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(71) Applicant and
(72) Inventor: **URSUT, Iosif** [RO/SE]; c/o Campean Iosif, Bandstolsvägen 20, S-756 48 Uppsala (SE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **CAMPEAN, Romulus, Iosif** [SE/SE]; Dirigentvägen 36, S-756 54 Uppsala (SE). **CAMPEAN, Aurora, Margareta** [SE/SE]; Linrepevägen 20, Ite, S-756 48 Uppsala (SE).

(74) Agent: **URSUT, Iosif**; c/o Campean Iosif, Bandstolsvägen 20, S-756 48 Uppsala (SE).

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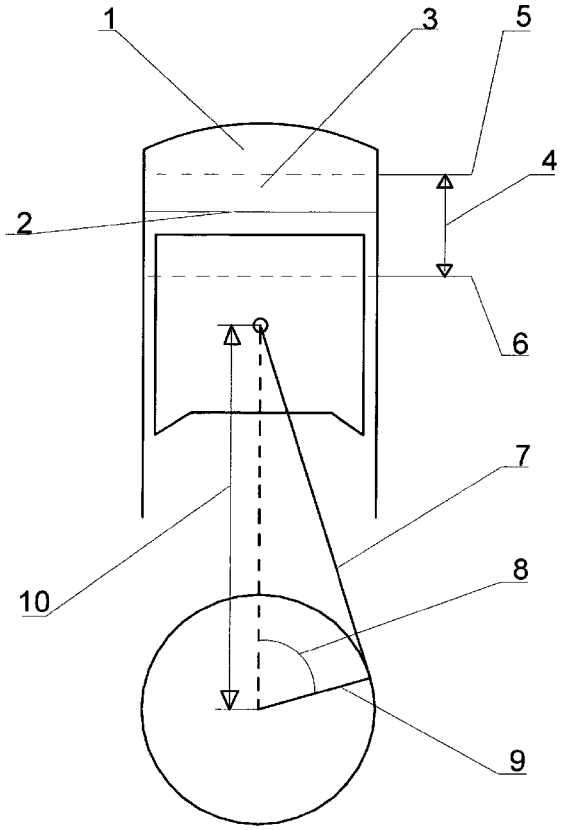
(54) Title: NEW COMBUSTION PROCESS

Figure 1




(57) Abstract: New combustion process allowing a complete combustion for all of the purified fuels by high air pressure. This process is characterised by the fact that the purified fuel is sucked in by high compressed air, that in turn gives a homogenised mixture before the ignition begins.

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# NEW COMBUSTION PROCESS

## Technical field/Field of the Invention

With this invention shall be solved climate crisis. The greenhouse effect is stopped for ever, This invention shall be used by all kinds of combustion contrivance forms which can burn up all kinds of pure fuels, including synthetic, in gas, fluid, solid form. This invention shall apply to a total combustion under complete control of the combustion without any pollution, i.e. the outlet shall be $H_2O$, $CO_2$ and $N_2$ that are recyclable. The *invention* refers to how this (the fuels) shall be burned up with an INJECTOR with high compressed air and the air sucks in fuel which becomes homogeneously mixed with the air to give a total combustion. Another field where this invention shall be used is for all different types of engines that are manufactured on world. The new engines shall take use of an INJECTOR with high compressed air that sucks in gas form or fuel fluid, ethanol, methanol, petrol, jet-fuel, diesel fuel, etc in state of (Table 1), that shall be ejected into the engine cylinder for complete combustion and the outlet shall be $H_2O$, $CO_2$ and $N_2$ which can be colected with a outlet handling, please have a look at Figure 5. From the outlets handling $H_2CO_3$ + N, these are obtained from new combustion process you can use a recycle labyrinth for irrigation with $H_2CO_3$ + $N_2$ these are drinkable and naturel manure. The recycle labyrinth will be used within agriculture for irrigation of plants with $H_2CO_3$ + $N_2$ which are recycled according to the new combustion process.Reactor seen **(Fig 9, 10 and 11)**; Reactor seen (Figure 9) will be used to obtain vapors for turbine, Reactor seen (Figure 10) will be used for thermal power station for warmth water and reactor seen **(Fig 11)** it is used for warm up private houses, these are without outlet exhause bicome work in closed circuit..These Reactors shall use an injector seen (Fig 8) at 5 to 250 atm or more which is constructing for complete combustion.

***The technical point of view/Background of the Invention***

All kinds of fuels have until today been burned up without control, incomplete combustion, that have led to the uncontrolled pollution of the atmosphere and that have been put in a cancer. All the engines of today, which uses different types of fuel under diverse forms, burns up the fuel uncontrolled with tons of outlets of contamination in the atmosphere. The combustion is not controlled, therefore the outlets of contamination is enormous. Since the engines have been invented there has that is to say never been a controlled combustion.This can be referred to the *Thermochemistry* principle that shows that the engines are regulated for $\Phi > 1$ and then the outlet becomes among other things CO. All of the combustion facilities and old engines are in need for scrap and new facilities and engines need to be manufactured. In the current time all the engines that rolls in Sweden lets out more than (18,9 millions of metric ton of $CO_2$) but with the new combustion principle the outlet shall halve and with the outlet handling and recycling labyrint the outlet exhause shall be zero.It will be zero exhaust of pollution if you use $H_2CO_3 + N_2$ that are obtained from the new combustion process. Every $H_2CO_3 + N_2$ that is obtain from the new combustion process shall be used as a fertilizer or nourishment to all sorts of plants with leaves and roots that shall take up $N_2$ and the leaves will liberate $O_2$ from $CO_2$. These reactors seen **(Fig 9, 10 and 11)** will work for obtaining warmth water and vapors in a closed circuit without polluting because have not outlet exhaust.

***Technical problem to be solved/The problem to be solved***

With this invention the outlets of contamination in the atmosphere will be eliminated for good and give rice to a new world without any contaminations. The invention will result in that the engines'

efficiency will improve, the consumption of the fuel will halve, and the cost for the heating will be 50 % less.

With the labyrinth for irrigation with $H_2CO_3 + N_2$ obtained from the new combustion process, the $H_2CO_3 + N_2$ will be further transformed to fertilize plants that leave oxygen. You can use bacteria that also liberate $O_2$ from $CO_2$. Reactorseen **(Fig 9, 10 and 11)** which work in closed circuit are without greenhouse exhaust. Thus this combustion process works inside the reactor.

***Figures register***

Figure in Fig 1, displays cylinder geometry with piston.

Figure in Fig 2, displays an air compressor connected with an injector.

Figure in Fig 3, displays an injector for mixture of air, fuel and coal.

Figure in Fig 4, displays the injector nozzle.

Figure in Fig 5, displays of the outlets handling for $H_2O_3$ and $N_2$.

Figure in Fig 6, displays the recycle labyrinth for irrigation with $H_2CO_3 + N_2$ for plants with leaves.

Figure in Fig 7, displays a pipe with holes made by PVC (a kind of plastic) for recycle labyrinth.

Figure in Fig 8, displays an injector model AF.

Figure in Fig 9, displays a reactor that will produce water or vapor for a turbine.

Figure in Fig 10, displays a reactor that will produce the warmth water for a thermal power station.

Figure in Fig 11, displays a reactor that will produce the warmth water for private houses.

## DETAILED ACCOUNT of INVENTION

**1) NEW COMBUSTION PROSSES** With this invention shall be solved climate crisis The greenhouse effect is stopped for ever, New combustion process is for **complete combustion and scientific can be achieved only by air pressure** from (5 to 200 or more) atm and give a complete combustion for all kinds of the existing purified fuels seen **(Table 1).** This high compressed air will suck in all kinds of the existing purified fuels from **(Table 1)** until the mixture between the air and fuel will become saturated and perfect homgeneous **on the basis air pressure,** these results in a complete combustion. **Without air pressure is impossible to obtain a complete combustion of a combustible because every molecule of combustible is needed for a larger number of molecules of air at the same time.** This new combustion process is accomplished with different injectors seen **(Fig 2, 3, and 8)** for complete combustion, which give the following outlets: $H_2O$, $CO_2$ and $N_2$ ($H_2CO_3 + N_2$), it is drinkable, that can undergo outlet handling and recycle labyrinth. This combustion process gives a complete combustion, since CO is not formed thanks to the fact that $\Phi = 1$ or less, see **(Fig 12).** The New combustion process respects the fundamental THERMOCHEMISTRY[1] principle, that is the Combustion Efficiency, $\eta c = 100$ (%), and the Fuel Equivalence Ratio $\Phi$, when $\Phi = 1$. The New combustion process withholds strictly the relation between the quantity of air molecules and fuel molecules $m_A/m_F$, see **(Table 1)** to create a complete combustion there is e.g. a need of 14,5 molecules of air to burn up one 1 molecule of combustible oil **it is posible only with air pressure.** The flow of fuel, from the fuel pipe, that is sucked in by the high compressed air for $\Phi = 1$ is calculated with the formula:

**$F = (P1-P2)\cdot\pi r^4/8L\eta$.** The meaning of the formula is: F = the flow in the fuel pipe, P1 = the pressure of (5 to 250 or more) atm. in the air pipe, P2 = one atmospheric pressure in the warmth installation or engines cilinder, r = the radius for the fuel pipe, L = the length for the fuel pipe. $\eta$ = the viscosity for the fuel or air. The relation between the air pipe, the fuel pipe or the holes of the nozzle must be holden in the strict proportion from the **(Table 1),** for a complete combustion.

For $\Phi = 1$ Stoichiometric can be obtain maximum energi from combustible.With New Combustion Process be realized the fact that noting disapears everything transform to peoples use.In the present time the combustion of the fuel is incomplete for all the vehicles and differing combustion installations. It's incomplete because of the outlet that still gets out, e.g.; HC hydrocarbon, CO carbon monoxide, and $NO_2$ nitrogen dioxide which are poisonous. With this NEW COMBUSTION PROCESS the combustion is complete and in the basis of air pressure are under control. The outlets are $H_2O$, $CO_2$ and $N_2$, drinkable, and they shall be put under an outlet handling and recycling with labyrinth. This contributes to that differing pollutions will be eliminated and the greenhouse effect will be handled. during a period of ten years it is possible to overcome the pollutions in the environment in a simple and cheap way. The **(Table 1)** bellow shows the stoichiometric AF (air, fuel) relation, between the pipe for the compressed air and the pipe for fuel and the holes nozzle for

fuel, when Φ = 1 and $m_A/m_F$.**(Table 1)** $m_a$ = molecule air, $m_f$ = molecule fuel, for complete combustion.

**Table 1.** For complete combustion uder perfect control with purifyed combustible.

| Fuel<br>Name / Formula | Share<br>$m_A/m_F$. | Stoichiom e-tricAF Φ=1<br>Air Mol $m_A$ | Fuel Mol. $m_F$. | Stoichiometric dim for: Φ=1<br>air-pressure pipe D mm | Fuel pipe / nozzle D mm |
|---|---|---|---|---|---|
| Gasoline $C_8H_{15}$ | 14,6/1 | 14,6 | 1 | 1,46 | 0,1 |
| Light diesel $C_{12,3}H_{22,2}$ | 14,5/1 | 14,5 | 1 | 1,45 | 0,1 |
| Heavydiesel $C_{14,6}H_{24,8}$ | 14,5/1 | 14,5 | 1 | 1,45 | 0,1 |
| Isooctane $C_8H_{18}$ | 15,1/1 | 15,1 | 1 | 1,51 | 0,1 |
| Methanol $CH_3OH$ | 6,5/1 | 6,5 | 1 | 0,65 | 0,1 |
| Ethanol $C_2H_5OH$ | 9,0/1 | 9,0 | 1 | 0,90 | 0,1 |
| Methane $CH_4$ | 17/1 | 17,2 | 1 | 1,72 | 0,1 |
| Propane $C_3H_8$ | 15,7/1 | 15,7 | 1 | 1,57 | 0,1 |
| Heptane $C_7H_{16}$ | 15,2/1 | 15,2 | 1 | 1,52 | 0,1 |
| Cetane $C_{16}H_{34}$ | 15,0/1 | 15,0 | 1 | 1,50 | 0,1 |
| Coal(carbon) C | 11,5/ | 11,5 | 1 | 1,15 | 0,1 |
| Toluen $C_7H_8$ | 13,5/1 | 13,5 | 1 | 1,35 | 0,1 |
| Hydrogen $H_2$ | 34,5/1 | 34,5 | 1 | 3,45 | 0,1 |

The combustion will be achieved with Injectors (a, b, and c) or more described below they is manufactured for a complete combustion.

