into the casing 1, its preliminary position is fixed by nut 3 and the end of section 2 is oriented to the hole 18, so that the end is in the centre of the holes 18, of which there are two in the device and into which methanol is introduced.

The integral interface is then assembled, consisting of parts 4, 9 and 10.

The reflectors 5 and 11 point in opposite directions and the flange 8 determines the distance between the parts so that the required distance between the shaping tapered surfaces in tapered ring channels 16 and 17 is obtained, 100 microns in channel 16 and 25 microns in channel 17.

The collector 12, which has a vortex generator 13, is then inserted into the housing.

Manifold 12 is orientated with respect to housing 1 by holes 19 which must be concentric with the corresponding holes in manifold 12; there are 4 such holes, each of which supplies 10% of the total quantity of diesel fuel

The lead section 14 is then inserted into the body and secured with nut 15.

The emulsion formation process from diesel and methanol follows the following sequence.

Into the axial orifice of section 2, 60% of the total amount of diesel intended for mixing with the methanol is injected at 3 to 7 bar.

The diesel fuel flow is converted from cylindrical flow to circular flow using the conical deflector 5 and the respective surfaces of section 2; the turbulence level in this flow becomes more uniform, as the lower turbulence level in the centre of the cylindrical flow becomes equal to the turbulence level at the periphery of the flow.

The annular flow is then introduced into capillary channels 6 in which the flow is accelerated, after which it enters a conical annular channel with a distance of 100 microns between the conical shaping surfaces.

In this channel, the linear velocity for this diesel fuel flow reaches its maximum and two phenomena occur simultaneously - cavitation-based movement in the channel forms ruptures and at the same time a zone of reduced pressure is formed in accordance with Bernoulli's theorem; a methanol flow is introduced into this zone through the holes 18 to fill the ruptures created by cavitation and this entire pre-mix is combined with an even more turbulent circular flow of a second diesel fuel portion of 40% of the total.

This flow, at 3 to 7 bar, is introduced into 4 radial channels at orifices 19, then reverses direction and converts to an annular channel at reflector 11, then enters capillary channels 10 and reverses direction in section 9 and enters an annular conical channel 17.

In channel 17, where the distance between forming conical surfaces is 25 microns, at a pressure equal to that of the first flow, the linear velocity of the second flow is at least 4 times higher, which allows to form a larger number of cavitation gaps of smaller size; in addition, a second annular rarefaction zone in accordance with the Bernoulli theorem is formed simultaneously.

In the annular area between section 9 and the inner bore of housing 1, two mixture flows meet in which the level of turbulence and the frequency of cavitation bursts are more intense in the channel area adjacent to the surface of section 9.

The rarefaction and the presence of a large number of free discontinuities from cavitation allow methanol droplets to be uniformly distributed throughout the mixture, and in this condition the mixture flow enters the collector 12 transit channels.

From the collector 12 transit channels (there are 4 channels in total), the mixture flow is introduced into the vortex generator, where a vortex tube is formed, passing into the conical channel 20 at the larger cone base side.

The mixture then passes from the small base of cone channel 20 to the outlet channel 21, from where it is discharged from the unit.

The entire mixing process and the first volumetric stage of homogenisation of the turbulence level of the mixture lasts no more than 0.1 second.

After the first mixing and homogenisation stage the residual size of the methanol droplets in the total diesel volume can be as little as 1 micron, with a high level of homogeneity of the methanol droplet distribution in the diesel volume.

After the first mixing and homogenisation step, using a high-pressure pump to inject the mixture into the combustion chamber, methanol droplet sizes can be reduced to 100 - 150 nanometres.

One application of the technology described:

Installing a fuel homogenisation module on the engine prior to injection virtually eliminates the risk of engine damage from degenerated fuel mixture, in which, for various reasons, water has appeared

In addition, all kinds of fuel additives containing methanol, which are not mixed homogeneously enough with the main fuel component, can also cause engine degradation.

The fuel homogenisation module for pre-injection, performs the function of repeatedly mixing base fuel with additives and after preparing an emulsion of the same base fuel, in case water appears in the base fuel.

The efficiency of the module has been tested many times on real engines (over 350 tests); no additional power sources are required and no adjustments need to be made during operation;

The module is integrated into the engine fuel system between the fuel pump and the high-pressure pump (in a modern diesel engine) or mounted after the fuel pump in any internal combustion engine;

In any engine's fuel system, installing the module requires no modifications;

The module, when produced in mass quantities (starting at 100,000 a year) will presumably cost no more than $40 and the cost of the piping components to connect the module to the engine's fuel system will be no more than $10;

Thus, at an additional cost of $50 for a new engine, the engine is 100% protected from the effects of the water contained in the fuel blend.

In comparison, the cost of replacing defective parts is at least 25 times higher.

Installation of the module on engines in service, taking into account the cost of the module itself and additional piping components, as well as the cost of labour time for installation, should not exceed $145, which is not onerous and at a price level in relation to the gain in durability and reliability of the engine should be of interest to vehicle owners.

When you consider that there are more than 450 million diesel engines in operation worldwide, if only 1% of owners install modules on their engines, then only the retro-market is talking about a market volume of $652.5 million.

Once again, it should be noted that this does not require any modifications to the engines and the module can be installed during regular maintenance by service station personnel.

By installing a compact module on an internal combustion engine for instantaneous online dynamic homogenisation prior to injection, the risk of engine damage from degraded fuel or de-generated fuel mixtures, in which water has occurred for various reasons, can be virtually eliminated.

In addition, all kinds of fuel optimisation additives which contain methanol and are not mixed homogeneously enough with the main fuel component can also cause engine degradation, especially for parts made of aluminium alloys.

The pre-injection fuel homogenisation module has the function of mixing the base fuel mixed with bio-fuel, mixed with additives and to re-emulsify the same base fuel in case water appears in the base fuel.

The source of water in most fuels is ethanol, which usually always contains water in its composition.

The efficiency of the module has been tested many times on real engines (over 350 tests); no additional power sources are required and no adjustments need to be made during operation;

The module is integrated into the engine fuel system between the fuel pump and the high-pressure pump (in modern diesel engines) or mounted after the fuel pump in any internal combustion engine;

In any engine's fuel system, installing the module requires no modifications;

Emulsion formation and homogenisation:

The original dynamic homogenisation device

A device for the dynamic homogenisation of liquid fuels and fuel mixtures has been developed, manufactured and repeatedly tested.

The unit is extremely compact, with dimensions that enable it to be integrated into virtually any internal combustion engine, whether stationary (e.g. marine engines) or fitted to vehicles (e.g. cars of all types).

The unit does not require any additional elements or components for operation and can practically be installed on the combustion engine fuel line, after the fuel pump and before the engine high-pressure pump.

All input and output connections are standardised. No special preparation, tools or equipment are required to install the unit on an internal combustion engine.

The unit has no moving parts and can be manufactured in any required dimensional scale factor;

The device can be manufactured on digitally controlled serial production equipment, no special technology, materials and tools are required for the manufacture and assembly and quality control of the device.

The thermodynamic effect of using homogenised fuel (obtained with a dynamic homogenisation device)

After homogenisation, the fuel burns homogeneously and no local zones with larger dispersion fractions are formed in its volume after injection.

This makes combustion 35-40% quicker and the effective heat extraction is accelerated to the same extent (results confirmed by over 60 test runs on a modern production diesel engine with a displacement of 2.5 litres).

The homogenisation technology works equally effectively on engines with standard equipment as well as on engines with exhaust gas recirculation systems.

In the event of unauthorised water entry into the fuel tank, dynamic homogenisation a few milliseconds before fuel enters the high pressure pump, ensures dynamic micro-emulsion formation and completely eliminates any harmful effects from water contained in the fuel emulsion on the engine and its operation; (results confirmed by over 60 test runs on a modern 2.5 litre production diesel engine).

Micro-emulsion, while maintaining the efficiency of the engine, significantly reduces the soot concentration in the exhaust gases (97% reduction) and the nitrogen oxide concentration (12% reduction), shortens the complete combustion cycle and accelerates heat recovery (results confirmed by over 60 complete reversing cycles on a modern 2.5-litre production diesel engine).

The environmental effect of using homogenised fuel

The use of a device for dynamic homogenisation of liquid fuels in the fuel system of internal combustion engines can significantly reduce the toxicity of exhaust gases and may enable compliance with environmental standards on older vehicles, including those that have been in use for a long time.

Sequential dynamic homogenisation process in a modern diesel engine

A device for dynamic homogenisation of the fuel and fuel mixture in a modern diesel engine is installed on the fuel line after the fuel pump and before the high-pressure pump.

The fuel flow after the fuel pump is divided into two streams, one of which has a flow rate equal to 60% of the total fuel flow and goes to the central axial inlet in the unit of dynamic fuel homogenisation, while the second stream, equal to 40% of the total fuel flow, goes to the integral inlet of the unit, consisting of four radial channels.

After homogenisation, the fuel burns homogeneously and no local zones with larger dispersion fractions form in the fuel volume after injection.

This makes combustion 35-40% quicker and the effective heat extraction is accelerated to the same extent (results confirmed by over 60 test runs on a modern production diesel engine with a displacement of 2.5 litres).

The homogenisation technology works equally effectively on engines with standard equipment as well as on engines with exhaust gas recirculation systems.

The process of consistent dynamic homogenisation in a modern petrol engine.

A device for dynamic homogenisation of the fuel and fuel mixture in a modern petrol engine is installed on the fuel line after the fuel pump and before the high-pressure pump.

The fuel flow after the fuel pump is divided into two streams, one of which has a flow rate equal to 60% of the total fuel flow and goes to the central axial inlet in the unit of dynamic fuel homogenisation, while the second stream, equal to 40% of the total fuel flow, goes to the integral inlet of the unit, consisting of four radial channels.

The homogenisation technology works equally effectively on engines with standard equipment and on engines with exhaust gas recirculation systems.

Application of the dynamic homogenisation process in internal combustion engines using a mixture of ethanol and petrol as fuel

Ethanol, even of high quality, contains some water;

Prior to mixing (for example) with petrol, ethanol is quite stable and there is no separation of water and alcohol;

A mixture of ethanol and petrol is not completely stable and under certain circumstances (e.g. at low temperatures) water separates from the petrol/ethanol mixture.

If a device for dynamic homogenisation is introduced into the engine system, water, under certain circumstances, separated in the engine fuel tank from the main hydrocarbon fraction of the fuel mixture in the device is dynamically mixed with the hydrocarbon fractions, transforming the resulting mixture into a micro or nano emulsion.

Emulsion combustion is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of the dynamic homogenisation process in internal combustion engines using a mixture of methanol and petrol as fuel.

Methanol, even of ordinary quality, contains virtually no water;

Before mixing (for example) with petrol, methanol is quite stable and once mixed with petrol it is virtually indistinguishable from petrol.

A mixture of methanol and petrol is not completely stable and is prone to formation of clots under certain circumstances (e.g. at low temperatures).

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of dynamic homogenisation process in internal combustion engines using a mixture of petrol and bio-fuel compositions as fuel.

As in the mentioned thermodynamic systems a mixture containing heavier biological fuel and various types of viscous combustible biological materials as well as petrol is used as fuel, clot formation goes more intensively in such types of composite fuel.

If a device for dynamic homogenisation is introduced into the thermodynamic system, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the rest of the hydrocarbon fractions, transforming the clotted mixture into a homogeneous system of micro or nano particles.

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Application of the dynamic homogenisation process in the feeding of fuel to burners of boilers, turbines and other thermodynamic devices.

Since these thermodynamic systems use heavier diesel fuel and various types of fuel oil as fuels, the formation of clots from the heavier, highly viscous fractions takes place more intensively in these fuels

If a device for dynamic homogenisation is introduced into the fuel supply and injection system of the combustion chamber, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the remaining hydrocarbon fractions with transformation of clotted mixture into micro or nano particles.

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

In individual cases and under certain conditions there are significant fuel savings.

Potential for applications of the dynamic homogenisation process in marine engines and diesel generators.

Since these thermodynamic systems use heavier diesel fuels and different types of fuel oils as fuels, the formation of clots is more intense in these fuels.

If a dynamic homogenisation device is introduced into the system of a marine engine or diesel generator, clots, under certain circumstances, formed in the fuel tanks and consisting of the main hydrocarbon fraction of the fuel mixture, are dynamically mixed in the device with the remaining hydrocarbon fractions, transforming the clotted mixture into micro or nano particles.

The combustion of homogenised fuel is generally stable thermodynamically, without detonation and with a reduced content of soot and nitrogen oxides in the exhaust gases.

Potential for the application of the dynamic homogenisation process in aircraft propulsion systems.

In view of recent reports on the experimental application of bio-fuels or fuel mixtures for aircraft engines, and knowing that fuel mixtures containing bio-fuel components tend to form clots, dynamic homogenisation of such fuel prior to injection into the combustion chamber could significantly improve the reliability of such engines and could pave the way for the use of fuel compositions in aircraft engines.

COMPARATIVE ANALYSIS OF EXISTING AND PROPOSED TECHNOLOGIES FOR THE PREPARATION AND USE OF EMULSIONS.

Comparison of known technologies for producing aqueous-fuel emulsions using chemical stabilisers and other non-hydrocarbon fuel chemicals with the invention of the on-line emulsion preparation technology:

The advantages of the invented online emulsion preparation technology over known technologies for producing aqueous - fuel emulsions, -

- there are only two components in the emulsion produced by the dynamic on-line emulsion preparation system, water and fuel oil, and the water quality can vary within a wide range from plain tap water to deionised water (using the same device to prepare the emulsion, unchanged).

- When emulsion is produced by dynamic on-line emulsion moulding, the emulsion preparation process incorporates a complex integrative dynamic on-line emulsion homogenisation process which includes instantaneous three-dimensional homogenisation of the turbulence level of the emulsion flow.

- The process of dynamic emulsion formation takes place in a sealed volume and the resulting emulsion retains its properties until the volume is depressurised.

- The emulsion obtained by dynamic on-line emulsion formation has a homogenous three-dimensional microencapsulated structure, which has the ability to regenerate after prolonged storage of the emulsion in insufficiently - sealed containers.

- The three-dimensional structure of capsules in such emulsion is at least a two-layer system with a micro- or nano-spherical water capsule core surrounded by a shell of fuel fluid; this structure allows for injection and evaporation of the core to obtain a dispersion effect equivalent to nano-spray; as a result this phenomenon enables a drastic reduction of injection pressure (by 35-45%) which gives additional fuel economy and increases injector lifetime with reduced fuel costs.

- The use of the invented emulsion in the fuel process of a modern diesel engine can reduce the concentration of soot in engine exhaust gases by 92%.

- The use of the invented emulsion makes it possible to significantly increase the intensity of heat extraction during fuel combustion in the cylinders of a modern diesel engine.

- The use of the invented emulsion in the fuel process of a modern diesel engine makes it possible to drastically reduce the time required for complete combustion in the engine cylinders and makes it possible to implement the most optimal injection timing.

- The encapsulated three-dimensional structure of the emulsion ensures that, when injected into the combustion chamber, the minimum dispersion sizes of hydrocarbon fuel particles are obtained and increases the efficiency of micro-droplet evaporation energy extraction.

- The encapsulated three-dimensional structure of the emulsion allows for a flame of uniform temperature and density when injected into the combustion chamber, which reduces the time required for complete combustion and full utilization of the heat contained in the fuel.

- The encapsulated three-dimensional structure of the emulsion ensures a symmetrical and homogeneous flame during injection into the combustion chamber, which has optimum local combustion conditions, at which the time required for accelerated heat extraction is dramatically reduced, allowing the most optimal injection timing and geometric conditions.

- the use of a water-fuel emulsion with an encapsulated three-dimensional structure as fuel enables optimised conditions and shorter injection times, which drastically shorten the complete combustion cycle and allow higher torque to be achieved for the same fuel consumption.

- The encapsulated three-dimensional structure of the emulsion ensures that when injected into the combustion chamber, a symmetrical and homogeneous flame is produced, which has optimum local combustion conditions that ensure a drastic reduction in the emission of black carbon particles into the atmosphere.

Comparison of known technologies of direct injection of water into the combustion chamber of a thermodynamic device with the invented technology of on-line emulsion formation:

- The encapsulated three-dimensional structure of the emulsion allows for a flame of uniform temperature and density when injected into the combustion chamber, which reduces the time required for complete combustion and full utilization of the heat contained in the fuel.

The advantages of the invented on-line emulsion technology over known technologies of direct injection of water into the combustion chamber.

- The encapsulated three-dimensional structure of the emulsion ensures a symmetrical and homogeneous flame during injection into the combustion chamber, which has optimum local combustion conditions, at which the time required for accelerated heat extraction is dramatically reduced, allowing the most optimal injection timing and geometric conditions.

The advantages of the invented technology of on-line emulsion formation over known technologies of direct injection of water into the air supply line of the thermodynamic apparatus.

- the use of a water-fuel emulsion with an encapsulated three-dimensional structure as fuel enables optimised conditions and shorter injection times, which drastically shorten the complete combustion cycle and allow higher torque to be achieved for the same fuel consumption.

Comparison of known technologies of direct injection of water into the combustion chamber of a thermodynamic device with the invented technology of on-line emulsion formation with an aqueous-alcohol mixture obtained by means of a preliminary dynamic mixing of water with methanol or ethanol.

Comparison of known technologies of direct injection of water into the combustion chamber of a thermodynamic device with the invented technology of on-line emulsion formation with additional aeration of the emulsion prior to injection.

Comparison of known technologies of direct injection of water into the combustion chamber of a thermodynamic device with the invented technology of emulsion preforming dynamic formation with a repeated process of emulsion formation before injection into the combustion chamber.

Comparison of known technologies of direct injection of water into the combustion chamber of a thermodynamic device with the invented technology of dynamic emulsion preformation with a process of emulsion reformation and homogenisation before injection into the combustion chamber.

Technology for dynamic, instantaneous, multi-component homogeneous mixing, homogenisation and activation of liquids, gases and aerosols based on three-dimensional, controlled and adaptive real-time cavitation.

Technology of dynamic, instantaneous, multi-component uniform mixing, homogenizing and activation of liquids, gases and aerosols on the basis of three-dimensional, managed and adaptive real-time cavitation.

Summary of system options for dynamic, instantaneous, multi-component homogeneous mixing, homogenisation and activation of liquids, gases and aerosols based on three-dimensional, controlled and adaptive real-time cavitation.

The technologies can be adapted with existing equipment in two main ways:

- in the form of a pre-mixing system with subsequent recovery of the mixture's properties and quality after various storage periods.

- as a system to be built into a pipeline and mixed on-line in this pipeline; This system in turn has two versions, - with and without recirculation of the return flow of the mixture.

The systems for assembly and installation do not require any special or original components, all parts and components of the systems are generally standard and do not require any adjustments or special modifications.

As the unit itself is relatively small, the systems are also exceptionally small, making them easy and convenient to adapt to the basic processing equipment.

Brief description Technologies for dynamic, instantaneous, multi-component homogeneous mixing, homogenisation and activation of liquids, gases and aerosols in various combinations and proportions, based on three-dimensional, controlled and adaptive real-time cavitation.

The unique properties and capabilities of this technology are currently unparalleled worldwide.

Such features and characteristics include the following:

- the extremely small size and weight of the device to implement the technology, in relation to its performance.

- there is no need for additional energy input into the process.

- the ability to run and complete a process in less than a second.

- the ability to mix liquids with liquids, liquids with liquids and gases.

- the ability to form in the flow of compressible liquids and liquid mixtures.

- the ability to homogenise mixtures of several liquids in a stream.

- the ability to mix and homogenise up to 8 different liquids simultaneously.

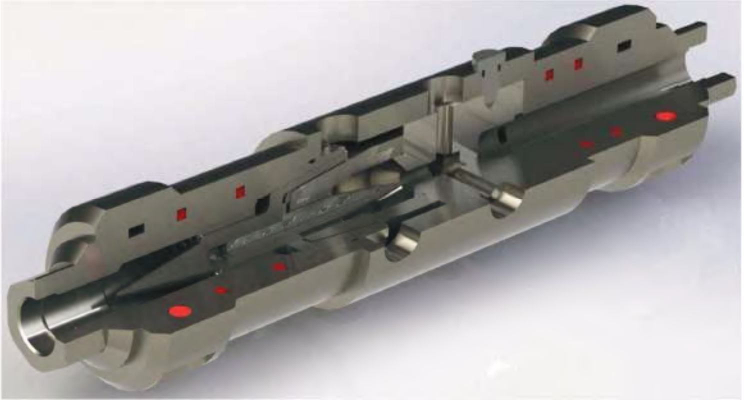
- The ability to regenerate mixtures and emulsions after several months of preparation.

- The ability to dissolve gases in liquids on the - fly, i.e. in the flow of liquids, including the dissolution of combustible gases in liquid fuels and oxygen in water.

- mixing in the device forms multi-level micro-capsules, in which the core of the capsule is a less viscous liquid mixture or emulsion, e.g. methanol or water, and the capsule shell is formed from e.g. diesel fuel

- The use of an encapsulated fuel mixture in the combustion chambers of thermodynamic devices allows a drastic increase in the energy yield of evaporation and a reduction in the required high pressure level at the injection, for example in a diesel engine from 1600 bar to 930 bar, while achieving a significant reduction in fuel consumption and pollutant concentration in the exhaust gas.

- extremely short mixture or emulsion preparation cycle, allowing the technology to be adapted to any equipment without modification.



System development and optimisation of complex integrated technical supersystems and subsystems under application of quantum computers and their derivatives in the form of programmable quantum controllers with embedded elements of artificial intelligence and artificial neural networks.

As an example, consider the different variations of innovative fuel elements in modern energy projects.

Figure 1, - the figure shows an autonomous online system for blending or emulsion preparation and homogenisation, mainly of liquid fuel materials

If such a system is integrated into the complex fuel system of a modern industrial boiler (red modules in Figure 1-1), this system becomes a complex integrated technical and technological supersystem, the development, optimisation and control of which requires high speed control processors.

This is a key factor today, because when using state-of-the-art computers, a considerable amount of control and monitoring is required to operate such boilers (Figure 1-2).

Due to the key factor that determines the efficiency of innovative undertakings and the correct choice of patent and licensing strategy for innovative projects with a high level of global novelty of the technical and software solutions used, investors and managers of new (one might say pioneering) projects in any field face a lack of the necessary level of speed and depth of instant analytical information processing when modelling processes on modern computers.

Figure 1-1, - shows the engine room with industrial boilers installed, each with a capacity of 10 tonnes of steam per hour.

The fuel system modules in the illustration are red.

Figure 1-1 - 2, - the figure shows an automatic fuel system module for an industrial boiler with a capacity of 10 tonnes of steam per hour.

All real-time control and monitoring instruments are part of the instrumentation and equipment of the fuel system and have feedback to the central control panel for all boilers in the system (Figure 1 - 2).

The simultaneous monitoring of such complex parameters and interconnections of several hundred devices and subsystems requires a productive and fast system with the initiation of artificial intelligence and artificial neural network capabilities

Figure 1-2, - the figure shows the central control and monitoring panel for a group of industrial boilers, each with a capacity of 10 tonnes of steam per hour.

It includes all necessary processor systems from the most modern computers, but as practice shows - for stable and confident operation of such a number of boilers and the complexity of thermodynamic processes running in them, require computers of significantly higher speed with an easy perception of the conditions and requirements from elements of artificial intelligence and artificial neural networks.

Information on the positive results of tests of a quantum computer created at the GUGL corporation has given rise to reasonable hope for progress in this direction

By definition and the basic information available, -

A quantum computer is a computing device that uses the phenomena of quantum mechanics to transmit and process data.

A quantum computer (unlike a conventional computer) does not operate with bits (capable of taking a value of either 0 or 1), but with Ku - bits that have values of both 0 and 1.

In theory, this allows all possible states of systems at all levels (both supersystems and subsystems) to be handled simultaneously, achieving a significant advantage over conventional computers.

In addition, the current lack of such analytical tools adds significantly to the costs of the budget of innovative projects, as it requires considerable expenditure on computer modelling and rapid screening of options with an analytical characterisation of their acceptability and all aspects of efficiency.

In addition, the laws of technical systems development formulated in TRIZ (theory of inventive problem solving) cannot reflect the diversity of tasks, functions and features of modern multifunctional object, and taking into account all new emerged and still emerging factors characterizing innovative object, it is necessary to reformulate these laws by connecting them to the laws of commercial structures development and commercialization of innovative ideas.

The formulations should be based on the data and test results of quantum computers, taking into account the nature of the underlying contradictions identified in the innovation object.

The dialectical approach (contradiction analysis) inherent in the basic problem-solving tool, which was ARIZ (algorithm for inventive problem solving), was at one time distorted by the introduction of new concepts (technical and physical contradiction) which lacked the speed and power of existing computers to model in real time.

These new concepts somewhat distorted the essence of dialectical contradiction formulated in dialectical logic, which led to difficulties in identifying the contradiction when trying to solve real inventive innovation problems by means of ARIZ, due to the lack of the necessary resource of speed and depth and breadth of modelling processes and apparatuses.

This should be a separate focus - but there is an extremely important question of principle - and what can be considered a real innovative inventive task?

From an investor's or project manager's point of view, a clear situational awareness and analytical modelling is needed to assess the progress of the project analytically: How can the correct or incorrect formulation of an inventive problem affect the commercialisation of the invention that has arisen?

The right or wrong formulation of the project's objectives and goals, in the absence of step-by-step modelling, can lead to a misunderstanding of the classic question - Can the resulting technical solution even be reliably protected against unauthorised copying?

Answering these and many other questions is now becoming a core part of the dialectic of creating a development strategy for innovative commercial projects and reliably patenting and licensing the inventions created as part of projects at all stages and phases of development.

If we take into account the fact that modern innovation sites are most often an integrative combination of apparatus, system, programme and method, it becomes clear that all parts or components of the site are in some way tied to these elements.

If we follow this logic, then it turns out that if it is necessary to achieve complete autonomy and independence of the object parts, it is necessary to endow each part with conformity with the specified - apparatus, system, program and method, which, given the requirement of patent law on the indivisibility of the invention object, and knowing the design principle of meaningless repetition of all constructive, software, technological and algorithmic features identified in the process of dividing the object into parts, makes this technique not so much a field

The 40 principles of systematic analytic synthesis of innovative technical solutions, adopted more than 70 years ago and largely aimed at achieving the ideal final result or its equivalent, will be optimised and modernised in the following format for the analysis and simulation of quantum electronic computing systems of various configurations and configurations:

Principles for brainstorming and implementation processes of synthesised innovative ideas to integrate the capabilities and requirements of the technical characteristics of quantum computers and their equivalents.

According to established practice, the development programme for each innovation project includes the following stages and phases:

1. An idea or declaration of technical necessity.

The project idea must be derived from reality and the technical and technological necessity for its realisation must be justified, and the real possibility of such realisation must be convincingly proven at the state of the art at the time of the proof.

2. Key words of the likely technical solution of choice.

There is a specific methodology for searching and selecting keywords and combinations of these words in the wording and descriptions of actual technologies and their technical descriptions.

3. The first step is to search for a patent and patent applications using the selected keywords [USPTO].

Keyword and keyword combinations are searched sequentially through the resources of the US patent office, then in parallel through the resources of the European patent office, then through the resources of other regional patent organisations.

4. Abstract formulation, preliminary computer modelling, second stage patent and patent application search by abstract, simulation and computer model work cycle simulation [USPTO].

At this stage, the lack of high-performance and high-speed computer technology hampers the developers' ability to model and simulate the workflow and formulate the basic technical specifications of a future innovative product.

5. Determination of the International Patent Classification Code, Third Search Step for a Patent and a Patent Application [European Patent Office].

Given the integrative nature of the new development, it is practically necessary to combine keywords and gradually increase the complexity of search topics using the analytical mechanisms of the latest computer technology - potentially with the help of quantum computer systems.

6. Terms of Reference.

A comprehensive consideration of the requirements and limitations of current industry and national standards is required in developing the specification to define the criteria and tolerances in all aspects of the design and its implementation in the actual application and operating environment.

7. Specifications for a new product or technical solution.

When developing specifications, the extent to which the parameters, criteria and conditions of current standards depend on and influence the conditions and possibilities of introducing and operating a new product in the infrastructure in place at the time of introduction is determined.

When developing the parameters of the specifications, it is optimal to simulate the level of influence of the parameters of the specifications on the possibilities without violating the requirements of current standards of all levels and the requirements and recommendations of production instructions, for the introduction and operation of new innovative products.

8. Technical requirements for a new product or technical solution.

The development of specifications also determines the extent to which the parameters, criteria and conditions of current standards depend on and influence the conditions and possibilities of implementing and operating the new product in the infrastructure in place at the time of implementation.

When developing the parameters of technical requirements, it is also optimal to simulate, step by step, the level of influence of the parameters of technical requirements on the possibilities, without violating the requirements of current standards at all levels and the requirements and recommendations of production instructions at all levels, for the introduction and operation of new innovative products.

9. Conceptual design [technical proposal].

New methods of conceptual design also involve parallel to 3D design in an equivalent design program, the transition to modelling and simulation of the work cycle and functional process of a new product.

10. Agreeing the technical specifications of the conceptual design with the technical requirements and specifications; Determining the subjects of the tender.

Technical specification harmonisation is carried out in parallel with modelling and simulation, which includes comparative analysis and comparison of variants and versions of technical parameters of a new product with existing products on the market.

11. Computer modelling, duty cycle simulation, stimulation and simulation of duty cycle and kinematic structure.

These processes are now part of the design process and are described in the previous paragraphs.

12. The second design phase [technical design].

The new methods of subsequent design and development stages - more familiarly known as technical design - in all local design stages and phases also involve, in parallel with 3D design in an equivalent design program, a transition to modelling and simulation of the work cycle and functional process of the new product.

13. Alignment with electrical, electronic, electrochemical, biological, semiconductor, microelectronic, parts and components of a product or technical solution.

Technical specification harmonisation in all of these areas is carried out in parallel with detailed modelling and simulations, including comparative analysis and comparison of variants and versions of technical parameters of the new product with existing products on the market, as well as with current standards and guidelines.

14. Comprehensive search phase for patent and patent applications; Determination of patent and licensing strategy [if necessary].

Key words and keyword combinations as well as specifications and technical characteristics of new products and, in addition, kinematic and electrical diagrams of new products are searched sequentially through the resources of the US patent office, then in parallel through the resources of the European patent office, then through the resources of other regional patent organizations.

Patent and licensing strategies are developed according to schemes and methodologies developed by the author of this publication.