**a) COMPRESSOR with INJECTOR, see Figure 2,** this injector is manufactured for complete combustion, shall be used for all two and also by four-cycled engines, which consumes all kinds of fuels sees **(Table 1)** for complete combustion. Shall at the same time inject the mixture between the air and the fuel into the engine cylinder (10). **Table of signs: for Figure 2. Compresor and Injector**; 1) Compressor for compressed air that shall be built with a cylinder for each engine cylinder, i.e. one engine with 4 cylinders requires one compressor for compressed air with 4 cylinders. 2) The Injector for each cylinder in the engine. 3) Air pipe it binds the Compressor with the Injector, which volum the $V_{olume}+ V_i$ is equal to $V_c + V_d$ see **(Fig 1)** and **(Fig 4),** diameter is chosen from **(Table 1)** in state of the fue. 4) Solenoid that opens the injectors' needle for injection. 5) The pipe for fuel with a tap fixed on it, diameter is chosen from **(Table 1)** in state of the fue. 6) The tap on pipe for fuel. 7) Tap = (gas system) with which the engines rev minim is regulated tap for $\Phi \leq 0, 4$ it is open, this opens to the rev maxim $\Phi = 1$ with gas pedal, and tap be rotated until $\Phi \leq 0, 4$ with a spring, for engine is the minimum speed in service. 8) The needle for the injector, through this are sucked in fuel by air pressure; this opens and closes both air-pressure and fuel. 9) Mouthpiece, through this the mixture of air-pressure and fuel is injected in to the engine cylinder when needle is opened of solenoid. 10) Cylinder. 11) The spring of the valve for out press of air in the pipe (3) diameter is chosen from **(Table 1)** that binds the compressor with the injector. 12) Valve for out press of air in the pipe (3) to injector. 13) Piston to the compressor for air-pressure. 14) Cylinder to compressor for air-pressure. 15) Air room. 16) Valve for intake of air.17) Spring for intake valve. 18) Filter for intake of air. 19) Roll. 20) Cam (eccentric) that together with a roll starts the compressor piston. 21) Spring for needle. 22) Safety bolt. 23) Support for spring, 24) Spring, 25) Piston foot, 26) Nozzle seen **(Fig 4)**

The new engine that will be equipped with Compresor and Injector sees (Figure 2) this injects mixture between air-pressure and fuel at the same time into the engines cylinder under high pressure, mixed with injects air-pressure and fuel/gas depending on the engines propellant, shall respect THERMOCHEMISTRY principles. This signifies to completely respect the state **(see Fig "diagram" 12)** between: 1). Combustion Efficiency $\eta_c = 100$ (%) 2). Fuel Equivalence Ratio $\Phi$, when $\Phi = 1$ $\Phi = (AF)_{stoich} / (AF)_{act} = 1$ optimal stoichiometric for air and fuel, which indicates that maximum energy is liberated from the fuel. For $\Phi = 1$ is received a maximum number of revolutions (speed), $N_{max}$, from the engine. For $\Phi \leq 0.4$ is received a minimal number of revolutions, $N_{min}$, from the engine.Compressed air shall be stored in the pipe (3) that joins the compressor (1) with the injector (2). The pipe (3) diameter is chosen from **(Table 1)** and area will be calculated out in relation to the cylinders' $(V_c + V_d)$; $(V_t + V_i) \cdot p_i = (V_c + V_d) \cdot p_c$ constant. $V_t$ = The pipe/tube (3) hole volume Vi = The volume in the chamber round the injectors needle'seen (Figure 4), pi = Compressed air from the pipe (200 or more) atm. determined for a certain pressure, e.g. 200 atm. $p_c$ = Compressed air in the cylinder that is 1 atm. (atmosphere pressure) $V_c$ = clearance volume see (Figure1); $V_d$ = displacement volume see **(Fig 1)** The air mass in the air pipe(3) shall be in state with the density and the air pressure .$m_a = p_c \cdot \eta_v \cdot \rho_a \cdot (V_d+V_c)$, $\eta_v$ = volumetric efficiency, $\rho_a$ = the air density.The fuel pipe (5) from the tap (6) to the injector shall be dimensioned for $\Phi = 1$ from see **(Table 1)** through an fixed high compressed air that is in state to the air mass. For gasoline $m_a/m_f$ is 14,5/1,seen **(Table 1)** i.e. to burn up 1 gram of gasoline it is needed 14. 5 g of air, it is possible with air pressure. The fuel mass $m_f$ that will be sucked in of air pressure will be calculate with **fomula F seen (page 5/41, row 1).**

**Table of signs for Figure 4:** 1) Air pipe; 2) $V_t$ = the volume of the air pipe. 3) B = *Bore*, 4) $V_d$ = *Displacement volume*, 5) $V_c$ = *clearance*

*volume*, 6) $V_i$ = *injector volume*, 7). Fuel intake. 8). Nozzle out side is conical, that is mounted on the injector needle is same with mouthpices con. 9).Mouthpiece is with inside con angle similar with nozzle out angle. B = cylinder diamete from **(Fig1)**

**Table of signs for Figure 1**: 1) $V_c$ = *Clearance volume*; 2) $V_d$ = *Displacement volume*; 3) B = cylinder diameter 4) S = stroke 5) TDC = "the pistons' top dead center "; 6) BDC = "the pistons' bottom dead center"; 7) r = connecting rod length; 8) $\theta$ = *Crank angel*; 9) a = *crank offset*; 10) s = the pistons' position.When the mixture of air and fuel is injected in to the cylinder the whole of the cylinders' volume ($V_c + V_d$) will be filled in a fast and effective way. At the compressed air (200 or more) atm. there will be a maximum turbulence and then the homogeneous between the air and fuel shall be perfect made of air pressure. And then the mixture vaporizes rapidly and that being so the fuel explosion and combustion shall be rapidly and total. Then there will be created a maximum velocity for the engine's piston. Exhaust of gases will be $H_2O$ vapour, $CO_2$ gas and $N_2$ gas.Under these conditions with $\Phi = 1$ for the new engines that will use Compresor and Injector see **(Fig 2)** there will be obtained:

1). Fuel consumption will be cut down (reduced to) with (30-50) % for $\Phi = 1$.see Footnote 1.

2). The Engines' efficiency will be improved with (30-40) %.

3) The fabrication cost will be cut down with (30-40) %, many components from the older engine will disappear.

4) The crank angel (intake angel), $\theta$, shall be newly calculated. See (Figure 1).

5) On these injector there shall be assemble a tap (7) for (chock, for speed) a) for $N_{minimum}$ there shall be $\Phi \leq 0,4$ b) for $N_{maxim}$ there shall be $\Phi = 1$ These engines will not exhaust pollution and they will be the engines of this millennium.

6) Mixture between air and fuel is perfect because of air-pressure.

7) Turbulence is 200 times more as the current engines.

8) Ignition and explosion is 200 times more rapidly but the current engines.

9) Engines efficienty increased.

10) Ignition skall be carried out with spark plugs.

Thus there will be created a complete combustion. This is possible by choosing the strict relation between the air pipe (3) and the fuel pipe (5)from (Table 1) in state of how many molecules air is needed to combust one molecule of fuel e.g. Gasoline. To combust one molecule of gasoline there is a need of 14,6 molecules of air. This state between the air pipe (3) and the fuel pipe (5) must thus be 14, 6/1. For this state you can decide that the air pipe (3) has a diameter of $\Phi$ = 14, 6 mm and the fuel pipe (5) a diameter of $\Phi$ = 1 mm., this gives a complete combustion. The Compressor (1) shall furnish the Injector (2) with compressed air at 200 atm through the air pipe (3), The piston (13) is for intake of air through the filter (18) and the valve (16) opens at intake and is closed with a spring (17).The Piston (13) is assemble on piston foot (25) on which is assembled the roll (19). Piston (13) is pressed down for contact with the cam (20) of the spring (24), that shore up between support (23) and piston foot (25).When the piston (13) presses up of the cam (20) and roll (19) into the cylinder (14).The piston (13) then presses up the air from the air room (15) through the valve (12). The valve (12) then opens up and after that is it closed with a spring (11). After that the air is pressed up to the pipe (3) and creates an air-pressure of 200 atm. The air pipe (3) connects the Compressor (1) with the Injector (2). When the intake cycle begins for the engine then the solenoid (4) opens the Injector (2) needle (8). The air from the pipe (3) with high

air-pressure of 200 atm flows out through the mouthpiece (9) to the cylinder (10). Thus at the same time the high air-pressure sucks in the fuel from the pipe (5) into the air mass through needle (8) and the nozzle (26) and then the mixture are quick homogeneous and is injected through the mouthpiece (9) into the cylinder (10).The nozzle (26) is assembled on the needle (8) tip. The nozzle (26) out side is conical similar with mouthpiece (9) inside con angle. The nozzle has four holes with a diameter = 0, 25 mm, and with the interval 90° in circumference. The nozzle (26) will be constructed with more holes if it is necessary. These holes distribute homogeneous the fuel in the air mass. When the compression cycle to engine begins, then the solenoid (4) is closed. The spring (21) presses down the needle (8) on the mouthpieces (9) con, which at the same time closes of the air and the fuel. The spring (21) shore up on the safety bolt (22). The arises high air-pressure, (compressed air) rapidly makes the mixture between the air and the fuel homogeneous. This homogeneous mixture is injected through mouthpiece (9) in cylinder (10) The mixture is 200 times more homogenise than in the present engines. When the high compressed air sucked in the fuel through nozzle (26), and is injected through mouthpiece (9) in into the cylinder (10) a maximum turbulence is created into cylinder (10). This high air-pressure than created a maximum turbulence into cylinder (10), is 200 times more turbulence than in the present engines. When the engine piston comes up is created the compressed- cycle, the explosion-cycle begin. The ignition and explosion is instantaneous and it is 200 times more rapid that in the present engines, the combustion is total with a maximal velocity that gives the engines piston more velocity and more power for the engine.The mixtures volume that is injected in through mouthpieces

(9) into the cylinder (10) must be equal to $V_d + V_c$ see **(Fig 1)**. Where Vd (2) = Displacement volume, $V_c$ (1) = Clearance volume. The flow of the fuel, that is sucked in into the air mass from the fuel pipe (5) through nozzle (26)similar nozzle (8) from **(Fig 4)** is calculated with formula, $\mathbf{F = (P1\text{-}P2) \cdot \pi r^4/8L\eta}$ seen (page 5/41 row 1) To secure that $\Phi = 1$, the fuel pipe (5) shall be equipped with a tap (6). The tap (6) shall be fixed in a special plant and be lead sealed for $\Phi = 1$. **This is a double assurance that the combustion is complete and under a total control.** The outlet will be $H_2CO_3 + N_2$. On to the buddy of the injector (2) where the fuel pipe (5) is connected there shall be installed a tap (7) shall be in connection with the gas pedal. The tap (7), that is produce the same a tap and adjusts there the engines' minimum rev for $\Phi \leq 0{,}4$ that is open, and with gas pedal will be opened up to rev maximum $\Phi = 1$, and will be rotated until $\Phi \leq 0{,}4$ with a spring. On the new engines shall be mounted the compressor (1) on to the same place where the fuel pump is mounted on the present diesel engines. The injector (2) shall be placed on to the cylinder-head instead of the intake valve and $\theta$ (8) = *Crank angel (8)* see **(Fig 1)** come to be calculate of. The new engines do not need to have intake valves, air filter, carburettor, cam axis for intake valves, springs and second components, the catalytic converter, because the new engines do not let out any outlet as: CO, $NO_2$ and HC. The new engines only let out the outlets $H_2CO_3 + N_2$ and these outlets will be put under an outlet handling and recycling in labyrinth. Hydrogen can be used as fuel for the new engines and then the outlet will be $H_2O$ that shall be put on an outlet handling and recycled in labyrinth. The $H_2O$ can be recycled through sale for electric-battery, laboratories and to the pharmacy.The compressor (1) and the injector (2) shall be produced with present techniques' and with minimum costs'. Through this invention the costs' for the producing a new engine will decrease with

30 % between 50%. The consummation of fuel will decrease between 50 % to 70 % for the new engines. The Fuel Equivalence Ratio Φ for the old engines increases from Φ = 1 to Φ = 1, 3 and is for big lorries up to Φ = 1, $7^1$ that creates more pollutions as: HC, CO and $NO_2$, because of incomplete combustion.The Compressor (1) and the Injector (2) shall be constructed in highest series whit actual technology and within10 years all new and old cars shall be equips with they. If so pollution will not come out from the vehicles.

**b) INJECTOR Sees Figure 3.** Is produced for complete combustion. The injctor is produced from three different pipes, two, one of which is for combustible oil and second is for coal, they have diameter equal and is parallel fixed the pipe for combustible oil with the pipe for coal, they is in the center of the air pipe, diameters is chosen fron **(Table 1)** and diameter for air pipe is = 14,5 +11,5 = 26 mm and for combustible oil diameter is = 1 mm ,for coal pipe diameter is = 1 mm.See **(Table 1)**

**Table of signs for Figure 3:** 1) The pipe with combustible oil inside, diamiter = 1 mm chosen from **(Table1)** and is parallel with the pipe (5) for coal. 2) Tap on the pipe with fuel inside. 3) Pipe for air the compressed air (30 - 100 atm.) diameter chosen from **(Table 1)** in centre are fixed the combustible oil pipe (1) and the pipe (5) for coal they is in parallel. 4) Tap on the pipe for air. 5) Pipe for coal diameter = 1mm chosen from (Table 1).is parallel with pipe (1). 6) Tap on the pipe for coal. 7) The section $A_a$ for the pipe with air inside. 8) The section $A_f$ for the pipe with fuel inside. 9) The section $A_s$ for the pipe with coal inside. 10) Injection with air, fuel and coal that forms accordingly to the picture. 11) Flange. 12) Nozzle with inside angle that will be 60°. 13) Outside angle 90° for nozzle. 14) The inside angle 60° for nozzle.The injectors' outflow, where these three materials already have been mixed of air pressure, the nozzle shall have a double conical shape one for speed with inside angle 60°.and other with out angle 90° for spreading so that you can get a better spreading out of

mixture. This principle is applicable on furnaces and all combustion instalations. This Injector see **(Fig 3)** shall be installed in a hermetically sealed furnace, boiler and all combustion instalations. This kind of injector will mix:1) air-pressure that flows through pipe 2) liquids of fuel that flows through pipe 3) coal that is finely ground and flows through pipe. The intake of fuel and coal shall be regulated with a tap. The air will also be regulated with a tap that will be opened till maximum wide when it's time for combustion. The consumption of fuel will be reduced with more than half.With this model of injector there will be create a controlled for combustion and complete combustion and the exhaust will be $H_2O$, $CO_2$ and $N_2$, that will be outlet handling seen **(Fig 5),** and recycled with a labyrinth **seen (Fig 6, 7)** The relation between the pipes section in the injector will be: $A_f = A_s < A_a$, see **(Fig 3)** . Where: $A_a$ = the pipe area for the compressed air flow will have a diameter = 14.5 + 11,5 = 26mm chosen from **(Table 1)** . $A_f$ = the pipe area for the fuel flow, diameter = 1mm. $A_s$= the pipe area for the coal flow diameter = 1 mm see **(Table 1)** Example: If I burn the combustible oil and coal; AF stoichiometric is: For the combustion of 1 molecule of combustible oil there is a need of 14, 5 molecule of air.For the combustion of 1 molecule of coal there is a need of 11, 5 molecule of air chosen from **(Table 1).**

For a total combustion the boiler/kilnand all combustion instalation must be hermetical sealed and have a injector for complete combustion and obtain $H_2$ $CO_3$ and $N_2$ that will be drinkable and natural manure.