15. Detailed design [assembly, sub-assemblies, parts, accessories, selection of construction materials, technical descriptions, operating and technological instructions, measuring instruments and methodical selection].

The harmonisation of technical specifications in all these areas and at all system levels, from the simplest subsystems to the most complex supersystems, is carried out in parallel with design, detailed modelling and simulation, including comparative analysis and comparison of versions and versions of technical parameters of a new product with existing products on the market, as well as with current standards and accepted guidelines.

16. Feasibility study, test programme and test report, test programme and methodology, test facility design, results evaluation methodology.

17. New product beta testing programme.

18. Design for series production stages.

19. Quality control and development of development processes and necessary design; Instructions for quality control.

20. Final determination of the composition and content of the technological instructions.

21. Industrial design, ergonomic solutions, standard rules and limitations [if necessary].

22. Linking the software component of the project or the complex digital component of the project to the most advanced products of its kind [if necessary].

All points of the project development programme are combined with the need for state-of-the-art computer-aided design and modelling software, taking into account the 40 principles for achieving an ideal end result, which in this publication are optimised and linked in the long term to the capabilities of quantum computers and their derivatives.

A LIST OF REFERENCES, PATENTS AND LICENSING MATERIALS.

Annex 1

United States Patent Application	**20190302107**
Kind Code	**A1**
Kauffman; Stuart; et al.	**October 3, 2019**

HYBRID QUANTUM-CLASSICAL COMPUTING SYSTEM AND METHOD

Abstract

Disclosed herein are systems and uses of systems operating between fully ***quantum*** coherent and fully classical states. Examples include a hybrid ***quantum-classical*** computing system comprising a plurality of ***quantum*** processors connected via classical means.

Annex 2

United States Patent Application	**20190310070**
Kind Code	**A1**
MOWER; JACOB C.; et al.	**October 10, 2019**

METHODS, SYSTEMS, AND APPARATUS FOR PROGRAMMABLE QUANTUM PHOTONIC PROCESSING

Abstract

A programmable photonic integrated circuit implements arbitrary linear optics transformations in the spatial mode basis with high fidelity. Under a realistic fabrication model, we analyze programmed implementations of the CNOT gate, CPHASE gate, iterative phase estimation algorithm, state preparation, and ***quantum*** random walks. We find that programmability dramatically improves device tolerance to fabrication imperfections and enables a single device to implement a broad range of both ***quantum*** and classical linear optics

experiments. Our results suggest that existing fabrication processes are sufficient to build such a device in the silicon photonics platform.

Annex 3

United States Patent Application	**20190347576**
Kind Code	**A1**
von Salis; Gian R.; et al.	**November 14, 2019**

MULTI-QUBIT ENTANGLING GATE USING A FREQUENCY-MODULATED TUNABLE COUPLER

Abstract

A ***quantum*** processing comprises n fixed-frequency ***quantum*** circuits of distinct frequencies, where n.gtoreq.3. The device further comprises a frequency-tunable coupler, designed in such a manner that its frequency can be concomitantly modulated at m frequencies, where m.gtoreq.2, and wherein said m frequencies correspond, each, to a difference of energy between a respective pair of ***quantum*** states spanned by the ***quantum*** circuits. The ***quantum*** circuits are, each, coupled to the tunable coupler. The method may rely on modulating the frequency of the tunable coupler concomitantly at said m frequencies. This, for example, is done so as to drive m energy transitions between connected pairs of states spanned by the ***quantum*** circuits and achieve an entangled state of the ***quantum*** circuits as a superposition of l states spanned by the ***quantum*** circuits, l.gtoreq.m.

Annex 4

United States Patent Application	**20190347076**
Kind Code	**A1**
PARK; Kyung-Hwan; et al.	**November 14, 2019**

APPARATUS AND METHOD FOR GENERATING QUANTUM

RANDOM NUMBERS

Abstract

The exemplary embodiments of the present invention provide a ***quantum*** random number generation apparatus according to an exemplary embodiment of the present invention including: a space-division semiconductor detector including a plurality of cells, each individually absorbing a plurality of emission particles emitted from a radioactive isotope; and a signal processor that generates a random number based on an absorption event at which the plurality of emission particles are absorbed into the plurality of cells, and thus a new type of random number conversion method that combines a spatial randomness and existing temporal randomness of the emission particle can be provided, there is no restriction generated due to the dead time, the random number generation rate can be remarkably increased, and it is possible to generate of a pure random number at high speed, which is required by a ***computer,*** a network processor, or an IoT device.

Annex 5

United States Patent Application	**20190347575**
Kind Code	**A1**
Pednault; Edwin Peter Dawson; et al.	**November 14, 2019**

SIMULATING QUANTUM CIRCUITS ON A ***COMPUTER*** USING HIERARCHICAL STORAGE

Abstract

Described herein is a simulation of an input ***quantum*** circuit, comprising a machine-readable specification of a ***quantum*** circuit. Aspects include partitioning the input ***quantum*** circuit into a group of sub-circuits based on at least two groups of qubits identified for tensor slicing, wherein the resulting sub-circuits have associated sets of qubits to be used for tensor slicing. The simulating can occur in stages, one stage per sub-circuit. A set of qubits associated with a sub-circuit can be used to partition the simulated ***quantum*** state tensor for the input ***quantum*** state circuit into ***quantum*** state tensor slices, and the ***quantum*** gates in that sub-circuit can be used to update the ***quantum*** state tensor slices into updated ***quantum*** state tensor slices. The updated ***quantum*** state tensor slices are

stored to secondary storage as micro slices.

Annex 6

United States Patent Application	**20190340532**
Kind Code	**A1**
DUCORE; Andrew Maps; et al.	**November 7, 2019**

QUANTUM ***COMPUTER*** SIMULATOR CHARACTERISATION

Abstract

The disclosure describes various aspects of ***quantum computer*** simulators. In an aspect, a method for characterizing a ***quantum computer*** simulator includes identifying simulator processes supported by the ***quantum computer*** simulator, generating, for each simulator process, characteristic curves for different gates or ***quantum*** operations, the characteristic curves including information for predicting the time it takes to simulate each of the gates or ***quantum*** operations in a respective simulator process, and providing the characteristic curves to select one of the simulator processes to simulate a circuit, ***quantum*** program, or ***quantum*** algorithm that uses at least some of the gates or ***quantum*** operations. In another aspect, a method for optimizing simulations in a ***quantum computer*** simulator is described where a simulator process is selected for simulation of a circuit, ***quantum*** program, or ***quantum*** algorithm based on characteristic curves that predict a time it takes for the simulation to be carried out.

Annex 7

United States Patent Application	**20190332731**
Kind Code	**A1**
Chen; Jianxin; et al.	**October 31, 2019**

METHOD AND SYSTEM FOR QUANTUM COMPUTING

Abstract

One embodiment described herein provides a system and method for simulating behaviour of a ***quantum*** circuit that includes a plurality of ***quantum*** gates. During operation, the system receives information that represents the ***quantum*** circuit and constructs an undirected graph corresponding to the ***quantum*** circuit. A respective vertex within the undirected graph corresponds to a distinct variable in a Feynman path integral used for computing amplitude of the ***quantum*** circuit, and a respective edge corresponds to one or more ***quantum*** gates. The system identifies a vertex within the undirected graph that is coupled to at least two-qubit ***quantum*** gates; simplifies the undirected graph by removing the identified vertex, thereby effectively removing the two-qubit ***quantum*** gates coupled to the identified vertex; and evaluates the simplified undirected graph, thereby facilitating simulation of the behavior of the ***quantum*** circuit.

Annex 8

United States Patent Application	**20190325338**
Kind Code	**A1**
Dukatz; Carl Matthew; et al.	**October 24, 2019**

QUANTUM COMPUTING IMPROVEMENTS TO TRANSPORTATION

Abstract

Methods and systems for a ***quantum*** computing approach to solving challenging, e.g., NP-complete, problems in transportation. One of the methods includes (a) ingesting transportation-related data into a graph structure, the transportation-related data being associated with a transportation system; (b) identifying a transportation metric associated with the transportation system; (c) identifying at least one attribute associated with the transportation-related data, where the transportation metric is based at least in part on the attribute; (d) using a ***quantum computer*** to derive an operational parameter for the attribute that improves the transportation metric; and (e) applying the operational parameter to the operation of the transportation system.

Annex 9

United States Patent Application	**20190339550**
Kind Code	**A1**
Grundmann; Michael Jason; et al.	**November 7, 2019**

QUANTUM CONFINED NANOSTRUCTURES WITH IMPROVED HOMOGENEITY AND METHODS FOR MAKING THE SAME

Abstract

A method that includes: providing a substrate including a layer of a crystalline material having a first surface; and exposing the first surface to an environment under conditions sufficient to cause epitaxial growth of a layer of a deposition material on the first surface, wherein exposing the first surface to the environment includes illuminating the substrate with light at a first wavelength while causing the epitaxial growth of the layer of the deposition material. The first surface includes one or more discrete growth sites at which an epitaxial growth rate of the ***quantum*** confined nanostructure material is larger than areas of the first surface away from the growth sites by an amount sufficient so that the deposition material forms a ***quantum*** confined nanostructure at each of the one or more discrete growth sites.

Annex 10

United States Patent Application	**20190325336**
Kind Code	**A1**
Reilly; Michele	**October 24, 2019**

QUANTUM BIOS FOR RECONFIGURING QUANTUM COMPUTING ARCHITECTURES

Abstract

Described herein are methods and systems for controlling an integrated optics

control system for ***quantum*** computing using a ***quantum*** bios chip. A ***quantum*** bios chip, comprising one or more qubit connection geometries and one or more error correction codes associated with the qubit connection geometries, receives instructions associated with a ***quantum*** computing application. The ***quantum*** bios chip configures one or more switching elements of an integrated optics control system coupled to the ***quantum*** bios chip, the switching elements controlling entanglement of one or more qubits of a ***quantum computer*** and the switching elements configured based on a selected one of the one or more qubit connection geometries and one of the one or more error correction codes that is compatible with the selected one of the one or more qubit connection geometries.

Annex 11

United States Patent Application	**20190318259**
Kind Code	**A1**
Mohseni; Masoud; et al.	**October 17, 2019**

CONSTRUCTING AND PROGRAMMING QUANTUM HARDWARE FOR ROBUST QUANTUM ANNEALING PROCESSES

Abstract

Among other things, an apparatus comprises ***quantum*** units; and couplers among the ***quantum*** units. Each coupler is configured to couple a pair of ***quantum*** units according to a ***quantum*** Hamiltonian characterisation of the ***quantum*** by the coupler.

Annex 12

United States Patent Application	**20190311284**
Kind Code	**A1**

Mohseni; Masoud; et al. **October 10, 2019**

CONSTRUCTING AND PROGRAMMING QUANTUM HARDWARE FOR ROBUST QUANTUM ANNEALING PROCESSES

Abstract

Among other things, an apparatus comprises ***quantum*** units; and couplers among the ***quantum*** units. Each coupler is configured to couple a pair of ***quantum*** units according to a ***quantum*** Hamiltonian characterisation of the ***quantum*** by the coupler.

Annex 13

United States Patent Application **20190325166**

Kind Code **A1**

Suresh; Vikram; et al. **October 24, 2019**

POST QUANTUM PUBLIC KEY SIGNATURE OPERATION FOR RECONFIGURABLE CIRCUIT DEVICES

Abstract

Embodiments are directed to post ***quantum*** public key signature operation for reconfigurable circuit devices. An embodiment of an apparatus includes one or more processors; and a reconfigurable circuit device, the reconfigurable circuit device including a dedicated cryptographic hash hardware engine, and a reconfigurable fabric including logic elements (LEs), wherein one or more processors are to configure the reconfigurable circuit device for public key signature operation, including mapping a state machine for public key generation and verification to the reconfigurable fabric, including mapping one or more cryptographic hash engines to the reconfigurable fabric, and combining the dedicated cryptographic hash hardware engine with the one or more mapped cryptographic hash engines for cryptographic signature generation and verification.

Annex 14

United States Patent Application **20190305206**

Kind Code **A1**

Harris; Richard G.; et al. **October 3, 2019**

SYSTEMS, METHODS AND APPARATUS FOR ACTIVE COMPENSATION OF QUANTUM PROCESSOR ELEMENTS

Abstract

Apparatus and methods enable active compensation for unwanted discrepancies in the superconducting elements of a ***quantum*** processor. A qubit may include a primary compound Josephson junction (CJJ) structure, which may include at least a first secondary CJJ structure to enable compensation for Josephson junction asymmetry in the primary CJJ structure. A qubit may include a series LC-circuit coupled in parallel with a first CJJ structure to provide a tunable capacitance. A qubit control system may include means for tuning inductance of a qubit loop, for example a tunable coupler inductively coupled to the qubit loop and controlled by a programming interface, or a CJJ structure coupled in series with the qubit loop and controlled by a programming interface.

Annex 15

United States Patent Application **20190327095**

Kind Code **A1**

HONG; Changho; et al. **October 24, 2019**

APPARATUS AND METHOD FOR RELIABLE QUANTUM

SIGNATURE

Abstract

An apparatus and method for a reliable ***quantum*** signature. The method using the apparatus for a reliable ***quantum*** signature includes preparing a ***quantum*** signature by sharing a first secret key and a first Bell state with a signer's terminal device and by sharing a second secret key and a second Bell state with a verifier's terminal device; signing, by the signer's terminal device, a message with the ***quantum*** signature using a first encoding value, the first secret key, and the first Bell state; verifying, by the apparatus, the ***quantum*** signature of the message using the first encoding value, the first secret key, and the first Bell state; and finally verifying, by the apparatus, the ***quantum*** signature of the message using the verifier's terminal device, a second encoding value, a third encoding value, the second secret key, and the second Bell state.

Annex 16

United States Patent Application	**20190305941**
Kind Code	**A1**
FU; Yingfang	**October 3, 2019**

AUTHENTICATION METHOD, DEVICE AND SYSTEM FOR QUANTUM KEY DISTRIBUTION PROCESS

Abstract

The present invention discloses an authentication method for a QKD process, and further discloses two additional authentication methods and corresponding devices, as well as as an authentication system. The method comprises the following steps: a sender selects a basis for preparing authentication information according to an algorithm in an algorithms library, and respectively applies different wavelengths to send ***quantum*** states of control information and data information according to a preset information format; a receiver filters the received ***quantum*** states, employs a basis of measurement corresponding to the same algorithm to measure the authentication information ***quantum*** state, and sends reverse authentication information when the measurement result is in line with the algorithm, and terminates the distribution process otherwise. In addition,

the sender terminates the distribution process when its local authentication information is inconsistent with the reverse authentication information. With this embodiment, the validity of the identities of the communication participants can be confirmed in real time to effectively defend against man-in-the-middle attacks and DDoS attacks; furthermore, the authentication information is generated by an algorithm-based means to prevent the waste of ***quantum*** keys.

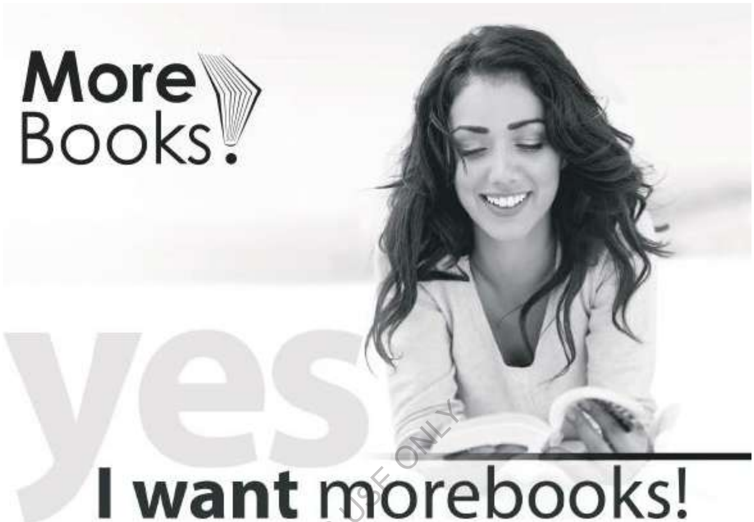
Annex 17

United States Patent Application	**20190303242**
Kind Code	**A1**
KAPIT; Eliot	**October 3, 2019**

SYSTEMS AND METHODS FOR PASSIVE QUANTUM ERROR CORRECTION

Abstract

Error-transparent ***quantum*** gates may be implemented with one or two logical qubits, each having a plurality of coupled physical qubits. Error-transparent ***quantum gates*** implement Hamiltonians that commute with the Hamiltonian for single errors in the logical qubits, and thus can operate successfully even in the presence of single errors. As a result, error-transparent ***quantum*** gates may operate with higher fidelity than their error-opaque counterparts. Each of the logical qubits may be, for example, a very small logical qubit (VSLQ) formed from a cluster of transmons or other superconducting qubits.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Convertible fuels for smart home infrastructure. Part 4

Options of fuel mixtures and emulsions with a high level of dynamic homogenization in real time are considered.
Modern engines with a high-pressure pump can be equipped with a system of dynamic homogenization of the fuel mixture without minimal modifications to the fuel system.
Dynamic homogenization system can be implemented on stationary combustion engines and internal combustion engines installed on vehicles.
The dynamic homogenization system can be equipped with an additional system for forming fuel emulsions of two types, - compressible emulsion and incompressible emulsion.
The dynamic homogenization system enables up to eight additional components to be effectively emulsified in an emulsion.
The dynamic homogenization system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines mounted on vehicles.

Aleksandr Gorbov is a specialist in technological equipment with digital software control including elements of artificial intelligence, a member of the Estonian Electronic Industry Association, a member of the New York Academy of Sciences, is an active inventor, author and owner of two integrative patents.

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OUR KNOWLEDGE
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Convertible fuels for smart home infrastructure. Part 4

Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

Aleksandr Gorbov

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Convertible fuels for smart home infrastructure. Part 4

Aleksandr Gorbov

Convertible fuels for smart home infrastructure. Part 4

Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube

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Convertible fuels for smart home infrastructure.

Options for fuel blends and emulsions with a high level of dynamic homogenisation in real time are considered.

Book in 4 parts

Part 4, - Converted innovative fuels and fuel blends in the form of an emulsion or fluid vortex tube.

Annotation

Modern engines with a high-pressure pump can be equipped with dynamic mixture homogenisation without any fuel system modifications at all.

The dynamic homogenisation system can be fitted to both stationary internal combustion engines and internal combustion engines mounted on vehicles.

The dynamic homogenisation system can be equipped with an additional system for the formation of two types of fuel emulsions, a compressible emulsion and an incompressible emulsion.

The dynamic homogenisation system allows up to eight additional components to be effectively emulsified.

A dynamic homogenisation system without modification can effectively dissolve combustible gases in the liquid hydrocarbon fuel stream before injection into the combustion chamber, both on stationary internal combustion engines and on internal combustion engines fitted to vehicles.

Keywords: liquid fuel; heavy fuel oil; complex dynamic homogenisation; hydrocarbon fuel blends; internal combustion engines; vortex mixing; vortex tube;

Table of Contents

Introduction:

TRIZ was conceived "as an exact science". For a while, all its laws and methods were in principle in line with the level of development and capabilities of technology and engineering;

What is TRIZ really about at present? How have its integration capabilities been affected by modern high technology and processor technology?
These are not all questions that need to be clarified; As an important fact, we should note the ubiquitous phenomenon of searching in biological objects for analogues of future inventions, especially based on bio-mechanical research; How does this fit with the laws, methods and techniques of TRIZ?
Nowadays, most interesting and effective inventions arise from the discovery of some element of living nature that inspires inventors to invent new and new technical solutions that solve unusual problems using unusual methods and techniques.

The criterion of the independence of the parts into which it is recommended to divide an object in modern machines and apparatuses is virtually impossible to fulfil.

If we take into account the fact that modern innovation sites are most often an integrative combination of apparatus, system, programme and method, it is clear that all parts or components of the site are in some way tied to these elements.

If we follow this logic, then it turns out that if it is necessary to achieve complete autonomy and independence of the object parts, it is necessary to endow each part with conformity with the specified - apparatus, system, program and method, which, given the requirement of patent law on the indivisibility of the invention object, and knowing the design principle of meaningless repetition of all constructive, software, technological and algorithmic features identified in the process of dividing the object into parts, makes this technique not so much a field

The methods of modern, innovative design are full-scale integration, and the principle of fragmentation is likely to evolve into the principle of selecting autonomous functional components of an object for horizontal and vertical layout integration.

Since pure invention does not exist in the modern innovation process, at least one element of integration should be the principle of commercial viability for horizontal integration and the principle of implementation universality in various technological categories, not always logically connected at first glance, for vertical integration.

The theory and algorithm of inventive problem solving were created at a time and in a situation when, at least in the Soviet economic system, there was no production of universal standardised constructional and technological components.

This defines the fundamental difference between modern machine design and engineering and the design methodologies and criteria that existed at the time of the creation of the Theory and Algorithm of Inventive Problem Solving.

All points of the project development programme are combined with the need to apply state-of-the-art computer-aided design and modelling software, taking into account the 40 principles for achieving an ideal end result, which in this publication are optimised and linked in the long term to the capabilities of quantum computers and their derivatives.

Crushing principle; (Principle No. 1)

A classic formulation of the principle:

- divide the object into independent parts;
- make the object disassembled to the level of independent and autonomous subsystems;
- increase the degree of fragmentation of the object into autonomous components capable of entering other structural configurations.

An analysis of the formulation of the principle, taking into account applications for the development and design of new design programmes, new high-speed computers of the conventional type and a future perspective with the possibility of quantum computers and their special design modifications

Figure 2. - The figure shows a system for feeding, metering and on-line preparation of different fuel mix variants, consisting of a number of independent parts and components.

As can be seen from the illustration, the above system is characterised by system triples, each consisting of a control valve, pressure gauge and flow sensor.

In the indicated triplets, each constituent element is an independent part with a link to the control and monitoring and measuring systems, outputting to a computer or processor.

All elements in and out of the system have the same standard components, connected by standard elements traditionally used in fuel system pipework.

The configuration shown allows the use of both automatic components - and manually operated components (as shown in Figure 2).

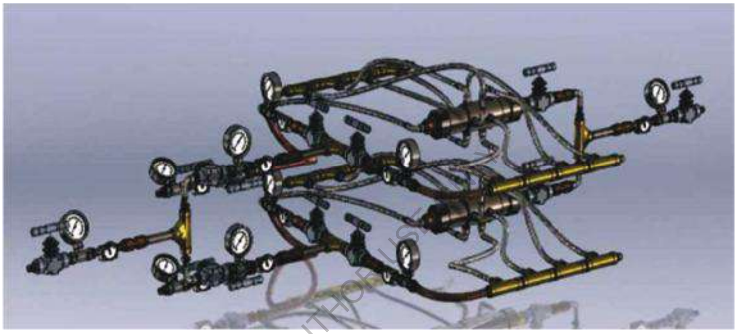


Figure 2 - 0, - the figure shows the feeding, metering and on-line preparation system for various fuel mix variants, consisting of a number of independent parts and components with the ability to operate in automatic mode, either as a set or singly.

In doing so, all components at all levels retain their system and functional independence as independent and autonomous subsystems.

This functional diversity, obtained by using standard components to complete the system, demonstrates the exceptional flexibility and possibility of multi-level modelling using high-speed computer technology, using elements of artificial intelligence and artificial neural networks for analytical modelling manipulations, combined with future quantum computer structures.

The criterion of independence limits into which it is recommended to divide an object in today's machines and apparatuses using today's computer systems is virtually impossible to fulfil.

If one also takes into account the fact that modern innovative objects are most often an integrative combination of apparatus, system, program and method, it becomes clear that all parts or components of an object are in some way tied to these elements and require different configurations of quantum computers for analytical operations.

If we follow this logic, it turns out that if it is necessary to achieve complete autonomy and independence of the parts of the object, it is necessary to endow each part with the correspondence of the specified, - apparatus, system, program and method, which, given the requirement of the patent law on the indivisibility of the invention object, and knowing the design principle of meaningless repeating all design, software, technological and algorithmic features highlighted during the division of the object into parts, makes this technique not so much a field of

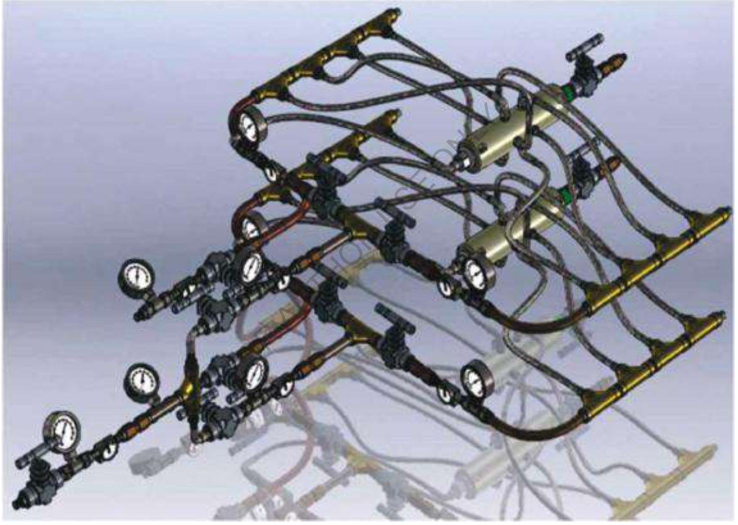


Figure 2-1, - the figure also shows a three-dimensional model of the feeding, metering and on-line preparation system for various fuel mix variants, consisting of a number of independent parts and components with the ability to operate in automatic mode, either as a set or singly.

In doing so, all components at all levels retain their system and functional independence as independent and autonomous subsystems

The object has several vertical integration levels of structural hierarchy, in which there are independent basic parts and components that perform the function of dividing the fluid flows into the required number of channels with control of pressure and fluid flow rate in each channel.

A characteristic feature of this division is that each local supersystem has three main components - control valve, pressure gauge and flow sensor - linked by standard pipe fittings, each constituting a sub-system.

The functional connection between all elements, all levels and configurations can have several variants, and for the analytical modeling variant the use of quantum computing technology is assumed in the future in the creation.

Figure 2-2, - the figure also shows a three-dimensional version of the design of the feeding, metering and on-line preparation of the various fuel mix variants, consisting of a number of independent parts and components with the ability to operate automatically, either as a set or singly.

This version looks at the option of using plastic pipe fittings in combination with flexible reinforced tubing, manually operated valves, pressure gauges and flow sensors.

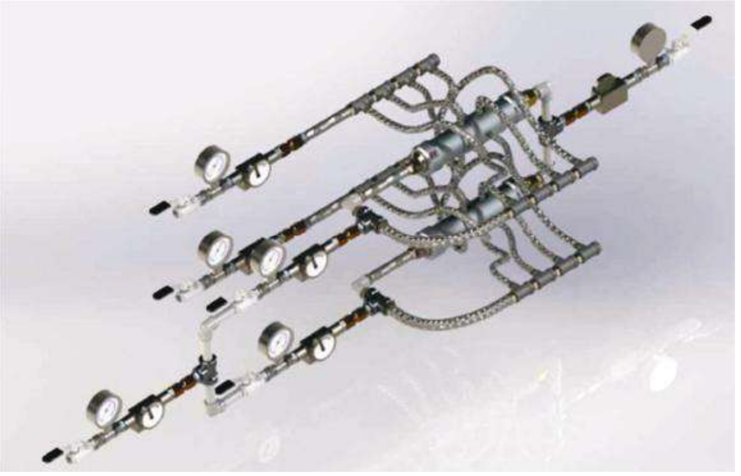


Figure 2-3, - the figure also shows a three-dimensional version of the design in which there are two independent supersystems, each with distribution pipework, linked by local supersystems for fluid entry and distribution to levels and a supersystem for connecting two fluid flows from levels, with identical subsystems in each supersystem - valve, gauge, fluid flow sensor and connection pipework fittings.

In addition, the system has two linear fluid flow and distribution supersystems each for 4 radial inlets into the unit to activate and mix the fluid flows with simultaneous homogenisation.

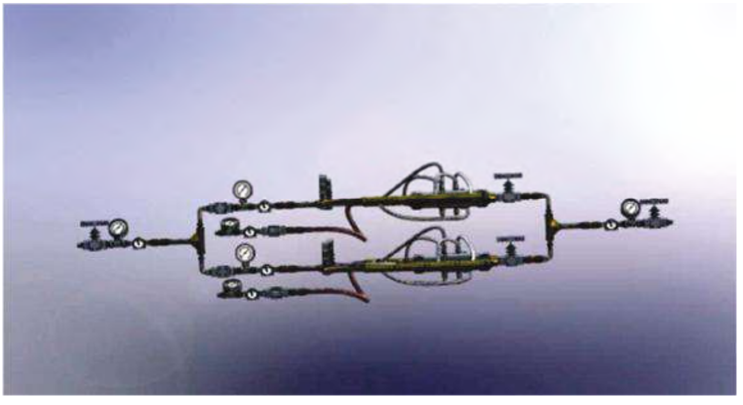


Figure 2-4, - the figure also shows the vertical structure of the feeding, metering and on-line preparation system for the various fuel mix options, consisting of a number of independent parts and components with the ability to operate in

automatic mode, either as a set or singly.

All components at all levels, however, retain their system and functional independence as independent and autonomous subsystems - with the system comprising two identical levels in the vertical hierarchy, each with full functional autonomy.

The object has several vertical integration levels of structural hierarchy, in which there are independent basic parts and components that perform the function of dividing the fluid flows into the required number of channels with control of pressure and fluid flow rate in each channel.

Characteristic is the connection of the levels between the inlet and outlet by identical subsystems, - valve, pressure gauge and liquid flow sensor at the inlet and the liquid flow sensor, pressure gauge and valve at the outlet.

The methods of modern, innovative design are full-scale integration, and the principle of fragmentation is likely to evolve into a principle of selection. autonomous functional components of an object for horizontal and vertical layout integration.

Since pure invention does not exist in the modern innovation process, at least one element of integration should be the principle of commercial viability for horizontal integration and the principle of implementation universality in various technological categories, not always at first glance logically connected, for vertical integration.

The theory and algorithm of inventive problem solving were created at a time and in a situation when, at least in the Soviet economic system, there was no production of universal standardised constructional and technological components.

This defines the fundamental difference between modern machine design and engineering and the design methodologies and criteria that existed at the time of the creation of the Theory and Algorithm of Inventive Problem Solving.