This Injector has a pipe (3) with air inside, under an air-pressure on 30 to 100 atm that is shot out in the kiln through the nozzle (12), at the same time that the air-pressure suck in combustible oil from the fuel pipe(1) and the coal pipe (5). Nozzle (12) has an exterior angle (13) on $90^o$ that makes that the mixture between the combustible oil, coal and air takes a conics form (10) to injection.

When the air from the air pipe (3) comes out with high air-pressure through the nozzle (12) with inside angle that will be 60° make at the air-pressur speed rise to injection it simultaneously sucks in combustible oil from the fuel pipe (1) and coal from the coal pipe (5).This high air-pressure makes that the mixture rapidly is homogeneous and this produces a complete combustion of combustibel. The flow of the fuel that is sucked in into the air mass from the fuel pipe (1) and coal sucked in by the air mass from the coal pipe (5), is calculated with the following formula; $F = (P1-P2) \cdot \pi r^4/8L\eta$. Seen (page 1/21, 25 row 5) To have more control over the combustion an the tap (2) shall be assemble on the fuel pipe (1), a tap (6) on the coal pipe (5), and a tap (4) on the air pipe (3), These taps shall be sealed with lead for $\Phi = 1$ which gives a complete combustion. The section $A_a$ (7) shall be calculated with the help of the air pipe (3) diameter = 26mm from (Table 1) Section $A_f$ (8) shall be calculated with the help of the fuel pipe (1) diameter = 1mm.from **(Table 1)** Section $A_s$ (9) shall be calculated with the help of the coal pipe (5) diameter = 1mm from **(Table 1).** This Injector see **(Fig 3)** shall be assembled on a combustion kiln with the help of a flange (11), combustion kilns and combustion installations must be hermetical stuffed in. This Injector from **(Fig 3)** reduces the consummation of the fuel with more at 50 % and with the help of the outlet handling can the injector put a stop to for ever of pollution, that is coming out from the combustion installations. This Injector is simple to be mass produced and in the course of one or two years it can furnished in all combustion installations, and it can stop the pollution that is coming out from the warming installation for all times with outlet handling which will be mounted on exhaust pipe

**c)INJECTOR see Figure 8.**This Injector is construct for complete combustion and combustible is purifyed, A complete combustion is posible only new combustion prosses with air-presure between 5 to 250 atm or more. Injector is manufactured from the two concentric

pipes, dimensions for pipes are chosen from **(Table 1)** seen above. From **(Table 1)** is chosed combustible oil (crude oil) which using 14.5 molecules air for a complete combustion of 1 (one) molecule. With this Injector the mixture between air and fuel is occurs quickly and homogeneity is perfectly because the pressure. The mixture between air and fuel into this type of Injector can be realized to perfection and most respect the basic THERMOCHEMISTRY[2] principle; the relation between; Combustion Efficiency, $\eta_c = 100$ %, and Fuel Equivalence Ratio $\Phi$, when $\Phi = 1$, see **(Fig 12).** For $\Phi = 1$ the combustion shall be complete and pollution will be equal to zero and outlet will be $H_2O$, $CO_2$ and $N_2$ that can be gathered from Reactor in reservoir (11) belong to outlet handling and recycled with labyrinth see **(Fig 6, 7)**

**Table of signs for Figure 8:** 1) The fuel pipe will be adopted in state to the fuel model from **(Table 1)** from new combustion process, 2) Tap on fuel pipe, 3) Solenoid on tap on fuel pipe, 4) The air pipe with pressure on 250 atm or more. diameter will be adopted in state to the fuel model from **(Table 1)** for complete combustion with new combustion process. 5) Tap on air pipe (4). 6) Solenoid on tap for air pipe(4). 7) Nozzle. 8) The outside angle for nozzle is 90°. 9) Flange. 10) The inside angle 60° for nozzle. 11) The outside angle 90° for nozzle it is for spray.Stoichiometric AF the proportion between the pipe (4) for air-presure and the pipe (1) for fuel (combustible oil) shall be 14,5 / 1, chosen from **(Table 1).**The diameter for air pipe (4) is chosen 14,5 mm and the diameter for the fuel pipe (1) is chosen 1 mm for a complete combustion.The high air-pressure to 250 atm or more in the air pipe (4) is compresed out when the solenoid (6) open the tap (5) then the compresed air goes through the nozzle (7) in Reactor or combustion installation, then at same time

[1] See Engineering Fundamentals of the Internal Combustion Engine, 2 edition, Willard W. Pulkrabek, 2004.

air-pressure suck in the fuel from the fuel pipe (1) and at same time the solenoid (3) open the tap (2) on pipe (1).

When air- pressure and fuel is passing through nozzle (7) mixture is homogeneous perfectly of pressure and will take a coniform with angle (8) on 90°, before ignition happens in side in the Reactor or combustion installation,. The Injector is assembled with a flange (9) on the Reactor. In the Reactor combustion is complete and results $H_2O$, $CO_2$ and $N_2$ it is drincable and it is part of the closed circuit, which can be gathered in reservoir (11) which belonging to outlet handling and will be recycled in labyrinth, seen (Annex 6, 7) The Flow of the fuel which are sucked in of air mass from the pipe (1) for fuel is; where: **F = (P1-P2)·πr⁴/8Lη** sen (page 5/41, row 1) This Injector is simple to be mass produced and in the course of one or two years it can furnished in all warming installations, and it can stop the pollution that is coming out from the warming installation for all times with outlet handling and recycle labyrinth.

**OUTLET HANDLING: for $H_2CO_3$ and $N_2$ sees Figure 5.**

.All the combustion installations that will use this new combustion process for all kinds of purified fuel will be equipped with a outlet handling system.All vehicles will be equipped with a outlet handling system for collect exhaust gas ($H_2CO_3 + N_2$).which is a manure.

**Table of signs for Figure 5:** 1) Exhaust pipe with $H_2O$ (steam/vapour) + $CO_2$ (gas) + $N_2$ gas which is obtain from new combustion process of a car that consumes 5 litres of gasoline, the outlet is 16 kg that will be compressed by a compressor in a reservoir.2) Compressor with a capacity of 16 kg/h. 3) Intake valve for the compressor.4) Exhaust valve for the compressor. 5) Pipe that furnishes the reservoir with [ $H_2O$(vapour)+$CO_2$(gas) +$N_2$] = ($H_2CO_3$ + $N_2$) that will be compressed to 3 to 4 atm for clear out.6) Coupling valves for reservoirs, 7) Reservoir for 25 kg $H_2CO_3$. 8) Condenser to 0°C.

Example: Calculate the mass of carbon dioxide $CO_2$, [and water $H_2O$,] that is established when 60 litres of gasoline burns up. $\rho$ = The density for engine gasoline is approximately 0,73 kg/dm$^3$. One mass of gasoline is 0,73 kg. If that's so, 60 litres of gasoline has the mass of,

$m(C_8H_{18}) = \rho \cdot V = 0{,}73 \cdot 60 = 43{,}8 = 4{,}38 \cdot 10^4$ g.

Formula of reaction:

| | | | | | |
|---|---|---|---|---|---|
| $2C_8H_{18} + 25O_2$ | burns up to | ii16$CO_2$ | + | $18H_2O$ | $+ N_2$ |
| n | | 384 (2) | | 3072 (4) | 3456 |
| mol | | m | $4{,}38 \cdot 10^4$ | | ? |
| ? | | g | | | |

The relation between the masses of substance is:

$n(CO_2)/n(C_8H_{18}) = 8/1$ $n(H_2O)/n(C_8H_{18}) = 9/1$

Calculate the mass of substance $CO_2$ och $H_2O$:

$n(CO_2) = 8 \cdot n(C_8H_{18}) = 8 \cdot 384 = 3072$ mol

$n(H_2O) = 9 \cdot n(C_8H_{18}) = 9 \cdot 384 = 3456$ mol

Calculate the mass of carbon dioxide and water:

$m(CO_2) = M(CO_2) \cdot n(CO_2) = 44$ g/mol $\cdot$ 3072 mol ~ 135 kg"[1]

$CO_2 = 135$ kg

$m(H_2O) = M(H_2O) \cdot n(H_2O) = 18$ g/mol $\cdot$ 3456 mol ~ 62 kg

$H_2O = 62$ kg

Out of 60 kg gasoline through the combustion you get $CO_2$ (135 kg) + $H_2O$ (62 kg) this shall be compressed to 4 atm. inside a reservoir and becomes carbonic acid $H_2CO_3$. For this there is a need of a compressor that will compress everything that is exhausted from the engine. The capacity of the compressor shall be in relation to the exhaust of the engine. The compressor will be run with an electric motor of 0,300 kw, fron car battery. To build a reservoir you can use the law of gas:$p \cdot V = n \cdot R \cdot T$ $V_b$ = the volume of the reservoir $V_b = n \cdot ((R \cdot T)/p)$ for $p = 10$ atm. Reservoir (7) for 25 kg $H_2CO_3$ will be cleared out in reservoir (1) from recycle labyrinth.

[1] See Gymnasiekemi A, Stig Andersson, m.fl., Liber AB, 3 u, ISBN 978-91-47-01875-8, p.114.

**REACTOR sees Figure 9, 10 and 11.** With this invention shall be solved climate crisis. The greenhouse effect will be stopped for ever. They are working with Injector sees in **(Fig 8)** in closed circuit without exhaust, $H_2CO_3+N_2$ obtain from the combustible is part of closed circuit.Have a cilindrical shape at the heads is mount spherical shape, constructed with the double wall and water at agent for cooling which is part of closed circuit.

These reactors will be used in a closed circuit to produce vapour and hot water which will be warmed up directly in contact with flames. In this situation water takes up all heating value from the fuels. The combustion in reactor sees **(Fig 9)** shall be made up of 16 injectors sees (Annex 8) Reactor sees in **(Fig 9).**is produced with dubel wall and for cooling is used water which belonging closen circuit. Is constructing to work with inside combustion in closen circuit without exhaust.The reactor see **(Fig 9)** shall produced vapour or hot water for the turbine with a pressure of up to 200 atm or more, which will start the turbine. The water that is used for vapour will be injected into the reactor with a pressure of 250 atm. through a system formed like a shower, which sprays water over the flames which is in two rows or more. The water in direct contact with the heat of the flames will rapidly take up all heating value and transform into vapour. The size of the reactor is chosen in state to the quantity of vapour (or water) that is needed for starting up the turbine. An example for a reactor with 2 m in diameter is that 4 $m^3$ will be used for flame space and the rest is for a volume for stockroom of vapours and spiral pipe. .In the stockroom shall be assembled a spiral of the pipes which will be warming up usually water for apartments The vapour or water shall be stored up to 200 atm. before it is used inside the turbine together with $H_2CO_3 + N_2$ which is obtained from the new combustion process.The reactor sees **(Fig 9)** for vapour (or warmth water) has a valve, on the pipe for the turbine, the valve unlocks at 200 atm. This reactor sees **(Fig 9)**

can also use injector with coal that will have a shower that will be assembled under the flames. Example; for warming up 120 litre water to $100^0$ degrees Celsius you need 1 litre combustible oil

**Table of signs for Figure 9: 1)** Reactor for inside combustion in a closed circuit, has a radius example of 1,5 m and with double wall (22, 23). 2) Injector see **(Fig 8)** for 250 atm compress air use 8 pieces on first row.3) Injector see **(Fig 8)** for 250 atm compress air use 8 pieces on second row. 4) The Distance between two rows of injectors 5) Valve which unlocks at 200 atm. 6) Tap on pipe for turbine.7) The pipe for turbine which is calculated with turbine necessity of water.8) Turbine.9) Return pipe10) Valve to reservoir for $H_2CO_3 + N_2$ 11) Reservoir for 25 litres.12) Tap on return pipe on water pipe.13) Shower.14) Compressor for 250 atm. 15) Pipe for water to double wall for cooling and return.16) Tap on water pipe.17) Stockroom 14 $m^3$ e.g.18) Pipe for water in.19) Pipe for water to apartments.20) Pump for water.21) Pipe spiral for heating water. 22) Wall inside. 23) Wall outside.The reactor see **(Fig 9)** shall be hermetically isolated for a maximum efficiency and shall have a warning system for the maximum temperature of and for the maximum pressure.

This reactor has zero exhaust of pollution. The reactor see **(Fig 9)** is used to warming up water which is going for cooling in return by apartaments. This reactor sees **(Fig 9)** will be isolated thermally for maximum efficiency and assemble a warning system for temperature and pressure.Efficiency $\eta$ = 99, 98 %

**REACTOR will be seen in Figure 10.** Is produced with dubel wall and for cooling is used water which belonging closen circuit. Is constructing to work with inside combustion in closen circuit without exhaust, have cilindrical shape at the heads is mount spherical shape, constructed with the double wall and water at agent for cooling which is part of closed circuit.

**Table of signs for Figure 10:** 1) Reactor has a radius of 2 m

example. 2) Injector see **(Fig 8)** for compressed air to 30 atm. use 6 pieces on first row. 3) Injector see **(Fig 8)** for compressed air to 30 atm, use 6 pieces on second row 4) Distance L=1 m between row 1 and row 2, 5) Valve opened at 10 atm.6) Tap on pipe for place to live.7) Pipe to apartments.8) Apartments 9) Return pipe.10) Valve to recycling reservoir.11) Reservoir for 25 litres.12) Tap on return pipe.13) Shower.14) Compressor for 30 atm.15) Pipe for water.16) Tap on water pipe.17) Stockroom 8 $m^3$ example18) Pipe for water in19) Pipe for water to apartaments.20) Pump for water.21 Pipe spiral for warming up usually water to apartments. Example1 litre combustible oil can warm up 120 litre water to100°C in contact direct with flame. In the stockroom shall be assembled a spiral of pipes for warming usually water for apartments.If you in reactor seen (Annex 10) with new combustion process consume 720 litres of combustible oil in 24 hours can warm up 86400 litre water at 100°C plus 2400 litres $H_2CO_3$+$N_2$ obtain from the combustible, there shall be a total of 88800 litres. For warming up 3100 apartments with only 1300$ USA, the price will be 1300/3100= 0, 40$ only for an apartment, so cheap will it be, and it is equitably Efficiency $\eta$ = 99, 98 %. With this reactor the price for warmth shall be 50 % less than the actual price of today, because is so little fuel that shall be used for heating up the water.