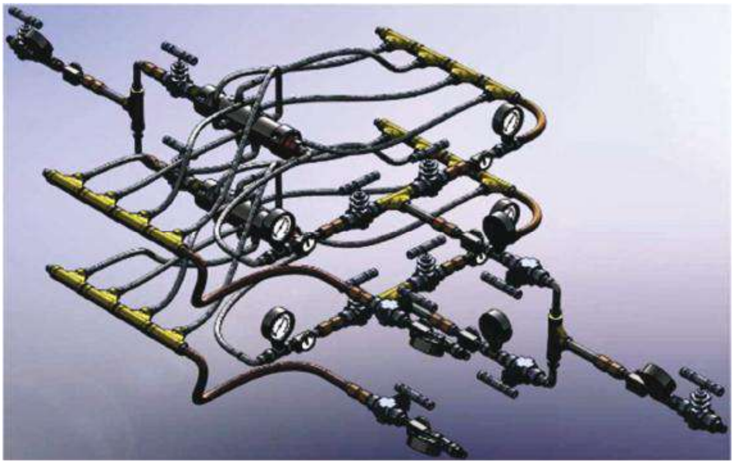


Figure 2-5, - In the figure, the distribution systems are highlighted in yellow to convert the linear fluid flows into 4 radial flows.

Modelling the parameters of such a distribution also requires high-speed tracking, measuring and control systems, which is also expected with quantum computing devices and processors.

The Principle of Imposition; (Principle No. 2).

A classic formulation of the principle:

- Separate the "interfering" part (the "interfering" property) from the object;
- highlight the only part you need (the right property).

An analysis of the formulation of the principle in view of applications for the development and design of new design programmes, new high-speed computers of the conventional type, and a future perspective with the possibility of quantum computers and their special design modifications.

Figure 3, - the figure shows a system for mixing, homogenising and, in principle, possible on-line preparation of an emulsion, mainly for fuel fluids.

Typically, these systems are tiered, i.e. they have several operating levels to increase productivity.
For ease of analysis and modelling of system operating cycles under different operating conditions, one level is removed and we are able to analyse and simulate the operation of a single level with all the functions and characteristics of the whole object.

As can be seen from figure 3, the presented layer (level) is sufficient to analyse and simulate the order of interaction between the elements (subsystems), for a line in which one liquid flow separates into two flows, of which one flow is fed to the mixing and activation device along the axis and the second flow is fed to the said device radially (4 radial flows) independently.

There is a complete unification of the subsystems in the input elements - valve, pressure gauge and flow meter.

All components used are standard, which, among other things, determines the optimum level of system costs, including service costs and the cost of maintaining the required level of maintainability and operability.

The high level of standardisation and standardisation also increases layout flexibility and widens the scope for using components from different suppliers and manufacturers.

One important factor in this issue is the real possibility of verifying the system output using components from different manufacturers.

Determination of the total output parameters of the system is also simplified in this case, as the specified level of harmonisation of the standard subsystems, allows the total output parameters of the system to be obtained by simple multiplication methods.

As a matter of principle, the current situation is one in which a deep and detailed structural analysis of the system under development can be seen, with an equally in-depth analysis of the scheme and system interaction of the parts (subsystems of the development).

In addition, this analysis requires the output parameters of each part and integrated comprehensive parameters of all parts together with real-time tracking of their impact on the technical performance of the overall system under development (development supersystem).

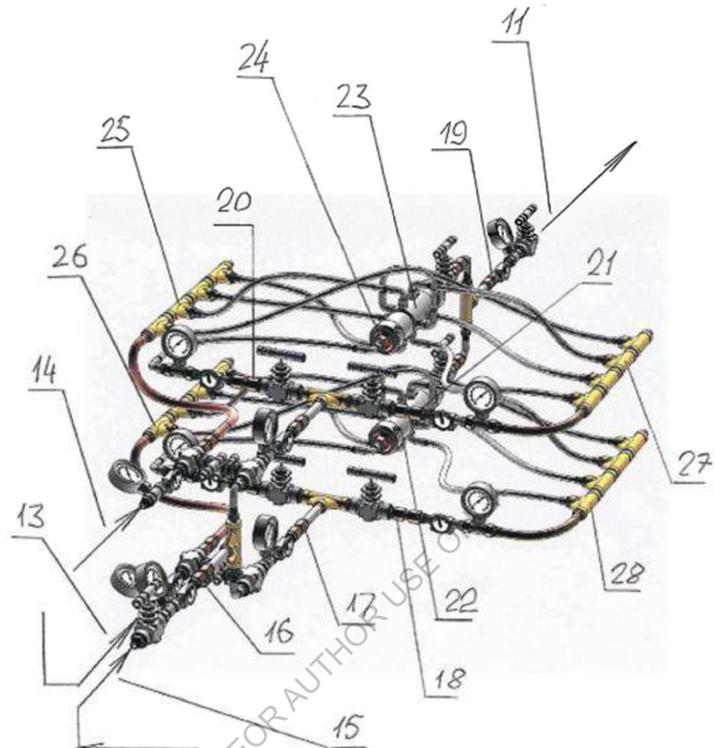


Figure 3 - 1, - the figure shows the system in a three-dimensional model generated with the ability to define and identify groups of standard components with similar functions and characteristics.

The numbers in the illustration indicate:

11, - direction of output of the received product from the system.

13, - fluid flow inlet in the lower radial fluid inlet line of the unit.

14, - fluid flow inlet in the upper radial fluid inlet line of the unit.

15, - fluid flow inlet in the axial flow and level distribution line.

16, - fluid flow input subsystem.

17, - fluid flow input subsystem.

18, - a subsystem for inputting, controlling and adjusting the fluid flow before distribution and radial feed into the unit.

19, - a sub-system for outputting, controlling and regulating the product flow before it enters the combustion chamber of an industrial boiler, for example.

20, - a subsystem for inputting, controlling and adjusting the fluid flow to the unit's axial inlet.

21, - a subsystem for inputting, controlling, distributing and regulating fluid flow to the radial inlets in the unit.

22, - the bottom unit of the system.

23, - the top unit of the system.

24, - axial inlet to the upper unit of the system.

25, - distribution line module (distribution subsystem) of the upper level.

26, - distribution line module (distribution subsystem) of the lower level.

27, - distribution line module (distribution subsystem) of the upper level.

28, - distribution line module (distribution subsystem) of the lower level.

Thus, in this system layout, a high degree of unification and standardisation makes it possible for system modelling to take place - starting with lower-level subsystems, continuing with equivalent upper-level subsystems and continuing with integration models for combining the upper and lower levels into a common supersystem.

With the most powerful modern computers, the modelling of these analytical processes is hampered by the insufficient speed of existing computer models.

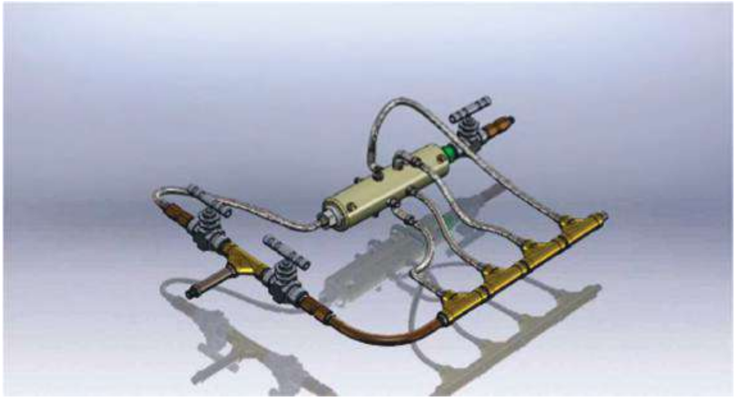


Figure 3-2, - The figure shows a simplified model of a single level system without measuring subsystems - pressure gauges and flow sensors, using only control valves with both manual and automatic control and adjustment options.

The valves are standard, made of stainless steel and have the ability to be relatively fine tuned and adjusted manually, which in principle does not allow for computer specific modelling.

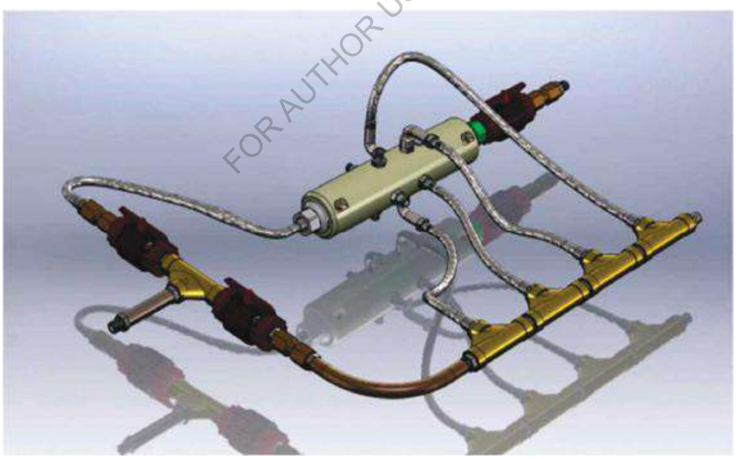


Figure 3-3, - The figure also shows a simplified model of a single level system without measuring subsystems - pressure gauges and flow sensors, using only control valves with both manual and automatic control and adjustment options.

The valves are standard, made of plastic and have the ability to be relatively fine tuned and adjusted manually, which in principle does not allow for computer specific modelling.

Since the originality of the idea of a new development is also determined by the criteria of obviousness or non-obviousness of the sets of technical solutions and private and local technical solutions included in them, the transition from technology to commerce also requires a careful analysis and equally careful modelling of each step and justification of the transition from step to step without losing the qualitative aspect.

The need for monitoring, adjustment and control subsystems also depends directly on the flow rate.

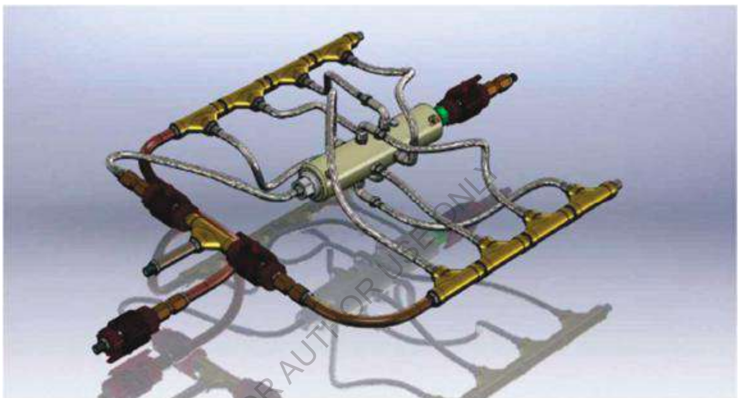


Figure 3-4, - The figure also shows a simplified model of a single level system without measuring subsystems, - pressure gauges and flow sensors, using only control valves with both manual and automatic control and adjustment options.

The valves are standard, made of plastic and have the ability to be relatively fine tuned and adjusted manually, which in principle does not allow for computer specific modelling.

There are two distribution modules in the presented model - one to distribute and supply fluid flow to the axial and radial inlets, the other to the radial inlets.

Therefore, identifying parts of a product as containing interfering features and highlighting the only part needed and its impact on the output parameters of the product being developed also requires modelling and simulation as part of the product specification and predicting the impact of these features on the potential to compete with similar products existing on the market.

Since all components (parts) of products under development are also objects of gradual technical selection, it is desirable to take into account the evolution of these components (components) in modelling programmes as well, so that the only part with the right properties is not missed in previous developments.

As a rule, component and part suppliers, for their local development process of their products, find it extremely valuable to model the functions of their products in design and process flow diagrams of supersystems.

Thus, obtaining all specifications and characteristics for modelling, taking into account all nuances and particularities also requires the capabilities offered by quantum computers in the long term.

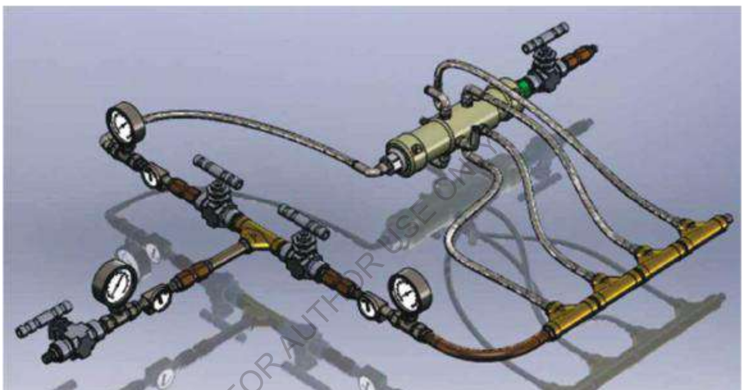


Figure 3-5, - The figure also shows a simplified model of a single system level with the additional application of measuring subsystems, - pressure gauges and fluid flow sensors, and also with the use of control valves having both manual and automatic control and adjustment options.

The valves are standard, made of stainless steel and have the ability to be relatively fine tuned and adjusted in manual mode, which in principle does not allow for computer specific modelling, but also having the ability to operate and adjust in automatic mode, which offers a real possibility for computer specific modelling, but also allows the introduction of this simplified system into automatic lines controlled by computers and with the possibility of future adaptation to quantum versions of computers and n

The principle of local quality; (Principle No. 3)

A classic formulation of the principle:

- move from a homogeneous structure of an object (or external environment, external influence) to a heterogeneous one;
- different parts of an object must have (perform) different functions;
- each part of the facility should be in the conditions most favourable to its operation.

An analysis of the formulation of the principle in view of applications for the development and design of new design programmes, new high-speed computers of the conventional type, and a future perspective with the possibility of quantum computers and their special design modifications.

Figure 4,-the figure shows a photo of the system for on-line formation of different levels of fuel fluid mixtures or emulsions; the system is made in a homogeneous structure and from one construction material, - stainless steel.

The use of such a resistant and inert material greatly extends the range of applications for the system, such as in the food industry.
The presented homogeneous system structure offers many advantages, but is more costly and requires more maintenance.

All elements of the pipe fittings, all valves, non-return valves, flexible reinforced hoses and other elements are standard, but the overall system has a homogenous structure.

Figure 4 - 1, - the figure also shows a photo of the system for on-line and remote formation of various levels of fuel fluid mixtures or emulsions; the system is also capable of on-line homogenisation at the sub-micron level; the system is also made in a homogeneous structure and from a single construction material, stainless steel.

The use of such a resistant and inert material greatly extends the range of applications for the system, such as in the food industry.

The presented homogeneous system structure offers many advantages, but is more costly and requires more maintenance.

All elements of the pipe fittings, all valves, non-return valves, flexible reinforced hoses and other elements are standard, but the overall system has a homogeneous structure.

Figure 4 - 2, - the figure shows a fragment of the system made in
The system is designed to homogenise milk at low pressure (standard systems homogenise at extremely high pressure).

In this system the constituent parts are heterogeneous, stainless steel in combination with special reinforced rubber is used as construction material; the reinforcement is made by means of spring steel.

There are different conditions and functions for one device in completely opposite fields of technology - thermodynamics and food processing - but the design is such that in both fields of use the system works in the most favourable conditions for its operation.

Targeted modelling of the application options for such a system can therefore allow for a significant extension of its scope of application without changing the basic design principles.

Figure 4 - 3, - the figure also shows a fragment of the system made in a non-uniform manner; the system is designed to homogenise milk at a low, - 15 bar pressure (standard systems perform homogenisation at extremely high pressure in the range of 1500 bar).