**REACTOR sees Figure11.** is produced with dubel wall and for cooling is used water which belonging closen circuit. Is constructing to work with inside combustion in closen circuit without exhaust.

is as big as D = 0,7 m and h = 1, 4 m used for a private house,have cilindrical shape at the heads is mount spherical shape, constructed with the double wall and water at agent for cooling which is part of closed circuit. The reactor will use injector (Annex 8) and a pressure of air at 5 atm. This Reactor shall warm up water to 100°C for the private house to be heated. . Water injected in through a shower directly on the flame This Reactor will consume two litre of combustible oil during 24 hours and will heat up 240 litres of water for

a private house. , In the stockroom shall be assembled a spiral of pipes for warming up usually water for private houses.All these reactors doesn't pollute because they work in a closed circuit. A very good building, does that it can reach high water pressure or high vapour pressure and temperature..

**Table of signs for Figure 11:** 1) Reactor with radius R = 0, 35 m and L = 1, 4 m and will have a cylinders form. 2) Injector see **(Fig 8)** with compressed air at 5 atm. with two pieces. 5) Valve open at 3 atm. 6) Tap on pipe to the private house. 7) Pipe to the private house radiator. 8) The private house. 9) Return pipe. 10) Valve for outlet handling reservoir. 11) Reservoir from outlet handling. 12) Tap on water pipe.13) Shower.14) Compressor for 5 atm.15) Pipe for water.16) Tap for water, 17).Stoockroom, 18) Pipe for water to spiral.19) Pipe for water to apartaments 20) Pump for water, 21) Pipe spiral for warming up water to the private houses.22) Inside wall. 23) Outside wall. The $H_2CO_3 + N_2$ which is obtained from the new combustion process will be used for irrigation in the backyard with a recycle labyrinth. These reactors stop for ever the exhaust of pollution in the atmosphere, through burning of all kinds of combustible. The greenhouse effect is stopped for ever, Reactor see **(Fig 9)** in spiral pipe will be obtain 100° degrees or more, if the new combustion process is regulate so, for warming will be used vapor and $H_2CO_3+N_2$ obtaining from new combustion process it work in close circle, example spiral pipe warming up crude oil for refine up it. These reactor with spiral pipe which not be on contact to the flame, shell be obtain high temperature over 100° degrees Celsius for the different utility, The reactor will be constructed with double wall, and water as agent for cooling which is part of a closed circuit.The flow for water, fuel, gas or air in a pipe is calculate with formula F seen (page 1/21, 25 row 5). In the Reactor the thermal efficiency is $\eta th <= 99, 98$ % it is ideal, Reactor see **Fig (9, 10, 11)** most resist to 250. 40 and 15 atm.

**LABYRINTH for recycele** with $H_2CO_3$ and $N_2$ sees **(Fig 6, 7)** with is obtain from reactors, vehicles and combustion instalation, with this invention there will be irrigation on 50-200 ha ground with $H_2CO_3+N_2$ it is obtein from new combustion process, within agriculture, for all the cultivatable plants with leaves. The labyrinth is good even for irrigation of woods nursery, and can even be used for irrigation in greenhouses. The irrigation shall carry on daily, shorter than 20 minutes a day until the ground will be saturated, or maybe every two days. This is up to the agronomist to decide. The labyrinth made out of pipes, see **(Fig 6),** with holes, see **(Fig7),** is built under the ground to a deep (profoundly) of 80 centimeters. Round the pipe there shall be a radius of 100 mm where there will be arranged a gravel circular round the pipe, for the hole not to be stuffed up with soil. The irrigation, with $H_2CO_3+N_2$ is superb, $CO_2$ as nourishment for the leaves that liberate $O_2$ from $CO_2$ and $N_2$ as nourishment for the roots of the plant, which the irrigation make the vegetation to grow rapidly and also with intensity and gives an ecological product that all of the human kind needs. The recycle labyrinth can also be used where the people cultivate forage for the cows. For release of $O_2$ from $CO_2$, bacteria[2] can be used. For an excellent action against the greenhouse effect the previously mentioned bacteria should also work into the atmosphere.

**Table of signs for Figure 6:** 1) Reservoir that will be filled up with $H_2CO_3 + N_2$ via valves (point 11) from outlet handling reservoirs. 2) Pump. 3) Tap. 4) Labyrinth made out of pipes with distance between 1,5 - 2 meters among the pipes and 1 meter towards the interior from the margin. 5) Return pipe to the reservoir. 6) Discharge pipe from reservoir with a tap on prior to the pump. 7) The distance 1 meter, from margin to the inside of the labyrinth, the labyrinth shall be

[2] See Gymnasiekemi A, Stig Andersson, m.fl., Liber AB, 3 u, ISBN 978-91-47-01875-8.

constructed in a way that the area is as big as possible so that's profitable.8) The distance 1,5 meters between the pipes in the labyrinth. 9) The labyrinth made out of pipes is buried in to the ground on a deep of 80 centimeters. 10) Round the pipe you must place gravel on a radius of 100 mm, to protect the holes of the pipe from not being blocked with soil. 11) The valve for filling the reservoir (1) with $H_2CO_3 + N_2$ from the recycle reservoirs. 12) Tap on the discharge pipe. **Table of signs for Figure 7:** 1) Pipe made of PVC. 2) The holes with $\Phi = 2 - 5$ mm. 3) Radius for the pipe is $R \geq 100$ mm. 4) Distance between the holes on the pipe is $l \geq 50$ mm and the angle between three holes on the same circumference will be 90° and the bottom of the pipe will not have any holes and shall be placed towards the deep of the soil/ground.The reservoir for $H_2CO_3 + N_2$ will be constructed, in condition to how many litres soil that daily is used up to become saturated, and how much the plants consume $CO_2$ to produce $O_2$. From this reservoir obtain recycled $CO_2$.

## THE CLAIMS FOR PATENT

**1) NEW COMBUSTION PROSSES** With this invention shall be solved climate crisis The greenhouse effect is stopped for ever, New combustion process is for **complete combustion and scientific can be achieved only by air pressure** (5 to 200 or more) atm and give a complete combustion. This high compressed air will suck in all kinds of the existing purified fuels from **(Table 1)** until the mixture between the air and fuel will become saturated and perfect homgeneous **on the basis air pressure**, these results in a complete combustion. **Without air pressure is impossible to obtain a complete combustion of a combustible because every molecule of combustible is needed for a larger number of molecules of air at the same time for combustion.** This new combustion process is accomplished with different **injectors (a, b and c) seen (Fig 2, 3, and 8)** for complete combustion, which give the following outlets: $H_2O$, $CO_2$ and $N_2$, ($H_2CO_3 + N_2$), it is drinkable, that can undergo outlet handling and recycle labyrinth. This combustion process gives a complete combustion, since CO is not formed thanks to the fact that $\Phi = 1$ or less, see **(Fig 12).** The New combustion process respects the fundamentalTHERMOCHEMISTRY[1] principle, that is the Combustion Efficiency, $\eta c = 100$ (%), and the Fuel Equivalence Ratio $\Phi$, when $\Phi = 1$. The New combustion process withholds strictly the relation between the quantity of air molecules and fuel molecules $m_A/m_F$, see **(Table 1).** To create a complete combustion there is e.g. a need of 14, 5 molecules of air to burn up one 1 molecule of combustible oil it is posible only with air pressure. The flow of fuel, from the fuel pipe, that is sucked in by the high compressed air for $\Phi = 1$ is calculated with the formula: $\mathbf{F = (P1-P2) \cdot \pi r^4/8L\eta}$. The meaning of the formula is: F = the flow in the fuel pipe, P1 = the pressure of 5 to 250 or more atm. in the air pipe, P2 = one atmospheric pressure in the warmth installation, r = the radius for the fuel pipe, L = the length for the fuel

pipe. $\eta$ = the viscosity for the fuel. The relation between the air pipe, the fuel pipe or the holes of the nozzle must be holed in the strict proportion from the **(Table 1).** for a complete combustion
For $\Phi = 1$ Stoichiometric can be obtain maximum energi from combustible.With NEW COMBUSTION PROCESS be realized the fact that noting disapears everything transform to peoples use.In the present time the combustion of the fuel is incomplete for all the vehicles and differing combustion installations. It's incomplete because of the outlet that still gets out, e.g.; HC hydrocarbon, CO carbon monoxide, and $NO_2$ nitrogen dioxide. With this NEW COMBUSTION PROCESS the combustion is complete **on the basis air pressure and under control.** The outlets are $H_2O$, $CO_2$ and $N_2$, drinkable and natural fertilizer, and they shall be put under an outlet handling and recycling labyrinth. This contributes to that differing pollutions will be eliminated and the greenhouse effect will be handled. During a period of ten years it is possible to overcome the pollutions in the environment in a simple and cheap way. The (Table 1) bellow shows the stoichiometric AF (air, fuel) relation, between the pipe for the compressed air and the pipe for fuel and the holes nozzle for fuel, when $\Phi = 1$ and $m_A/m_F$.**(Table 1)** $m_a$ = molecule air, $m_f$ = molecule fuel for complete combustion.

**Table 1.** For complete combustion under perfect control with purifyed combustible.

| Fuel<br>Name / Formula | Share<br>$m_A/m_F$. | Stoichiom e-tricAF Φ=1 Air Fuel Mol Mol. $m_A$ $m_F$. | Stoichiometric dim for: Φ=1 air-pressure Fuel pipe / pipe D mm | nozzle D mm |
|---|---|---|---|---|
| Gasoline $C_8H_{15}$ | 14,6/1 | 14,6 1 | 1,46 | 0,1 |
| Light diesel $C_{123}H_{22,2}$ | 14,5/1 | 14,5 1 | 1,45 | 0,1 |
| Heavydiesel $C_{14,6}H_{24,8}$ | 14,5/1 | 14,5 1 | 1,45 | 0,1 |
| Isooctane $C_8H_{18}$ | 15,1/1 | 15,1 1 | 1,51 | 0,1 |
| Methanol $CH_3OH$ | 6,5/1 | 6,5 1 | 0,65 | 0,1 |
| Ethanol $C_2H_5OH$ | 9,0/1 | 9,0 1 | 0,90 | 0,1 |
| Methane $CH_4$ | 17/1 | 17,2 1 | 1,72 | 0,1 |
| Propane $C_3H_8$ | 15,7/1 | 15,7 1 | 1,57 | 0,1 |
| Heptane $C_7H_{16}$ | 15,2/1 | 15,2 1 | 1,52 | 0,1 |
| Cetane $C_{16}H_{34}$ | 15,0/1 | 15,0 1 | 1,50 | 0,1 |
| Coal(carbon) C | 11,5/ | 11,5 1 | 1,15 | 0,1 |
| Toluen $C_7H_8$ | 13,5/1 | 13,5 1 | 1,35 | 0,1 |
| Hydrogen $H_2$ | 34,5/1 | 34,5 1 | 3,45 | 0,1 |

**2) COMPRESSOR with INJECTOR, see Figure 2,** this injector is construct for complete combustion, shall be used for all two and also by four-cycled engines, which consumes all kinds of fuels sees in (Table 1) for complete combustion. Shall at the same time inject the mixture between the air-pressure and the fuel into the engine cylinder (10).The compressor (1) shall be construct whit one cylinder for

each cylinders engine.Thus there will be created a complete combustion. This is possible by choosing the strict relation between the air pipe (3) and the fuel pipe (5) in state of how many molecules air is needed to combust one molecule of fuel it is selected from the **(Table 1)**e.g. Gasoline. The Combustion is complete as it is obtained through holding after the fundamental THERMOCHEMISTRY[1] principle, see (Fig 12). That is the relation between Combustion Efficiency, $\eta_c$=100 (%) and Fuel Equivalence Ratio $\Phi$, when $\Phi$ = 1. E.g. Gasoline sees (Table 1). To combust one molecule of gasoline there is a need of 14, 6 molecules of air. This state between the air pipe (3) and the fuel pipe (5) must thus be 14,6/1. For this state you can decide that the air pipe (3) has a diameter = 14,6 mm and the fuel pipe (5) a diameter = 1 mm. The diameters for the air pipe (3) and the fuel pipe (5) shall be taken from the (Table 1), this gives a complete combustion.Compressor (1) for compressed air that shall be built with a cylinder for each engine cylinder. The Compressor (1) shall furnish the Injector (2) with compressed air at 200 atm through the air pipe (3), The piston (13) is for intake of air through the filter (18) and the valve (16) opens at intake and is closed with a spring (17).On the Piston (13) is assemble on piston foot (25) on which is assembled the roll (19). Piston (13) is pressed down for contact with the cam (20) of the spring (24), that shore up between support (23) and piston foot (25).When the piston (13) presses up of the cam (20) and roll (19) into the cylinder (14).The piston (13) then presses up take the air from the air room (15) through the valve (12). The valve (12) then opens up and after that is it closed with a spring (11). After that the air is pressed up to the pipe (3) and creates an air-pressure of 200 atm. The air pipe (3) connects the COMPRESSOR (1) with the INJECTOR (2). When the intake cycle begins for the engine then the solenoid (4) opens the INJECTOR (2) needle (8). The air from the pipe (3) with high air-pressure of 200 atm flows out through the mouthpiece (9) to the

cylinder (10). Thus the high air-pressure sucks in the fuel from the pipe (5) into the air mass through the nozzle (26) and then the mixture is injected through the mouthpiece (9) into the cylinder (10).The nozzle (26) is assembled on the needle (8) tip. The nozzle (26) out side is conical similar with mouthpiece (9) inside con angle. The nozzle has four holes with a diameter on = 0, 25 mm, and with the interval 90° in circumference. The nozzle (26) diameteris chosen from (Table 1) will be constructed with more holes if it is necessary These holes distribute homogeneously the fuel in the air mass. When the compression cycle to engine begins, then the solenoid (4) is closed. The spring (21) presses down the needle (8) on the mouthpieces (9) con, which at the same time closes of the air and the fuel. The spring (21) shore up on the safety bolt (22). The arises high air-pressure, rapidly makes the mixture between the air and the fuel homogeneous. This homogeneous mixture is injected through mouthpiece (9) in cylinder (10) The mixture is 200 times more homogenise than in the present engines. When the high compressed air sucked in the fuel through nozzle (26), and is injected through mouthpiece (9) in into the cylinder (10) a maximum turbulence is created into cylinder (10). This high air-pressure than created a maximum turbulence into cylinder (10), is 200 times more turbulence than in the present engines. When the engine piston comes up is created the compressed- cycle, the explosion-cycle begin. The ignition and explosion is instantaneous and it is 200 times more rapid that in the present engines, the combustion is total with a maximal velocity that gives the engines piston more velocity and more power for the engine. The mixtures volume that is injected in through mouthpieces (9) into the cylinder (10) must be equal to $V_d + V_c$ see (Annex 1) ; Where $V_d$ (2) = Displacement volume(2), $V_c$ (1) = Clearance volume (1).

The flow of the fuel, that is sucked in into the air mass from the fuel pipe (5) through nozzle (26)similar nozzle (8) from **(Fig 4)** is calculated with formula, $\mathbf{F = (P1\text{-}P2) \cdot \pi\, r^4/8L\eta}$ where F = the flow in the fuel pipe (5), P1 = the pressure for the air pipe (3) with 200 atm., P2 = the 1 atmospheric pressure in the cylinder (10), r = the radius for the fuel pipe (5) e.g. the sum of the radius from the nozzle (26), L = the length for the fuel pipe (5), $\eta$ = the viscosity for the fuel. To secure that $\Phi = 1$ the fuel pipe (5) shall be equipped with a tap (6). The tap (6) shall be fixed in a special plant and be lead sealed for $\Phi = 1$. This is a double assurance that the combustion is complete and under a total control. The outlet will be $H_2CO_3 + N_2$. On to the buddy of the injector (2) where the fuel pipe (5) is connected there shall be installed a tap (7) shall be in connection with the gas pedal. The tap (7), that is produce the same a tap and adjusts there the engines' minimum rev for $\Phi \leq 0, 4$ that is open, and with gas pedal will be opened up to rev maximum $\Phi = 1$, and will be rotated until $\Phi \leq 0, 4$ with a spring. On the new engines shall be mounted the compressor (1) on to the same place where the fuel pump is mounted on the present diesel engines. The injector (2) shall be placed on to the cylinder-head instead of the intake valve and $\theta$ (8) = *Crank angel(8)* see **(Fig 1)** come to be calculate of. The new engines do not need to have intake valves, air filter, carburettor, cam axis for intake valves, springs and second components, the catalytic converter, because the new engines do not let out any outlet as: CO, $NO_2$ and HC. The new engines only let out the outlets $H_2CO_3 + N_2$ and these outlets will be put under an outlet handling mounted on the car and recycling in labyrinth. Hydrogen can be used as fuel for the new engines and then the outlet will be $H_2O$ that shall be put on an outlet handling and recycled. The $H_2O$ can be recycled through sale for electric-battery, laboratories and to the pharmacy.

The compressor (1) and the injector (2) shall be produced with present techniques' and with minimum costs'. Under these conditions with Φ = 1 for the new engines that will use Compresor and Injector sees **(Fig 2)** there will be obtained:

1). Fuel consumption will be cut down (reduced to) with (30-70) % for Φ = 1.see Footnote 1.

2). The Engines' efficiency will be improved with (30-40) %.

3) The fabrication cost will be cut down with (30-40) %, many components from the older engine will disappear.

4) The crank angel (intake angel), θ, shall be newly calculated. See **(Fig 1).**

5) On these injector there shall be assemble a tap (7) for (chock, for speed) a) for $N_{minimum}$ there shall be $\Phi \leq 0,4$ b) for $N_{maxim}$ there shall be Φ =1 These engines will not exhaust pollution and they will be the engines of this millennium.

6) Mixture between air and fuel is perfect homogeneous because of air-pressure.

7) Turbulence is 200 at the time more as the current engines.

8) Ignition and explosion is 200 times more rapidly but the current engines.

9) At the engines efficienty increased.

10) Ignition skall be carried out with spark plugs.

The Fuel Equivalence Ratio Φ for the old engines increases from Φ = 1 to Φ = 1, 3 and is for big lorries up to Φ = 1, 7 that creates more pollutions as: HC, CO and $NO_2$, because of incomplete combustion. The COMPRESSOR (1) and the INJECTOR (2) shall be constructed in highest series whit actual technology and within10 years all new and old cars shall be equips with they. If so pollution will not come out from the vehicles.

**3). INJECTOR see Figure 3,** is manufactured with two paralel the pipes, is for combustion of grind coal with help of combustible oil,

this is paralel and cocentric in the air pipe. When the INJECTOR is constructed shall it have an absolute relation to the air pipe (3), the fuel pipe (1), and the coal pipe (5).sees **(Table 1)** for complete combustion. If it is decided up on complete combustion of combustible oil and coal, there will be need of 14, 5 molecules of air to combust a molecule of combustible oil and you need 11, 5 molecules of air to combust a molecule of coal. This absolute relation, shall respect the fundamental THERMOCHEMISTRY[1] principle between Combustion Efficiency $\eta_c$ = 100 (%) and Fuel Equivalence Ratio $\Phi$, for $\Phi = 1$, respect see (**Fig 12)**. This gives a complete combustion and the diameter for the air pipe (3) is chosen by (14,5 air molecules for combustible oil and 11,5 molecules of air for coal) that gives the air pipe (3), a diameter on =(14,5mm + 11,5mm) = 26mm.The pipe (1) for combustible oil has a diameter on = 1mm and the pipe(5) for coal a diameter on = 1mm takes from **(Table 1).** This INJECTOR has a pipe (3) with air inside, under an air-pressure on 30 to 100 atm that is shot out in the kiln through the nozzle (12), at the same time that the air-pressure suck in combustible oil from the fuel pipe(1) and the coal pipe (5). Nozzle (12) has an exterior angle (13) on $90^o$ that makes that the mixture between the combustible oil, coal and air takes a conics form (10) to injection. When the air from the air pipe (3) comes out with high air-pressure through the nozzle (12) with inside angle that will be 60° make at the air-pressur speed rise to injection it simultaneously sucks in combustible oil from the fuel pipe (1) and coal from the coal pipe (5).This high air-pressure makes that the mixture rapidly is homogenised and this produces a complete combustion. The flow of the fuel that is sucked in into the air mass from the fuel pipe (1) and coal sucked in by the air mass from the coal pipe (5), is calculated with the following formula; $\mathbf{F = (P1-P2) \cdot \pi\, r^4/8L\eta}$ where F = the flow in the fuel pipe (1) an coal pipe (5), P1 = the pressure for the air pipe (3) with 30 to 100 atm., P2 = the 1 atmospheric pressure in the combustion kiln, r = the radius for the fuel pipe (1) and coal pipe

(5), L = the length for the fuel pipe (1) and coal pipe (5), $\eta$ = the viscosity for the fuel.F is calcullated for each pipe.To have more control over the combustion an the tap (2) shall be assemble on the fuel pipe (1), a tap (6) on the coal pipe (5), and a tap (4) on the air pipe (3), These taps shall be sealed with lead for $\Phi = 1$ which gives a complete combustion. The section $A_a$ (7) shall be calculated with the help of the air pipe (3) diameter = 26mm from **(Table 1)** Section $A_f$ (8) shall be calculated with the help of the fuel pipe (1) diameter = 1mm.from **(Table 1)** Section $A_s$ (9) shall be calculated with the help of the coal pipe (5) diameter = 1mm from **(Table 1).** This Injector see **(Fig 3)** shall be assembled on a combustion kiln with the help of a flange (11), combustion kilns and combustion installations must be hermetical stuffed in. This Injector from **(Fig 3)** reduces the consummation of the fuel with more at 50 % and with the help of the outlet handling which is mounted on the combustion installation exhaust pipe can the injector put a stop to for ever of pollution, that is coming out through exhaust pipe from the combustion installations. This Injector is simple to be mass produced and in the course of one or two years it can furnished in all warming installations, and it can stop the pollution that is coming out from the warming installation for all times.

**4) OUTLET HANDING, see Figure 5.**This system of outlet handling shall be assembled on all the vehicles and the combustion installations to collect together the outlet of $H_2O$, $CO_2$ and $N_2$ in a reservoir (7) it will be emptied in the reservoir (1) to labyrinth for recycle. From all of the vehicles and the combustion installations through the exhaust pipe (1), is $H_2O$ vapours + $CO_2$ gas and $N_2$ gas coming out that shall be compressed with a compressor (2). For a car that consumes 5 litres of gasoline per hour is the outlet 16 kg/h of ($H_2CO_3$ +$N_2$) For this car is needs a compressor (2) with a capacity of

16 to 20 kg/h. The capacity shall be variable depending on where the outlet handling shall be utilized. This compressor (2) shall through the intake valve (3), sucked in all of the outlet that comes out of a car by exhaust pipe (1) or combustion instalation exhaust pipe, This outlets shall be compressed out through the exhaust valve (4), in the pipe (5), and pass by through cooler(8). The cooler (8) shall condense the $H_2O$ vapour to $H_2O$ liquid. The $CO_2$ dissolves in the water and become $H_2CO_3 + N_2$ gas that shall be compressed through the valve (6) into a reservoir (7).This reservoir (7) has a capacity of 25 kg. The compressor (2) shall be driven by an electric engine with a power of 0,300 kw for vehicle and for the bigger engines for combustion installations. The electric engine that operates the compressor (2) for outlet handling of the vehicles shall be driven from the battery. The reservoir (7) shall be changed at the gasoline station through sale. The $H_2CO_3 + N_2$ shall be recycled with labyrinth as natural fertilizer for agriculture, to cultivate ecologic vegetables and fruits for food and drinks. The pressure in the reservoir (7) shall be between 2 to 4 atm so that it enables to by pour out. If the outlets $H_2CO_3 + N_2$ pour out in a bigger reservoir, it is possible to sort out $N_2$, $CO_2$ and $H_2O$ one by one and can be used up within different domains, e.g. the water in the electric batteries, at the pharmacies and laboratories. This outlet handling is simple to produce in highest series. All of the warming installations and vehicles shall be equipped with outlet handling. If so, all the outlets, from the vehicles and all the warming installations, shall during a period of ten years be stopped for ever.

**5) REACTOR for heating water see Figure (9, 10, 11,)** with this invention shall be solved climate crisis. The greenhouse effect will be stopped for ever.This Reactor will be used in a closed circuit to produce the heat water up to 90° C or more and 200 atm or more and vapour up to 200 atm or more. The water is heat in directly contact with flams; this is possible with an Injector to create complete combustion with new combustion prosses, Injector seen in **(Fig 8)**

this is working with air-pressure at 250 atm or more. This Reactor shall be used for distillation of crude oil, for distillation of sea water or more. **The Reactors see Figure (9, 10, 11),** with inside combustion in closed circuit has cilindrical shape at the heads is mount spherical shape, constructed with the double wall (22, 23) and water at agent for cooling which is part of closed circuit. The Reactor example has a radius of 1, 5 m. The combustion in Reactor shall be made up of 16 Injectors (2 and 3), see **(Fig 9, 10, 11),** placed in two or more rows (2 and 3). The distance (4) between the rows (2 and 3) is in state of the flame size and will be used an air-pressure at 250 atm or more for complete combustion. The water to the Reactor (1) is furnished by the pipe (15) through the tap (16) and return pipe (9) and (15).The water is then compressed by a compressor (14) with 250 atm or more through the tap (12) in the shower (13) that sprays water over the flames. The water will be vaporized and vapours pressured in the Reactor (1) shall be raised to 200 atm in the stochroom (17). Vapours or water from the stochroom (17) shall be pressed out through valve (5) which unlocks at 200 atm, by the tap (6) through the pipe (7) is pressed into the turbine (8), apartaments or private hauses. The ($H_2CO_3 + N_2$) is drinkable, which is obtained from the combustion shall be gathered from the pipe (9) through the valve (10) in the reservoir (11) belonging to outlet handling and recycled by labyrinth. In the Reactor (1) in stockroom (17) there will be assembled a pipe spiral (21) for warming up the water to apartments. Thus the water goes through the pipe (18) for water in to the pump (20) who pressed water through spiral (21) for warming up the water to apartments. The pipe (19) is for water out to apartments,The reactor (1) is construct with dubel wall (22and 23) and water is used as an agent of cooling, the size of the Reactor for warming up water is chosen in state to the quantity of vapours (water) that is needed for startig up the turbine or warming up apartaments. In state of turbine size will be connect more numerous the Reactors in parallel.The water in direct contact with the heat of the flames will

rapidly take up all heating value and is transform into vapours These Reactors will forever stop the exhaust of pollution in the atmosphere, through combustion of all kinds of purify combustibles. Example; 1 litre combustible oil can heat up120 litre water to 100°C in direct contact with the flames. If, in the **Reactors sees (Fig 10)** is created for thermal power station, use an Injector who make complete combustion, than will consume 720 lites of combustible oil. In 24 hours can be warm up 86400 litre of water at 100°C plus 2400 litres of ($H_2CO_3 + N_2$) obtain from the combustible, they 2400 litre ($H_2CO_3 + N_2$) will be taked out from the closed circuit with reservoir (11) which belongs outlet handling , and will be used in the labyrinth for recycling. There shall be a total of 88800 litres. For warming up 3100 apartments with only 1300 $ USA, the price will be 1300/3100= 0, 40$ only for an apartment a day, so cheap will it be, and it is equitable. **The Reactor from Figure 11,** is as big as a boiler and can be used for private houses. The Reactor will use the injector see **(Fig 8)** for complete combustion with an air-pressure at 5 to 10 atm. This Reactor shall warm up water to 100°C for the private houses and these will be heated. This Reactor will consume two litre of combustible oil during 24 hours anr heat up 240 litre of water for a private house. **The Reactor seen Figure 9, 10 and 11.** Is created for; turbins, thermal power station and private houses. The Reactor are construct with dubel wall (22, 23) and water is an agent for cooling, shall be hermeticaly isolated for maximum efficiency it is $\eta = 99, 98\%$ and shall have a warning system for the maximum temperature and extreme pressure.