In this system, all constituent parts are non-uniform, standardised, stainless steel combined with a special reinforced rubber; the reinforcement is made by means of spring steel.

There are different conditions and functions for one device in completely opposite fields of technology - thermodynamics and food processing - but the design is such that in both fields of use the system works in the most favourable conditions for its operation.

Principle of asymmetry; (Principle #4).

A classic formulation of the principle:

- move from a symmetrical object shape to an asymmetrical one;
- if the object is asymmetrical, increase the degree of asymmetry.

As a rule, multi-component objects have several levels of structural and process asymmetry, - at the supersystem level, - assembly and functions are asymmetrical, - at the level of the subsystems included in the supersystem, at the scale of each subsystem - symmetrical.

Criteria for symmetry and signs of asymmetry are linked to the functional and structural features of the object.

An analysis of the formulation of the principle in view of applications for the development and design of new design programmes, new high-speed computers of the conventional type, and a future perspective with the possibility of quantum computers and their special design modifications.

Figure 5, - The figure shows an asymmetric system in which all the standard components that make up the system have a symmetric structure;

The properties of the system and its operating parameters are little affected by symmetry levels and in modelling the system in all stages and phases of development, symmetry criteria are only taken into account if the symmetry in some way affects the performance and technical characteristic of the system.

However, with the speed capability that quantum computing provides, it is possible to find further reserves for improvement, as this parameter is currently hardly modelled or analysed.

The principle of unification (Principle No. 5).

A classic formulation of the principle:

- connect objects that are homogeneous or intended for related operations;
- combine homogeneous or related operations over time.

An analysis of the formulation of the principle in view of applications for the development and design of new design programmes, new high-speed computers of the conventional type, and a future perspective with the possibility of quantum computers and their special design modifications.

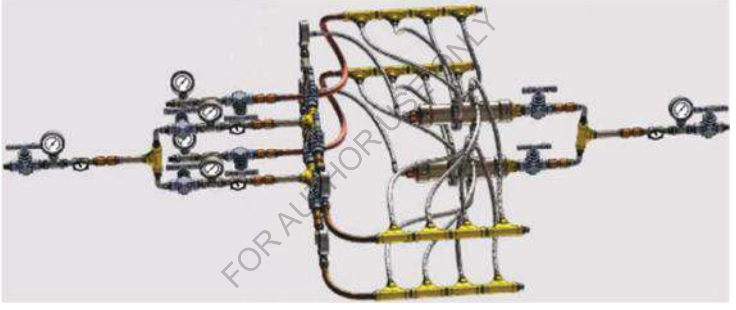


Figure 6, - the figure shows the combination of two homogeneous on-line mixing, activation and homogenisation systems into one higher-level system with combined inlet and combined outlet, with an additional valve at the outlet on each device, to regulate the pressure in the flows and working channels of the device and create a certain level of hydraulic resistance.

As shown in the previous illustrations, the combined system has two radial, four-channel input systems and one axial input system in each unit.

In order to simulate the correct proportions or input ratios in each system, high speed processors combined with a reliable and accurate feedback system and a coordinating processor providing commands and signals for local pressure and flow changes in the working channels are required.

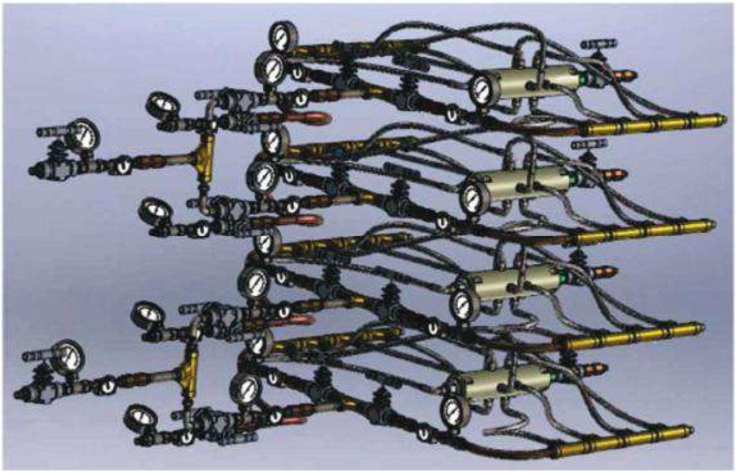


Figure 6 - 1, - The figure shows a three-dimensional model of a dual system, in which two dual systems with two devices in each system are combined;

Simulation of such a system requires at least double the speed, despite the fact that all 4 systems in this assembly are identical in design and perform identical parallel functional loads.

In other words, it can be tentatively concluded that the flexible digital control and monitoring of such a system and the coordination of the communication of this system with the combustion chamber of a thermodynamic object requires a processor technique with the capabilities and characteristics of a quantum computing device.

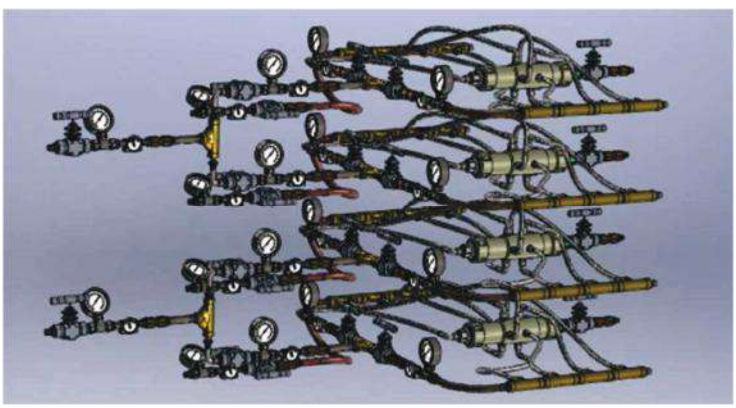


Figure 6 - 2, - The figure also shows a three-dimensional model of a dual system,

combining two dual systems with two devices in each system;

As can be seen from the figure the control and measuring subsystems of the system - the supersystems are all identical and consist of the standard lower level subsystems - valve, pressure gauge and liquid flow sensor.

Four subsystems in such a supersystem is by no means the limit, in turbine fuel lines, where fuel consumption is in the tens of tonnes per hour, 6, 8 or more subsystems can be combined.

Thousands of signals from control and measurement and control subsystems comprising hundreds of valves, gauges and flow sensors are processed in parallel, justifying the need for quantum computing processors.

Application of dynamic foam generators in complex technologies for water treatment, regeneration and recycling, including greenhouse facilities and hydroponic systems.

There are quite a few different basic technologies for the treatment and regeneration of water and aqueous process solutions and there are many different materials on the market, including composite materials for the same purpose, but when a final decision has to be made on the choice of a particular technology and material for a particular case, there are difficulties in comparative analysis.

The latest technological ideas in this and related fields encounter, when implemented, a significant influence of the scale factor on the results of one or the other water treatment, water purification and water reclamation operations.

As is always the case in technology, especially in innovative developments, properties and capabilities have been discovered in special robotics grippers that enable effective foaming when compressed air is injected from a Bernoulli vacuum gripper into a liquid (water).

During the first experiments it was found that the prototype of the future foam generator, due to the fact that the thickness of air flow is not more than a few microns, can regulate the diameter of air bubbles in the foam by adjusting the gap between the membrane and the housing.

This indicator and technical performance parameter has proved to be very important and has ensured the flexibility and breadth of capabilities of the foam generation processes in the new principle.

In addition, the load-bearing capacity of the foam produced in this way is much higher than that of conventional foam.

The ease and accuracy of adjusting the diameter of the air bubbles in the foam is shown in the following photograph - you can see how the foam format in the same liquid, in the same container, can change when the gap between the membrane and the body is altered.

This simplicity is ensured by the outstanding simplicity of the foam generator design.

As can be seen in the picture, the dynamic foam generator assembly consists of 3 parts, none of which is movable.

Additional technical conditions for planning water treatment equipment with foam generators based on the aerodynamic effect.

1. Several options for the dimensional factor of foam generators and the features of their constructional design are considered.

1.1. A foam generator with optimum dimensions and optimally matched compressed gas pressure.

The dimensions of the foam generator and the pressure of the compressed gas determine the number and size of the bubbles that form the foam that accumulates contaminants and carries them away to the surface of the liquid in the module. In addition, as mentioned above, the most important factor determining the type of foam and the overall efficiency of the foam generator is the thickness of the gap between the membrane and the generator body.

1.2. Foam generator with optimum dimensions and reduced compressed gas pressure in relation to the optimum pressure.

Lowering the compressed gas pressure relative to the nominal or optimum compressed gas pressure,- 8 atm, reduces the compressed gas bubble formation rate, reduces the number of bubbles and reduces the separation efficiency of the contaminant fractions in the water;

1.3. A foam generator with optimum dimensions and increased compressed gas pressure in relation to the optimum pressure.

Increasing the pressure of compressed gas within certain limits increases the speed of bubble formation, raises their kinetic energy, increases the level of rarefaction in the bubble formation zone and increases the lifting force of the vortices; a negative consequence of increasing the pressure of compressed gas is increased energy consumption.

1.4. Foam generator with oversized dimensions and optimum compressed gas pressure.

The proportional increase in size of the foam generator, while maintaining the pressure level of the compressed gas, while retaining the basic principle characteristics, results in an increased consumption of compressed gas and an increase in the number of bubbles formed.

At this point, the author proposes to interrupt the specification and turn to one practical application of the foam generator.

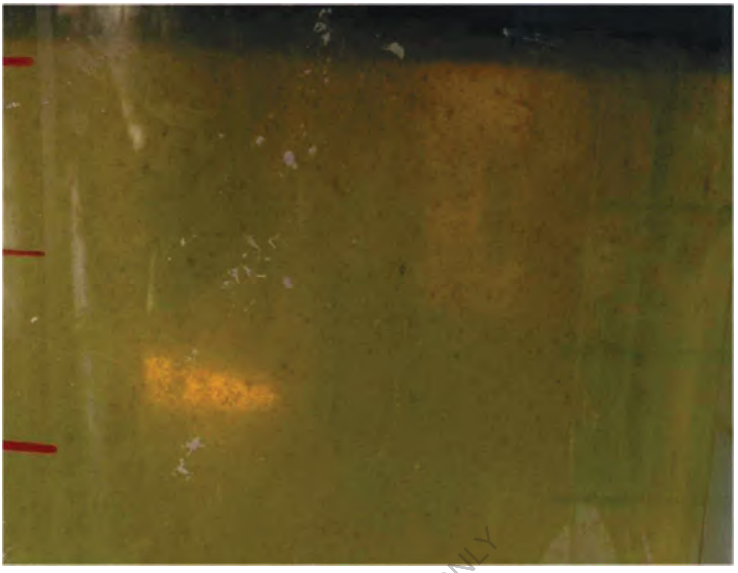
The image shows a foam layer produced by a foam generator in the wastewater of a modern butter production facility.

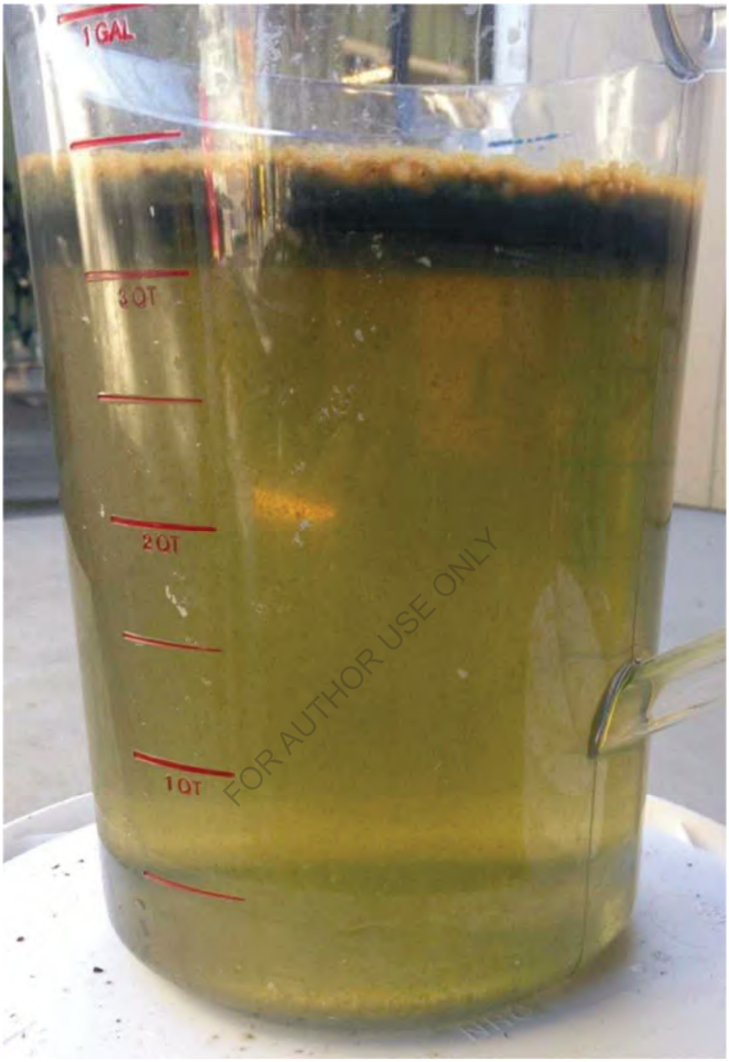
All major contaminants of grease and organic origin are present in this foam, which is a fairly insulated layer and can be relatively easily separated from the rest of the liquid, which, without grease and other organic contaminants, can be effectively treated using electrochemical technology.

This requires only a foam generator and compressor to form and generate foam - no other chemicals are required.

It should be noted that chemical reagents are currently being used in manufacturing to form similar processes, at a cost of hundreds of thousands of dollars per month, not to mention the need to protect the products produced from the harmful effects of the chemicals.

It is difficult and extremely costly to eliminate the detrimental effects of chemicals and residues in the process water on the dairy products produced. Therefore, the aerodynamic foaming technology offers significant economic and ecological advantages to ensure the same technological effect through the use of compressed air alone.





As the following picture shows, the separated layer makes up 10% of the total treated liquid volume and in addition, as the picture also shows, the water contains many impurity particles which will be separated in the sedimentation baths.

The remaining liquid (water) without organic and fatty impurities can very effectively be cleaned by electrochemical treatment methods.

What is extremely important to note is that this method of induction treatment virtually eliminates the impact of the scale factor on the process, as the most time-consuming part of the contamination is separated before the cleaned liquid enters the containers of the main process equipment.

Also extremely important is the fact that grease and organic contaminants are separated out before the mechanical filtration processes, which simplifies the cleaning processes of the mechanical filter elements.

Compared to the above, the use of the most advanced graphene materials and components does not provide such a simple and reliable processing process, let alone the real cost of all the latest graphene modifications.

The Australian research organisation CSIRO reports that its experiments with nano-channel films made from soybean graphene even make it possible to desalinate seawater to drinking water quality.

This report coincides with information on the search for an actual industrial manufacturer of soybean graphene films, indicating that the practical implementation of this method is postponed indefinitely.

Liquid treatment using aerodynamic foam generators makes it possible to obtain the required level of purification quality at a sufficiently low process cost, without having to look for investments to master the soy graphene production process.

After a digression, it again makes sense to return to discussing additional specifications.

1.1. A foam generator with reduced dimensions and optimum compressed gas pressure.

Reducing the size of the foam generator, while maintaining optimum pressure, reduces the amount of compressed gas consumed and the number of bubbles formed.

1.2. Foam generator with enlarged dimensions and increased compressed gas pressure in relation to the optimum pressure.

In this case, if the increase is made proportionally for all criteria, there is a linear increase in the compressed gas flow rate and therefore in the number of bubbles formed, while maintaining their energy performance.

1.3. Foam generator with reduced dimensions and increased gas pressure in relation to optimum gas pressure.

In this case, the amount of compressed gas is not reduced and the number of bubbles formed is not reduced, but their energy saturation is increased.

2. Module options and ratios for aerodynamic flotation

2.1. Increased column capacity of the module at a constant optimum number of foam generators.

Increasing the capacity of the column, while maintaining the optimum number of foam generators, reduces the capacity of the flotation module.

2.2. Increased capacity of the module column with more foam generators.

In this case, the performance of the module increases, but so does the energy consumption of the module.

The design of the foam generator is so versatile and simple that it can be made from a wide variety of construction materials, including all types of plastics and composites.

The following photos show foam generators made of aluminium alloys and stainless steel.

The author suggests that attention should be paid to the shape of the diaphragm combined with the conical reflector, which allows a minimum gap to be set, regardless of the construction material and its stiffness.

There are many known applications for foam generators, one of which seems necessary to disclose for comparison between the scale of application of foam generators in greenhouse conditions and the other in conditions of systems for cleaning oil from the sea surface.

A system for cleaning oil from the sea surface.

An apparatus for separating oil from seawater, mounted on a specially prepared ship.

The oil/seawater separation apparatus is to be mounted on a special ship; this ship, together with the modules in which the oil is to be separated from the seawater by aerodynamic treatment of the polluted water with foam generators, must carry all the necessary units and installations, such as diesel generators to be fueled by the same oil/water mixture, compressors to be powered by these diesel generators, piping, pumps, containers for the polluted water,

MODULE FOR AERODYNAMIC SEPARATION OF OIL FROM SEAWATER.

To create conditions for effective separation of oil from seawater, the proposed module uses a foam generator or a specially prepared configuration of pipelines with foam generators placed in series.

The oil/seawater separation unit (module) is mounted on a specially equipped ship.

In order to achieve the required level of productivity and cost-effectiveness (as calculated in advance), 125 of these modules are required to operate simultaneously.

The ship has an inlet in the bow, positioned so that oil from the sea surface, together with a thin layer of water, is introduced into a special tank as the ship moves;

In this tank, the mixture of water and oil is stabilised and the blades of a special device rake the oil from the surface of the tank; this oil is directed to an oil collector

At the bottom of the tank there is an outlet to a pump that directs the water-oil mixture to the apparatus for separating the oil from the seawater.

In the apparatus, a mixture of seawater and oil is foamed by foam generators, the oil with the foam rises to the top of the vertical pipes, from where it flows into the oil collector (the central pipe of the module).

Purified seawater flows through a system of pipelines into a special tank, from where it is discharged to the sea through an outlet in a suitable location.

The oil, separated from the seawater, flows into an intermediate storage tank, from where it flows to an oil collector.

The ship has a generator designed to generate electricity; this generator uses oil mixed with seawater dynamically mixed in a device for dynamically mixing and activating liquid hydrocarbon fuels with water, producing an emulsion with water droplet sizes not exceeding 5 microns.

The generator consists of an internal combustion engine, an associated pulse generator, the pulses from which are transmitted to an electromagnetic rotary torque amplifier, to the output shaft of which a planar electric generator is connected.

A compressor is *connected to* the generator to produce compressed air for the foam generators.

A mixture of seawater and oil is injected into the working columns through a special pipeline.

There is a raking mechanism at the top of each working column that rakes the foam consisting of oil with minimal water impurities into the oil collector column.

The oil-purified water is led out of each working column through a pipeline.

The lower part of the pipework is on the same level or slightly above the level of the foam generators.

There is a conical base at the bottom of the oil collector tower, from which accumulated debris is removed during repair and maintenance.

Compressed air from the compressors is introduced into the working columns via a pipeline.

Working columns (the module contains 6 such columns) are arranged around the oil collector column, and the working columns are connected to the oil collector columns by means of special trays.

GENERAL CHARACTERISTICS OF THE APPLIANCE.

The general characteristics of the appliance include the following parameters:

Performance.

Occupied production area.

Compressed air consumption.

The time during which the cleaning cycle takes place.

The number of modules on the ship.

The assumed and required level of seawater treatment must be at least 99.97%.

Residual concentration of oil in treated water, - cannot be more than 3 milligrams per litre of seawater treated.

The compressed air requirement at 4 bar should not reach more than 0.8 litres per second per foam generator.

The capacity per module must be at least 20 gallons of water per minute.

Number of working columns in one module.

Number of oil collector columns in one module.

Number of foam generators per working column.

Number of foam generators in the entire module.

The compressed air requirement for the entire module should not exceed 19.2 litres per second at 4 bar, or 1152 litres per minute at 4 bar or 40.7 cubic feet per minute at 4 bar.

The power requirement to run one module using screw compressors should not exceed 5 kW (6.7 hp).

THE ADVANTAGES OF THE PROPOSED METHOD AND APPARATUS.

-the machine has a modular design, which increases its overall reliability

-the capacity of the unit can be increased by increasing the number of modules, as the area covered by one module does not exceed 6 square metres; to achieve the given capacity, 125 modules are needed, which cover an area of 750 square metres.

-The entire cleaning system includes all the necessary components and cleaning stages, the system is tiered so it can be installed on a ship with a deck area of 1,000 square metres.

- modules can be arranged in two or more tiers, which, if necessary, allows the system capacity to be doubled and tripled, using the same ship size.

- the system can be supplemented with devices for additional types of cleaning.

- The system, including the ship on which it is installed, is fully autonomous and draws its energy from a mixture of oil and water, which dramatically improves its economics and eliminates the need for unauthorised vessels to enter the accident area to provide fuel.

- The system, thanks to its modular construction, has a high level of flexibility, high level of interchangeability and, consequently, a high level of reliability and maintainability.

As can be seen from the above, the proposed technology of dynamic foaming has a wide range of applications, which should provide high technical - economic advantages at low investment costs.

In conclusion, the author sees the need for a return to the principles and ways of achieving the ideal end result.

Since the quality and properties of materials largely determine the characteristics and parameters of new products, including those in the equivalent category of smart products and smart materials, it makes sense to elaborate on the latest materials that can be categorised as composite materials.

It is necessary to note the indisputable fact that only a change of material cannot be considered as an invention, it is necessary to formulate basic principles of formation of technical solutions with parallel application of the so-called composite materials, due to properties and characteristics of which not only the construction material itself changes, but in many ways due to new properties and characteristics of the materials composing the composite - as a supersystem, various subsystems - composing the material - new properties of the construction

Application of composite materials; (Principle No. 40)

A classic formulation of the principle:

- move from homogeneous materials to composite materials.

An analysis of the formulation of the principle in view of applications for the development and design of new design programmes, new high-speed computers of the conventional type, and a future perspective with the possibility of quantum computers and their special design modifications.

As the example chosen is an innovative technology for the efficient and homogeneous mixing of liquids and their derivatives, let us look at examples from the same field - the production of on-line automated fuel composites from liquids of organic origin and water, methanol, ethanol as well as oxygenated water and water obtained from permafrost, for example, saturated with methane.

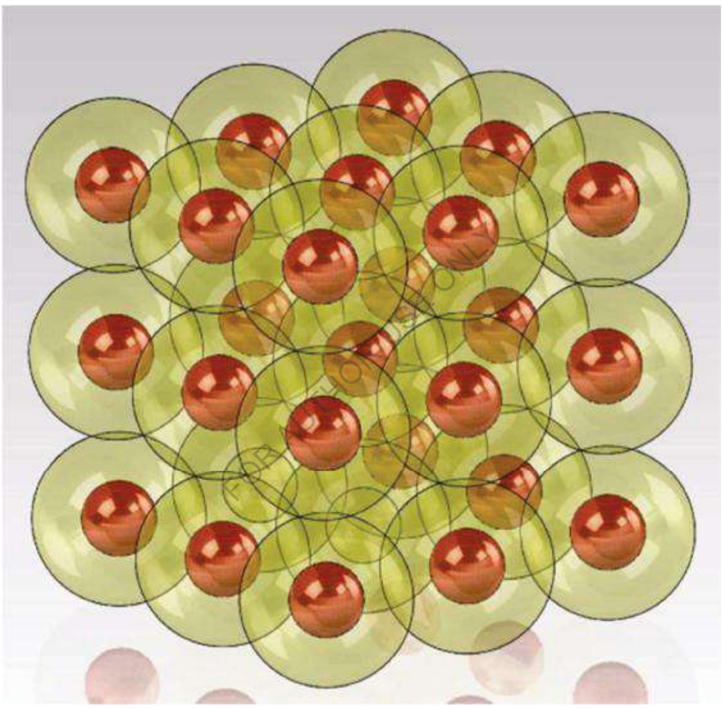


Figure 20, - the figure shows such a fuel composite, in which the red spheres are drops of inorganic liquid, and the greenish-yellow shells of the spheres are liquid of organic origin - for example, diesel fuel.

In such a composite, the spherical capsules have a hydraulic memory, which enables a regeneration-emulsion mode or process, in the event of prolonged storage and the appearance of a partial degradation effect.

Generally, increasing the level of turbulence in the composite mass returns the geometric three-dimensional structure of the composite to its original state with a higher level of homogeneity and homogeneity.

Figure 20 -1. - Figure shows a photo of an emulsion consisting of 20% methanol and 80% diesel #2.

As one can see from the photo, the capsules of the composite have a multi-level structure. They consist of capsules of the first subsystem level (outer diameter of 120 - 250 nanometers) and capsules of the second subsystem level, in which capsules of the first subsystem level are the core, and capsules of the second subsystem level are the shell.

The capsules of the second subsystem have a unifying phenomenon whereby several capsules of the second subsystem are connected to form an integral core from the connected capsules of the first subsystem.

This composite state also allows for additional blending of base components, e.g. diesel fuel and methanol with water, which drastically reduces the toxicity of exhaust gases when such composite fuels are burnt in the combustion chambers of, for example, industrial boilers.

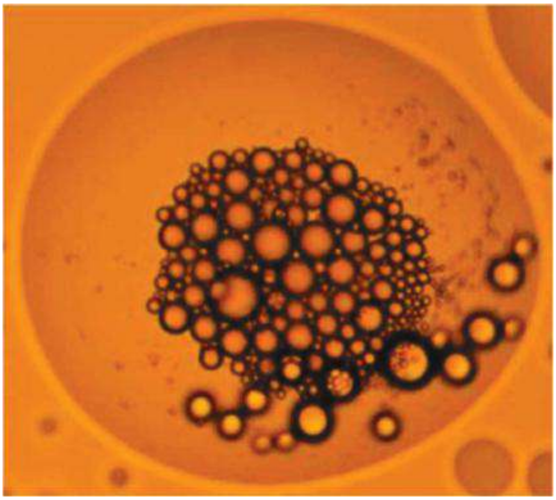


Figure 20-2, - the figure shows a composite emulsion with the integrated capsules of the first subsystem located in the central zone of the capsule of the second subsystem.

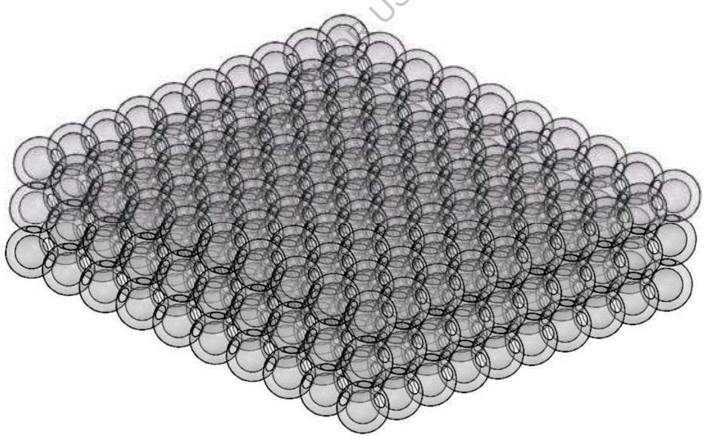


Figure 20 -2-1 shows the layer-by-layer structure of such a composite.

This fuel composite format enables a significant reduction in injection pressure (e.g. from 1600 bar to 950 bar), which reduces fuel consumption by almost 10 %, and also reduces noise and vibration levels at the combustion chamber liner.

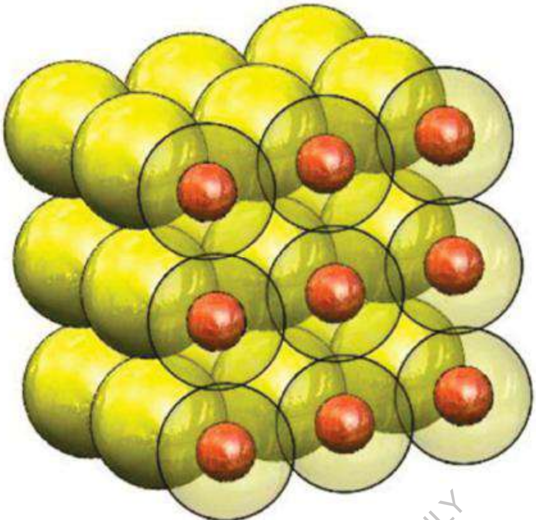


Figure 20 - 3, - The figure shows a three-dimensional model of a composite droplet with transparent shells in which, after injection, nuclei of water (red coloured spheres) explode and in doing so tear the shells of diesel fuel into particles no larger than 1 micron in size.

Geometrically the same shape and three-dimensional structure can also be achieved with solid composites, e.g. composite materials based on micropowders of synthetic diamonds, which are excellent insulators. In electronic assemblies and modules, pseudo-porous structures can be created in conductors and electronic substrates, in which unwanted electrical impulses can be efficiently dissipated without drawing additional energy.

This factor is particularly valuable for control modules for high-energy laser diode units, allowing the dissipation of spontaneous electrical pulses arising that are dangerous to the laser diode.

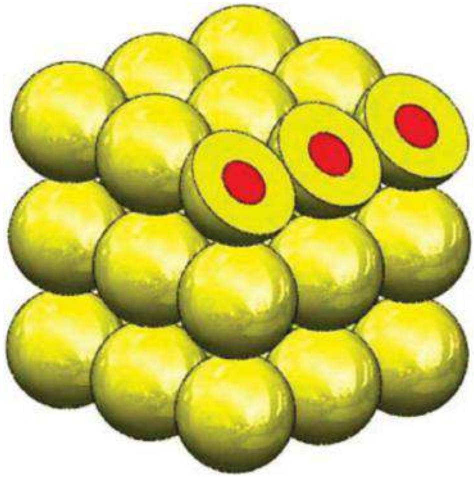


Figure 20 - 4, - The figure shows a three-dimensional model of a composite droplet with opaque shells in which, after injection, nuclei of water (spheres of red in cross-section) explode and in doing so rupture the shells of diesel fuel into particles no larger than 1 micron in size.

It is one of the most important elements of a new technical solution and also an important tool for profound and complex modification of the technical characteristics of a new product.