**6) INJECTOR seen Figure 8.** This Injector is construct for complete combustion and combustible is purifyed, A complete combustion is posible only new combustion prosses with air-presure between 5 to 250 atm or more. Injector is manufactured from the two concentric pipes, dimensions for pipes are chosen from **(Table 1)** seen above (page 27/44). From **(Table 1)** is chosed combustible oil (crude oil) which using 14.5 molecules air for a complete combustion of 1 (one)

molecule. With this Injector the mixture between air and fuel is occurs quickly and homogeneity is perfectly because the pressure. The mixture between air and fuel into this type of Injector can be realized to perfection and most respect the basic THERMOCHEMISTRY[2] principle; the relation between; Combustion Efficiency, $\eta_c = 100$ %, and Fuel Equivalence Ratio $\Phi$, when $\Phi = 1$, see **(Fig 12).** For $\Phi = 1$ the combustion shall be complete and pollution will be equal to zero and outlet will be $H_2O$, $CO_2$ and $N_2$ that can be gathered from Reactors in reservoir (11) which belongs outlet handling sees **(Fig 5)** and recycled with labyrinth see **(Fig 6,7)** Stoichiometric AF the proportion between the pipe (4) for air-presure and the pipe (1) for fuel (combustible oil) shall be 14,5 / 1, chosen from **(Table 1).**The diameter for air pipe (4) is chosen 14,5 mm and the diameter for the fuel pipe (1) is chosen 1 mm for a complete combustion.The high air-pressure to 250 atm or more in the air pipe (4) is compresed out when the solenoid (6) open the tap (5) then the compresed air goes through the nozzle (7) in Reactor, then at same time air-pressure suck in the fuel from the fuel pipe (1) and same time the solenoid (3) open the tap (2) on pipe (1). When air- pressure and fuel is passing through nozzle (7) mixture is homogeneity perfectly of pressure and will take a coniform with angle (8) on 90°, before ignition happens inside in the Reactor. The Injector is assembled with a flange (9) on the Reactor. In the Reactor combustion is complete and results $H_2O$, $CO_2$ and $N_2$ it is drincable and it is part of the closed circuit, which can be gathered in reservoir (11) which belonging to outlet handling and will be recycled in Labyrinth. The Flow of the fuel which are sucked in of air mass from the pipe (1) for fuel is; where: $\mathbf{F = (P1-P2)\cdot\pi r^4/8L\eta}$, seen (page 33/44, 30 row 2) This Injector is simple to be mass produced and in the course of one or two years it can furnished in all Reactors and combustion installations, and it can stop (Reactor see**(Fig 9,10 and 11)** most resist to 250, 40 and 15 atm)

[1] See Engineering Fundamentals of the Internal Combustion Engine, 2 edition, Willard W. Pulkrabek, 2004.

the pollution that is coming out from the warming installation for all times The **(Table 1)** shows stoichiometric AF; The proportion between the pipe for air-presure and the pipe for fuel or nozzle for fuel for complete combustion, this is possible only with high air-pressure.

**7) LABYRINTH for recycle** ($H_2CO_3 + N_2$) and **for the release oxygen from $CO_2$ by leaves plants**, see **Figure 6, 7.** for irrigation with ($H_2CO_3 + N_2$) it is an natural fertilizer, for release of $O_2$ from $CO_2$; this shall be gathered with the outlet handling from the Reactors closed circuit,all vehicle and combustion instalation. With this invention all the cultivable plants with leaves will be irrigated on a ground of 50-200 ha or less, within the agriculture. The labyrinth is good even for irrigation of woods nursery, and can even be used for irrigation in greenhouses, the woods. The irrigation shall carry on daily, shorter than 20 minutes a day until the ground will be saturated, or maybe every two days. This is up to the agronomist to decide. The labyrinth see **(Fig 6, 7)** is made out of pipes (4) with holes (2),see (Annex 7), The labyrinth is built from pipes (4) under the ground with a deep (9) (profoundly) of 80 centimeters. Round the pipe (4) there shall be a radius (10) of 100 mm and there will be arranged gravel circular round the pipe (4). This so that the hole (2) see **(Fig 7)** will not be stuffed up with soil. All that the outlet collected with outlet handling into the reservoir (7, 11) from all reactors, vehicles and combustion instalations shall be emptied out through the valve (11) in a bigger reservoir (1). When the tap (12) is opened, the pump (2) will pump out $H_2CO_3$+$N_2$ through the discharge pipe (6) into the labyrinth pipe (4) for the irrigation. The distance (8) between the labyrinth pipes (4) is 1, 5 m to 2 m and is thus buried into the ground on a deep (9) of 80 centimeters. The distance (7) is1 meter, from the margin to the inside of the labyrinth. The labyrinth shall be constructed in a way that the area is as big as possible so that's profitable.

The labyrinth pipes (4) have holes (2) in see (Annex 7) to empty out $H_2CO_3$+$N_2$ into the ground. The returning of $H_2CO_3$ + $N_2$ will occur through the pipes (4) into pipe (5) and through the tap (3), which is fixed to the bigger reservoir (1) se **(Fig 6).** The **(Fig 7)** shows that the pipe (1) same the labyrinth pipes (4) shall be constructed with holes (2) in. The diameter of the holes (2) shall be choused in state of whom big the irrigation area is. The distance (4) between holes (2) shall be choused in state at the irrigation area is and who much of $H_2CO_3$ + $N_2$ is needed for irrigation. The distance (4) between the holes (2) on the pipe (1), similar (pipe 4) is $l \geq 50$ mm or more in state of the irrigation area, and the angle between the three holes (2), on the same circumference, will be 90°. The bottom of the pipe (1), the similar with (pipe 4) will not have any holes and shall be placed towards the deep of the soil/ground. Round (10) the pipe (4) you must place gravel on a radius of 100 mm, to protect the holes of the pipe (4) from not to be blocked with soil. The radius (3) for the pipe (1) the similar pipe (4) is $R \geq 100$ mm in state of how big the area for irrigation is.All these are examples and decides agronomul.

The reservoir (1) for $H_2CO_3$ + $N_2$ will be constructed, in condition to how many liters need for soil, that daily is used up to become saturated, and how much the plants consume $CO_2$ to produce $O_2$ per day and per-hectare in agriculture. The irrigation with $H_2CO_3$+$N_2$ is superb as nourishment for the roots of the plant and the leaves, and makes the vegetation to grow rapidly and also with intensity and gives an ecological product that all of the human kind needs. For release of $O_2$ from $CO_2$, bacteria[1] can be used. For an excellent action against the greenhouse effect the previously mentioned bacteria[1] should also work in the atmosphere.From the resevoir (1) through agitation it obtain $CO_2$. gas, $N_2$ gas, and $H_2O$ water.