As is well known, replacement of one material by another is not recognised as an invention; composite material itself is the subject or object of an original invention, but very often, when an ordinary construction material is replaced by a composite, the properties and capabilities of the product are so changed that the product in which composites are used becomes completely new, previously unknown, with completely new functions and unusual technical characteristics (in most factors and in most inventions which are the basis of a new product - this is the main quality of the new product).

Of course, in order to carry out such a replacement, the amount of work required is comparable to the development of a completely new technology or a completely new product, and only companies with strong research departments can do this.

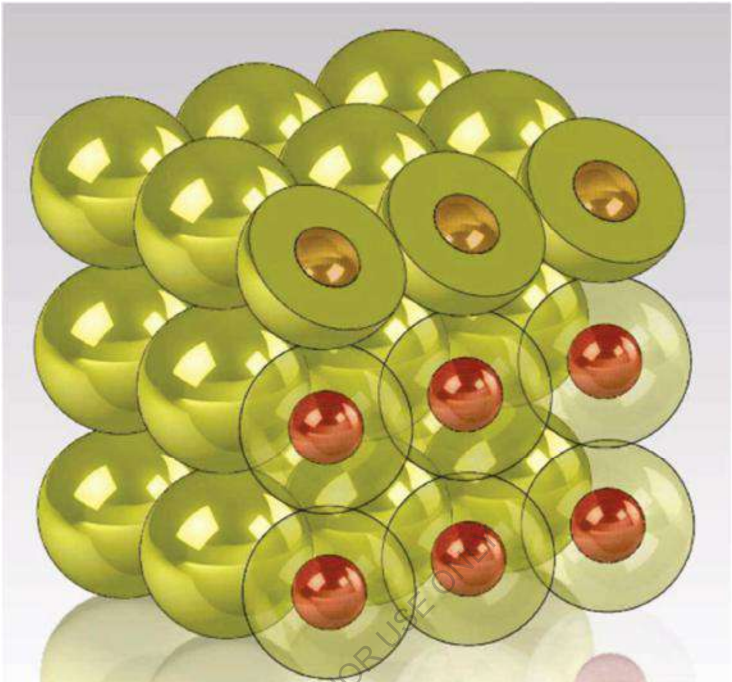


Figure 20-5 also shows the three-dimensional structure of a composite which can be both liquid and solid, e.g. a diamond and copper composite in which each capsule has a core (red in the figure) made of artificial (synthetic diamond) and a shell made of plastic metal - copper, aluminium, nickel, silver, etc.
Let's return to the question of applying quantum computer systems to complex operations and process transitions in digital technology.

In these technologies, the static and dynamic simulation of the functional parameters of complex electronic devices has a key role to play in the processes of improving the quality aspect of such devices and allows the necessary brainstorming steps to be taken beforehand to shape the structure and performance of new products.

The following is an example of such an innovative development:

A method for the static and dynamic simulation and testing of the functional parameters of a three-dimensional optical data storage device, following a formatting operation,

Preferably by exposing the volume of said storage medium to a focused and directed laser beam, in various mounting positions of the optical body, of said data storage medium, comprising:

- setting, orientation, and identification of the position of the working face of the optical data logger;

- setting, adjusting and maintaining the distance between the outer lens of the optical focusing head and the working face of the optical data logger;

- setting, adjusting and maintaining the distance between the outer lens of the optical focusing head and the inner lens of the specified head;

- identifying and maintaining the position of the optical focusing head's focal point in relation to the working face of the optical data logger;

- simulates servo stabilisation of the optical focusing head's focal point coordinates, relative to the optical data logger's datum setting coordinates;

- The optical data logger is moved in two plane coordinates and the focus coordinates of the specified optical focusing head are identified and maintained before and after pulsed laser light is applied to the volume of the specified data logger and the focus coordinates of the optical focusing head are servo-stabilised based on the setting coordinates of the optical data logger during the setting movement of the optical data logger, and, furthermore, the position of the optical focusing head is servo-stabilised based on the setting coordinates of the optical data logger.

2. Apparatus for static and dynamic simulation and testing of the functional parameters of a 3D optical data storage device, following a formatting operation, comprising:

- an optical focusing head with at least two coaxial lens movements forming the laser beam focus, interlinked by kinematic systems and software algorithms;

- a mechanism for controlling and compensating the distance between the working end of said optical focusing head and the working end of said optical data logger, kinematic systems and software algorithms associated with at least two, said coaxial mechanisms for linear movement of the lenses forming the focus of the laser beam;

- A mechanism for controlling and compensating the focus position relative to the working faces of said optical focusing head and said optical data logger, with kinematic systems and software algorithms associated with said mechanism for controlling and compensating the distance between the working faces of said optical focusing head and the working face of said optical data logger;

- A spindle carrying said optical data logger connected by kinematic systems and software algorithms to said focus position control and compensation mechanism, wherein said spindle and focus position control and compensation mechanism are mounted on a rotary table at a defined angular interval one from the other and said table connected by kinematic systems and software algorithms to a super system has, with respect to the optical axis of said optical focusing head, at least two degrees of c.f.

3. The apparatus according to claim 2, characterised in that the mechanisms for linear movement of the lens, the optical focusing head, are each a coaxial system of differential screw elements having a common geometrical and optical axis, kinematically and programmatically linked by means of a static differential screw element included in the kinematic chain of each of said mechanisms.

4. The apparatus of claim 2, characterised in that, all structural elements of the linear lens movement mechanisms of the optical focusing head are coaxial with each other and have an opening in the axis in which the lenses are fixed in the output elements having the possibility of linear movement.

5. The apparatus of claim 2, characterised in that, the output elements of the linear lens movement mechanisms, of said optical focusing head, are in direct sliding contact with each other, and with, said static element of the differential screw in indirect sliding contact.

6. The apparatus of claim 2, characterised in that the said output elements of the linear lens movement mechanisms of the said optical focusing head have a common local kinematic circuit comprising a static differential screw element carrying fixing devices for the output element, in which the inner lens of the said optical focusing head is fixed, the said output element mounted therein, in the outer cylindrical surface of which the output element is sliding, in the

7. Apparatus according to claim 2, characterised in that, said locking devices are, each, a screw at the end of which there is an eccentric axis with a ball rolling bearing.

8. Apparatus according to claim2,7, characterised in that, the bearings of the locking devices, are the closing links of said local kinematic chain.

9. Apparatus according to claim 2, characterised in that the mechanisms for linear movement of the lenses of the optical focusing head are coupled together by a common static element and in the coupled state constitute a double differential screw mechanism, with adjustable angular distortion of the linear path of the output elements carrying the optical lenses.

10. Apparatus for static and dynamic simulation and testing of functional parameters of a three-dimensional optical data storage device, after performing the formatting operation, mainly by simulating basic writing, reading, erasing and their combinations, as well as simulating the servo-stabilization of three-dimensional coordinates of the focus of the light energy pulse source on the photosensitive internal volume of the specified optical data storage device,

consisting of:

- a source of light energy, such as a laser diode that is optically coupled to an optical focusing head;

- a converter of the output parameters of the indicated light energy source with at least two energy parameters connected to the light energy source with regard to its output parameters and to the mains power conversion device with regard to its input parameters;

- An optical system comprising a support pedestal on which is mounted an optical focusing head coupled by kinematic systems and software algorithms to a mechanism for controlling, compensating, and pseudo servo stabilizing the focus position of said optical focusing head within the three-dimensional volume of said optical data storage device, Based on a flexible drive and coupled to a system of, for example, capacitive sensors mounted in opposition to said optical storage medium's drive end;

- A system for comparative optical identification of the vertical coordinate of the actual focus position, linked by kinematic systems and software algorithms to mechanisms for control, compensation and pseudo servo-stabilisation of the focus position;

- a system for filtering, selectively amplifying, receiving and identifying signals from said optical data logger and, in addition, a swivel mechanism whose swivel mechanism carries a spindle with mounting elements for the optical data logger and said system for optical comparative identification of the vertical coordinate of the actual position of focus

As a result of system analysis and virtual simulation of the various states and processes in the innovation process branches, new techniques for generating optimal and new technical solutions emerge.

It is particularly important to assess the need to start the innovation process and to understand, or better to calculate, all the possible developments in the commercialisation process.

List of references, patents and licensing materials.

Annex 1

United States Patent Application	**20100193445**
Kind Code	**A1**
	August 5, 2010

FOAMING OF LIQUIDS

Abstract

Methods and systems for processing of liquids using compressed gases or compressed air are disclosed. In addition, methods and systems for mixing of liquids are disclosed.

Annex 2

United States Patent Application	**20150130091**
Kind Code	**A1**
	May 14, 2015

FOAMING OF LIQUIDS

Abstract

A foaming mechanism configured to receive a plurality of streams of gas and generate a foamed liquid, having an aerodynamic component and an aerodynamic housing disposed around at least a portion of the aerodynamic component. The aerodynamic housing includes a plurality of first channels and a plurality of second channels connected to the plurality of first channels at regular intervals on a distributed plane. The distributed plane is about perpendicular to the plurality of first channels, wherein the plurality of first channels and the plurality of second channels are configured to transform an axial stream of the gaseous working agent into a plurality of radial high-speed streams of the gaseous working agent by channeling the gaseous working agent through the plurality of first channels and

into the plurality of second channels on the distributed plane. A hydrodynamic conical reflector and a hydrodynamic housing form a ring channel in an area between the hydrodynamic conical reflector and the hydrodynamic housing. An accumulation mechanism is configured to disperse the plurality of radial high speed flows of the gaseous working agent into the ring channel and create turbulence to foam the liquid.

Annex 3

United States Patent Application	**20160207013**
Kind Code	**A1**
	July 21, 2016

Device For Mixing Fluids

Abstract

A device is provided for mixing similar or dissimilar fluids into a homogenous fluid mixture. The device operates without consuming additional energy.

Annex 4

United States Patent Application	**20100224506**
Kind Code	**A1**
	September 9, 2010

PROCESS AND APPARATUS FOR COMPLEX TREATMENT OF LIQUIDS

Abstract

Methods and apparatus for complex treatment of contaminated liquids are provided, by which contaminants are extracted from the liquid. The substances to be extracted may be metallic, non-metallic, organic, inorganic, dissolved, or in suspension. The treatment apparatus includes at least one mechanical filter used to filter the liquid solution, a separator device used to remove organic impurities

and oils from the mechanically filtered liquid, and an electroextraction device that removes heavy metals from the separated liquid. After treatment within the treatment apparatus, metal ion concentrations within the liquid may be reduced to their residual values of less than 0.1 milligrams per liter. A Method of complex treatment of a contaminated liquid includes using the separator device to remove inorganic and non-conductive substances prior to electroextraction of metals to maximize the effectiveness of the treatment and provide a reusable liquid.

Annex 5

United States Patent Application	**20100224497**
Kind Code	**A1**
	September 9, 2010

DEVICE AND METHOD FOR THE EXTRACTION OF METALS FROM LIQUIDS

Abstract

A volume-porous electrode is provided which increases efficiency and production of electrochemical processes. The electrode is formed of a carbon, graphitic cotton wool, or from carbon composites configured to allow fluid flow through a volume of the electrode in three orthogonal directions. The electrode conducts an electrical charge directly from a power source, and also includes a conductive band connected to a surface of the electrode volume, whereby a high charge density is applied uniformly across the electrode volume. Apparatus and methods which employ the volume-porous electrode are disclosed for removal of metals from liquid solutions using electroextraction and electro-coagulation techniques, and for electrochemical modification of the pH level of a liquid.

Annex 6

United States Patent Application	**20110056457**
Kind Code	**A1**
	March 10, 2011

SYSTEM AND APPARATUS FOR CONDENSATION OF LIQUID FROM GAS AND METHOD OF COLLECTION OF LIQUID

Abstract

The present disclosure generally relates to an apparatus for the condensation of a liquid suspended in a gas, and more specifically, to an apparatus for the condensation of water from air with a geometry designed to emphasize adiabatic condensation of water using either the Joule-Thompson effect or the Ranque-Hilsch vortex tube effect or a combination of both. Several embodiments are disclosed and include the use of a generator to extract water and unburned hydrocarbons from exhaust of combustion engines, to collect potable water from exhaust of combustion engines, to use the vortex generation as an improved heat process mechanism, to mix gases and liquid fuel efficiently, and an improved generator with baffles and external condensation.

Annex 7

United States Patent Application	**20120102736**
Kind Code	**A1**
	May 3, 2012

MICRO-INJECTOR AND METHOD OF ASSEMBLY AND MOUNTING THEREOF

Abstract

The invention relates to a compact device for producing a composite mixture made of two or more fluids, and for aerating and energising the composite and injecting it into a volume, and more specifically a micro-fuel injector mixing water, air, or any other types of fluid before it is injected into a volume such as a combustion chamber of an engine made of stackable mechanical elements, and the method of assembly and mounting thereof.

Annex 8

United States Patent **5,871,814**

February 16, 1999

Pneumatic grip

Abstract

A device for shaping a vacuum includes a housing having a primary passageway which includes an inlet. A fluid shaping mechanism is disposed in the primary passageway in fluid communication with the inlet for changing the shape of a fluid flow into a planar fluid flowing radially outwards from a central point. The fluid shaping mechanism includes a conically-shaped portion disposed within the primary passageway, a plurality of secondary passageways extending through the housing from a periphery of the cone-shaped surface to outlets at a bottom surface of the housing, and a reflector adjacent to and spaced from the bottom surface for uniformly reflecting the fluid from the secondary passageways radially outwards to create a vacuum adjacent thereto.

Annex 9

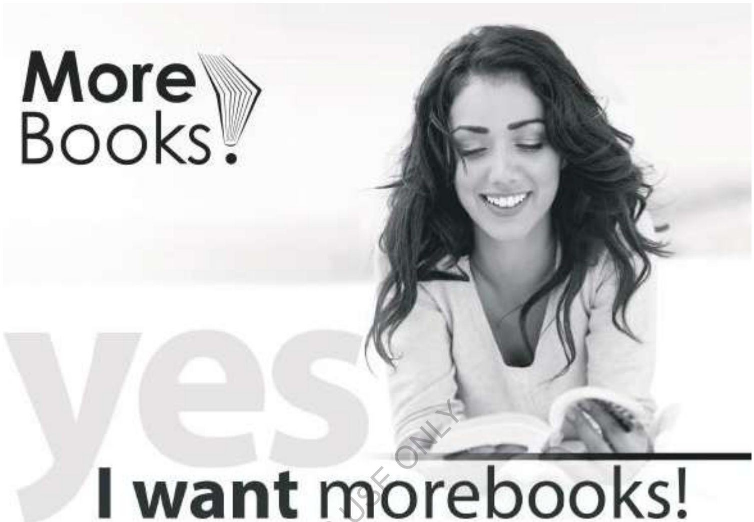
United States Patent **6,139,714**

October 31, 2000

Method and apparatus for adjusting the pH of a liquid

Abstract

A process for adjusting the pH of an aqueous flowable fluid includes an electrochemical mechanism for adjusting the pH of an aqueous flowable fluid and a mechanism for then electrochemically stabilizing the adjusted pH of the fluid. A device for performing the process is also included. The device includes an inlet and a channel in fluid communication with the inlet. The channel has the appearance and properties of a U-shaped connected vessel. The U-shaped connected vessel includes an inlet accumulating passage in fluid communication with an active zone between two spaced electrodes wherein the active zone has a small volume relative to the passage for accelerating fluid flow from the passage through the active zone complying with the physics of connected vessels.


More
Books!
yes
I want morebooks!