Figure 1

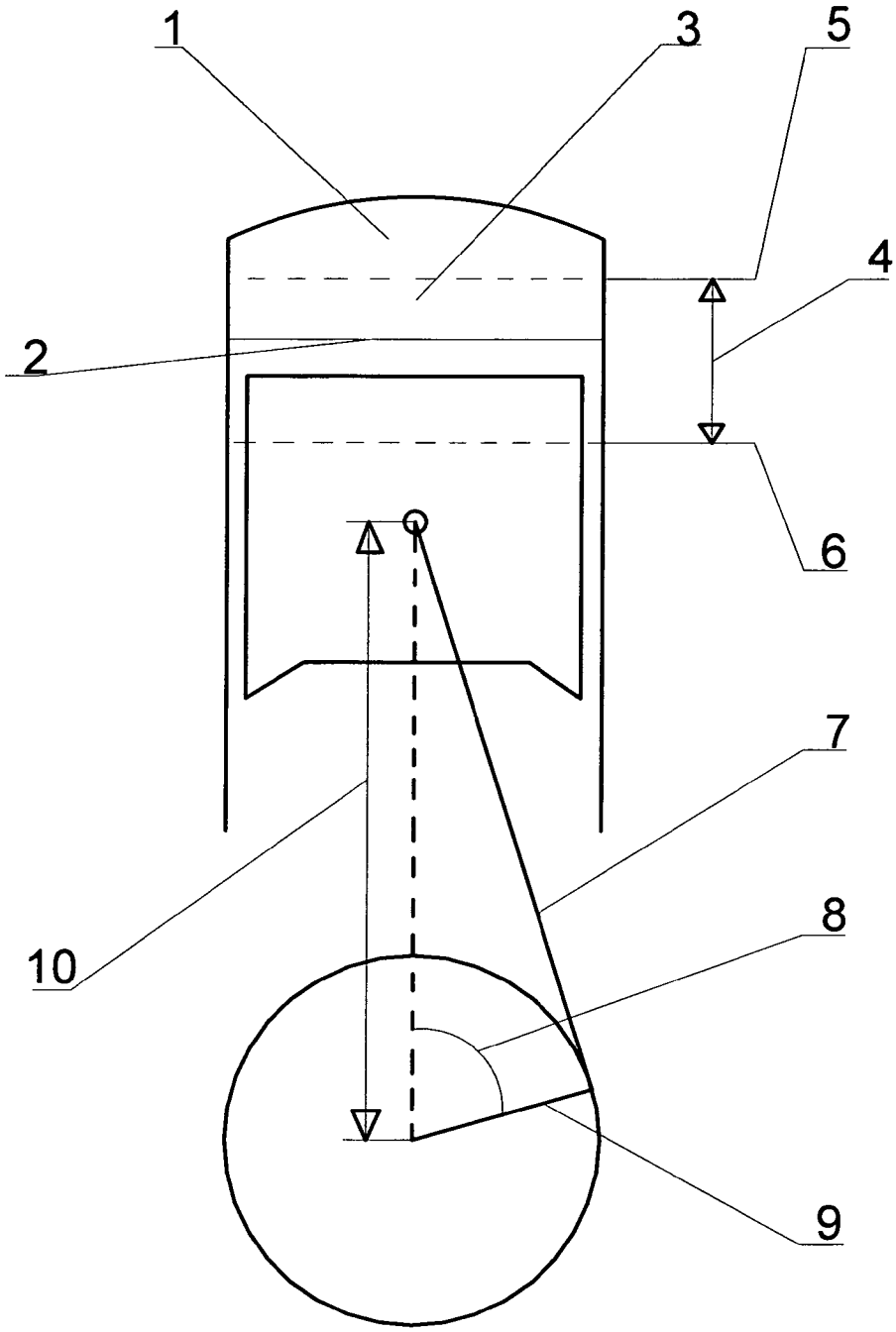


Figure 2

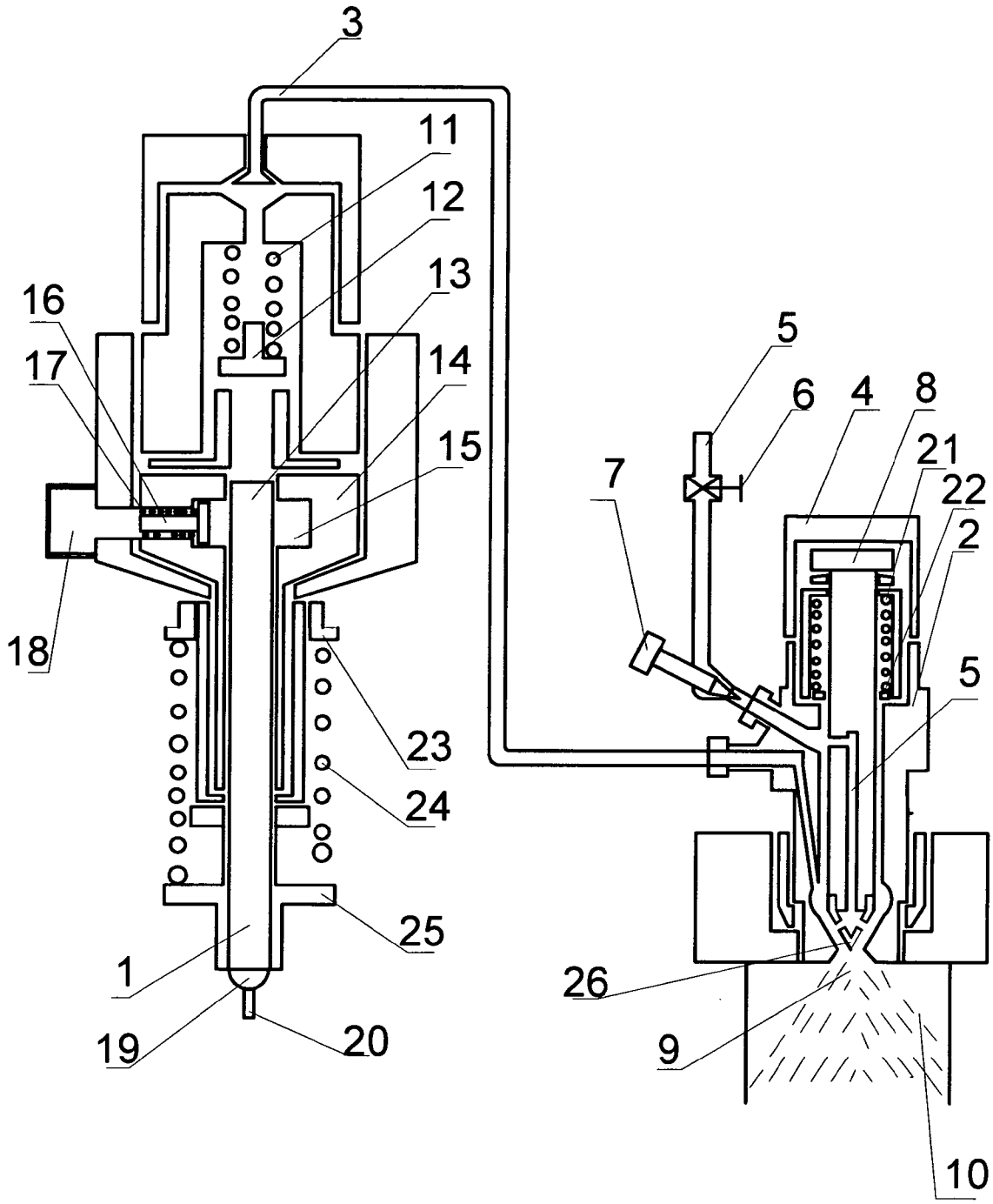


Figure 3

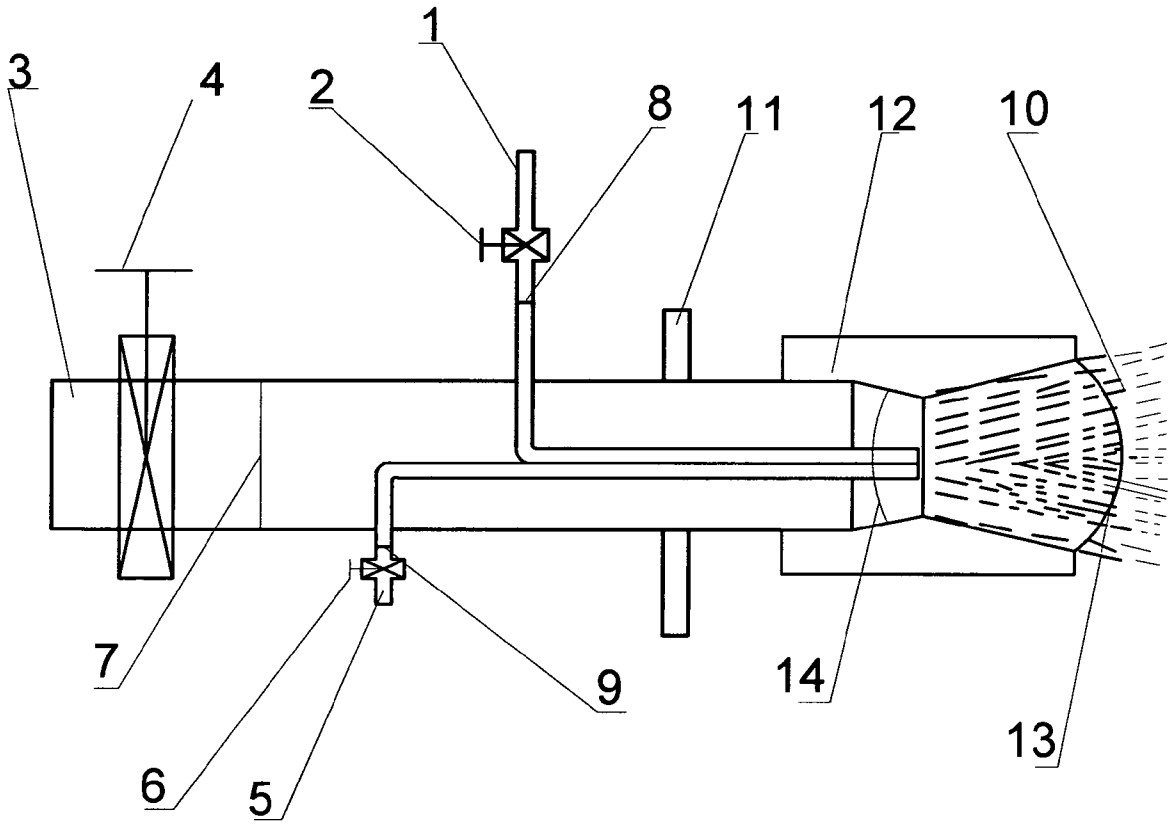


Figure 4

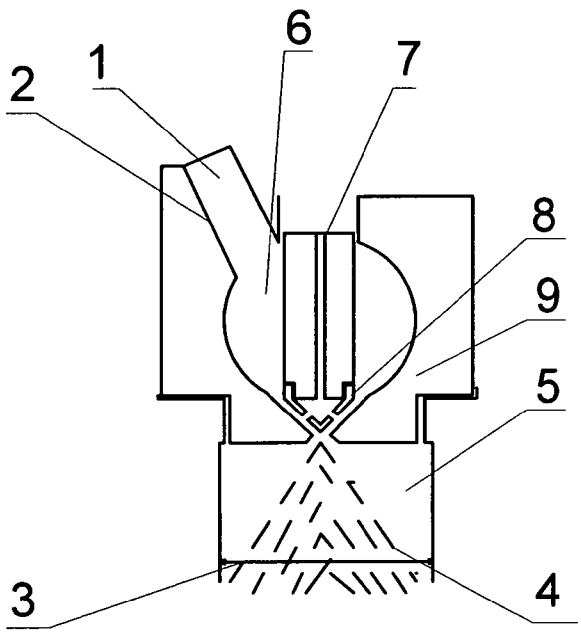


Figure 5

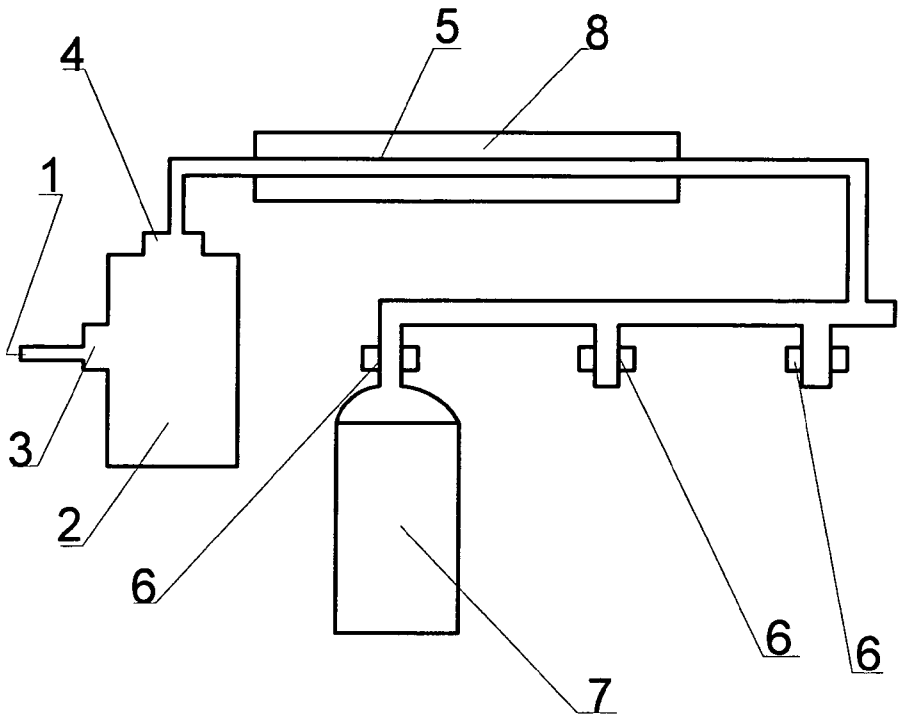


Figure 6

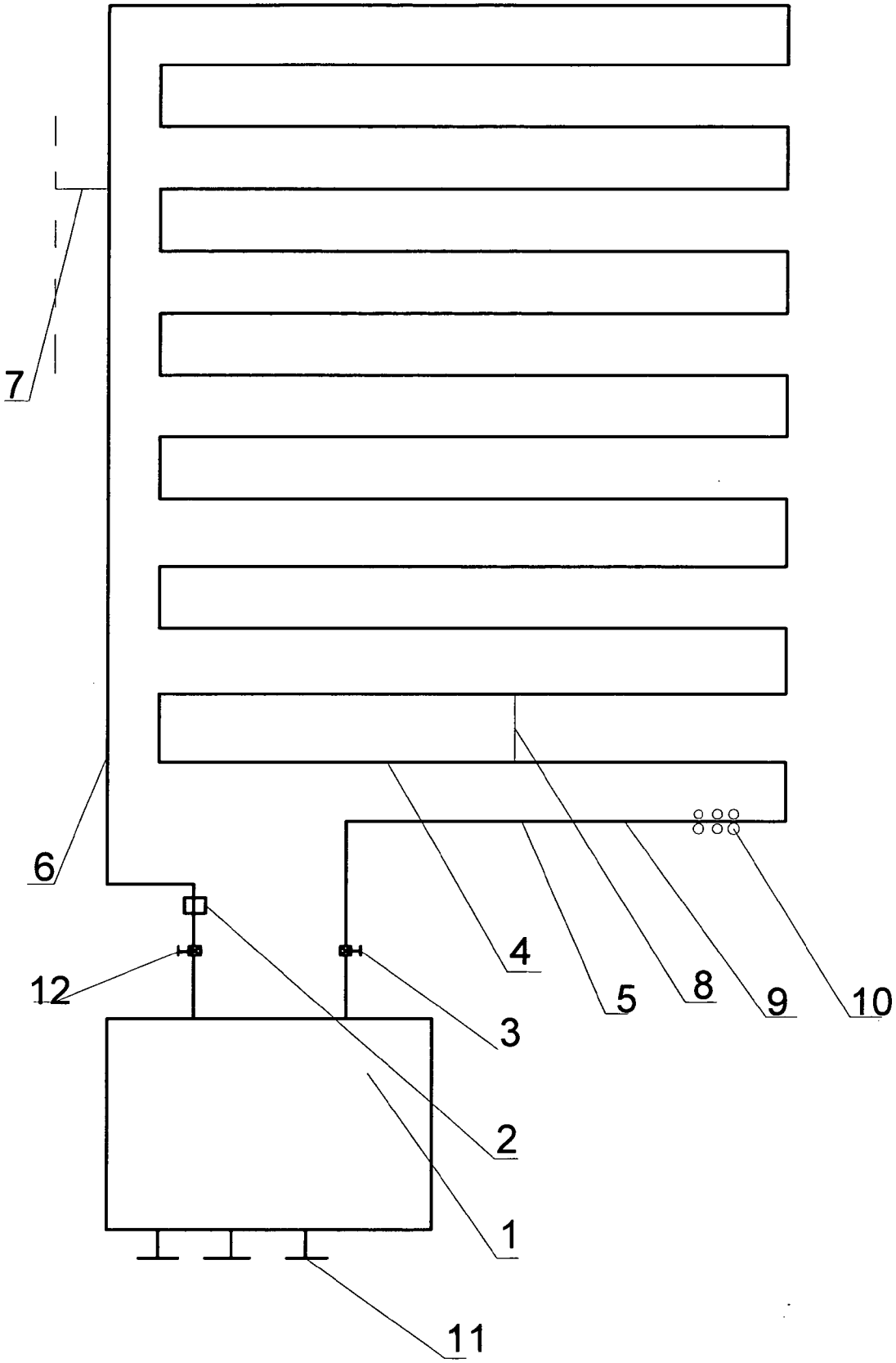


Figure 7

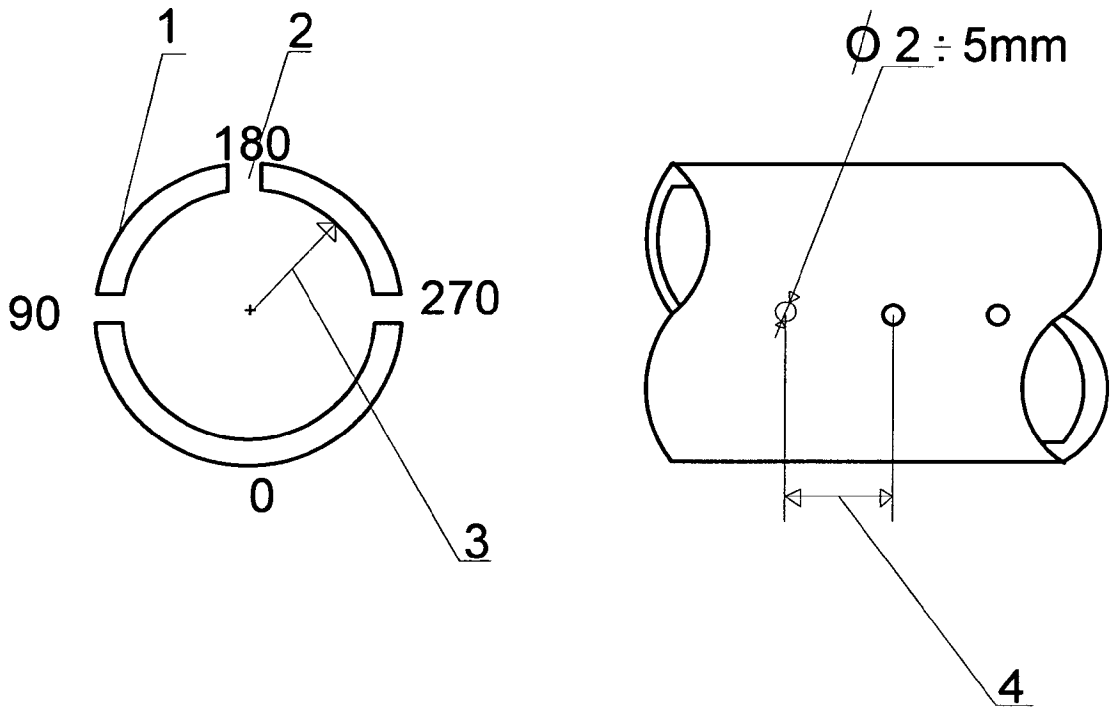


Figure 8

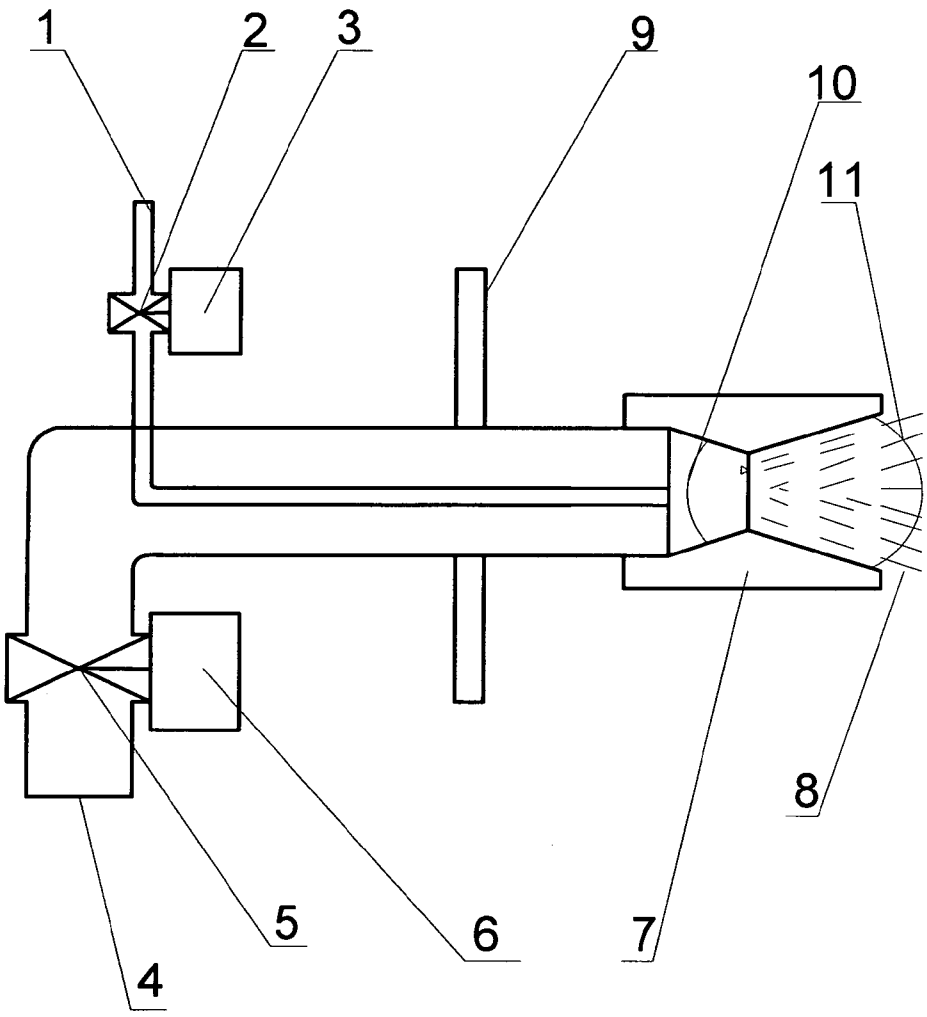


Figure 9

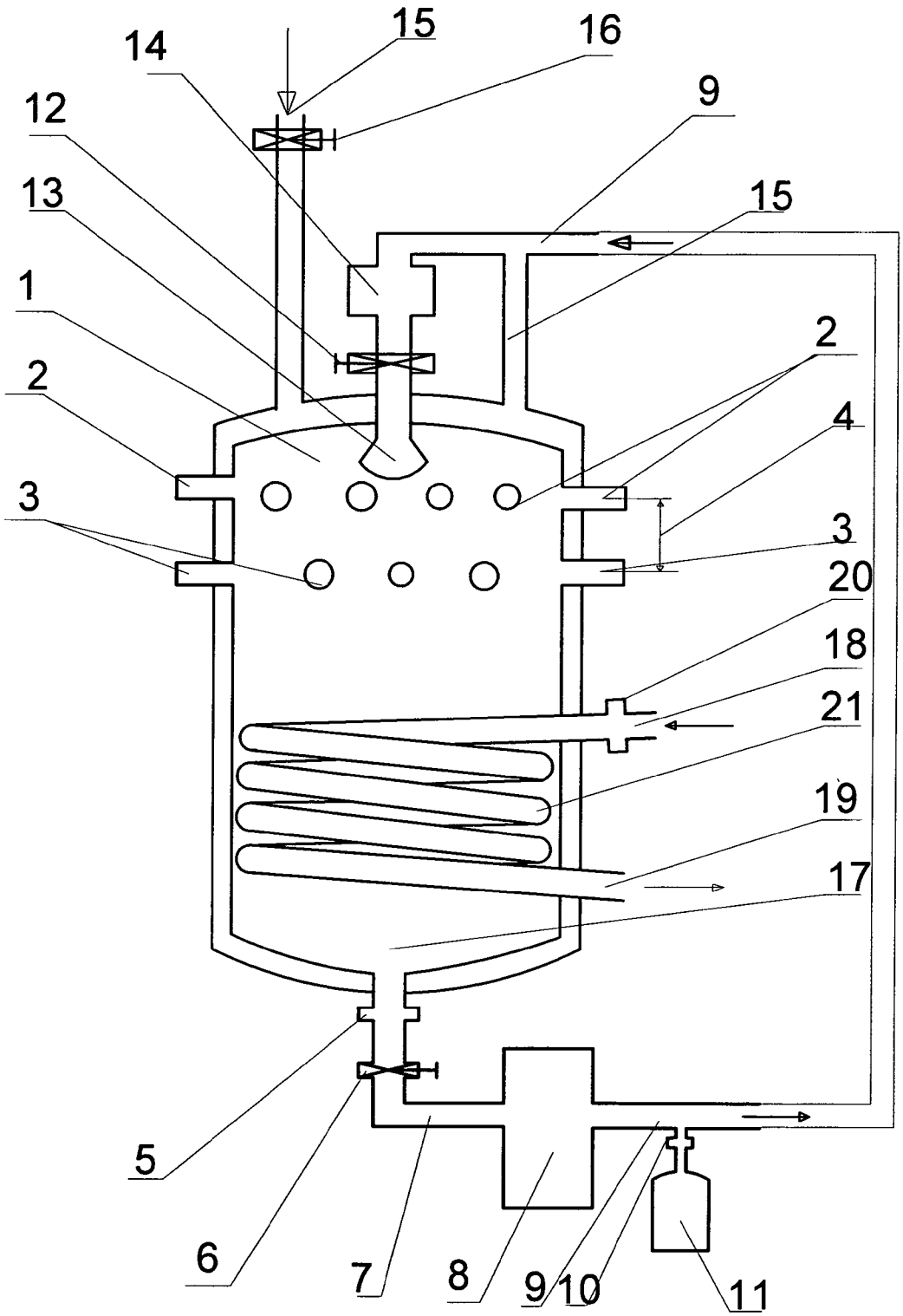


Figure 10

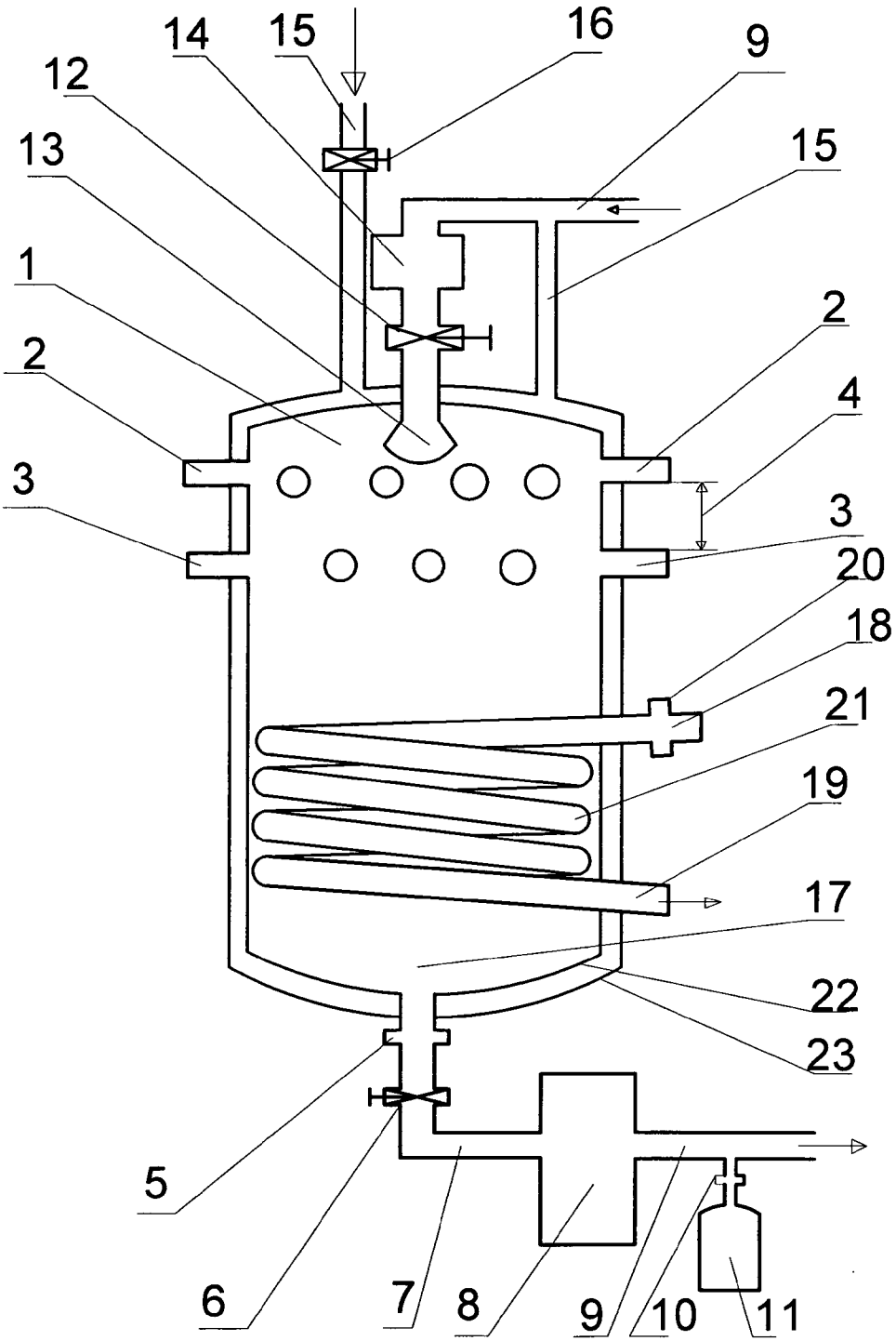
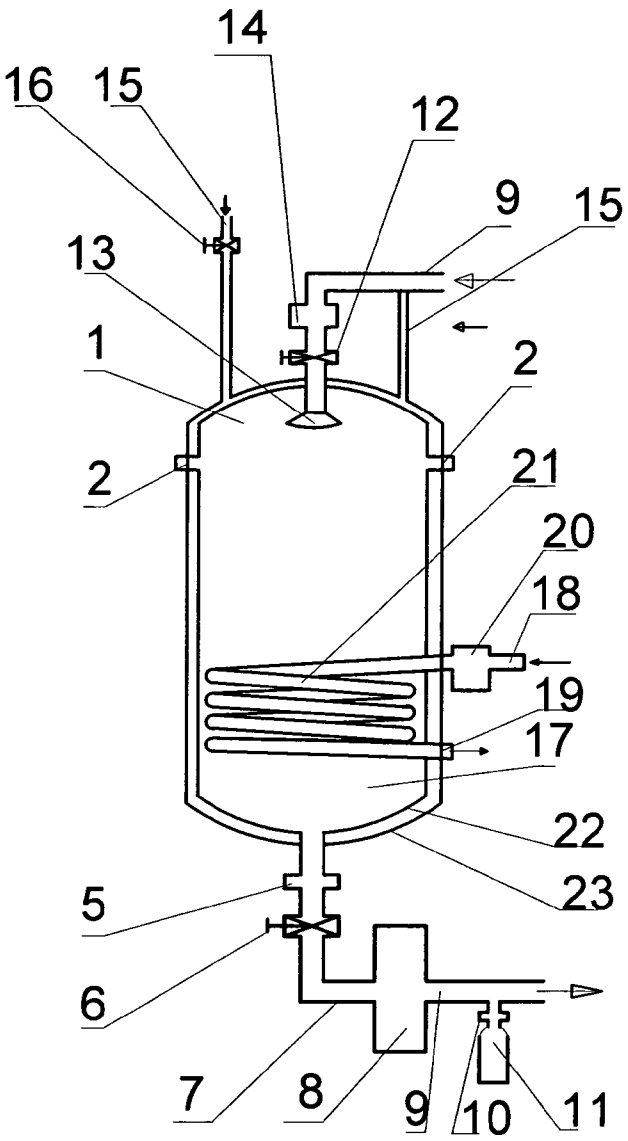
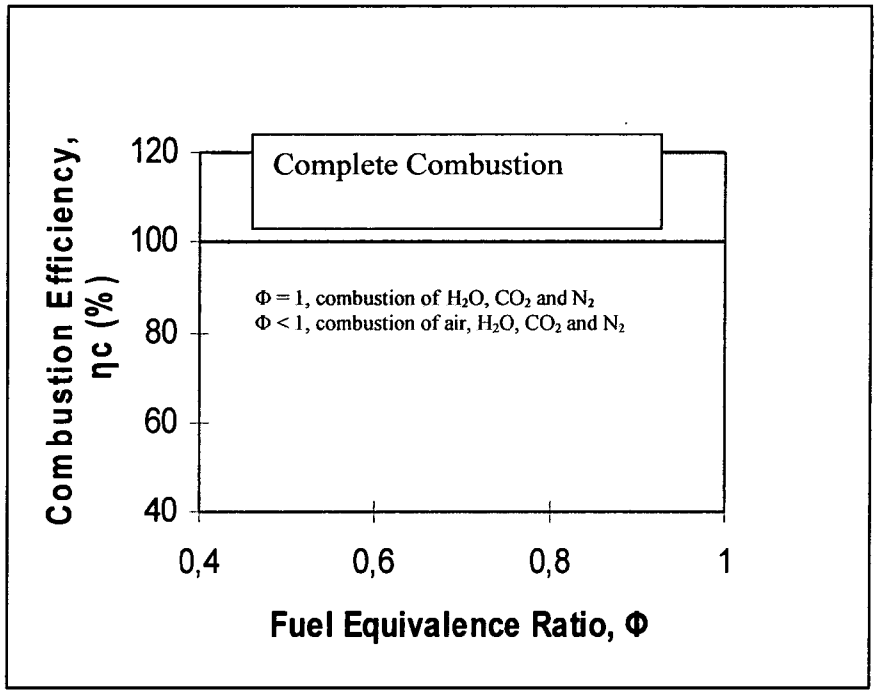


Figure 11



# Figure 12


Combustion Efficiency, ηc (%)
120
100
80
60
40
Complete Combustion
Φ = 1, combustion of H2O, CO2 and N2
Φ < 1, combustion of air, H2O, CO2 and N2
0,4
0,6
0,8
1
Fuel Equivalence Ratio, Φ