



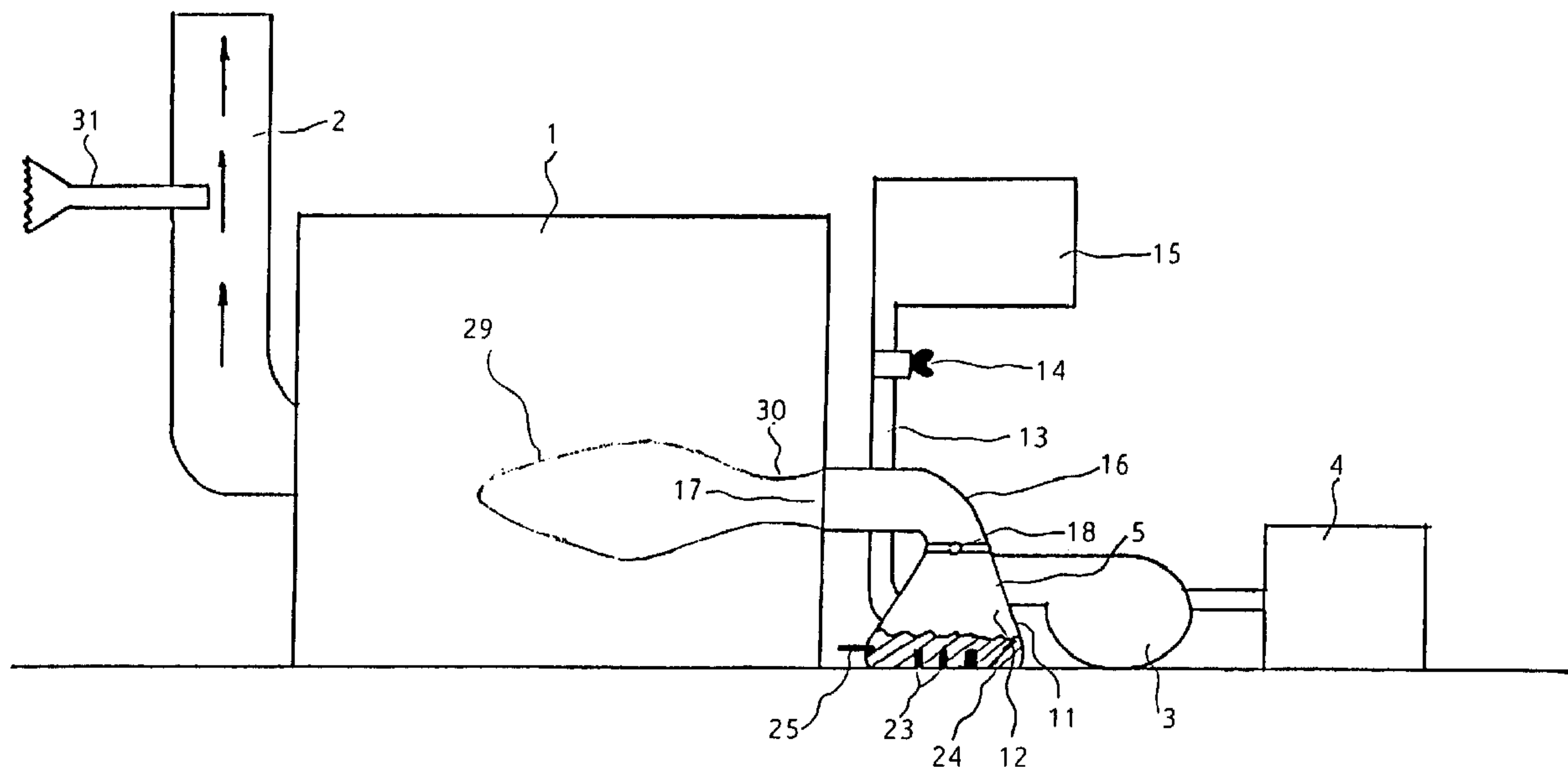
(51) Cl.Int.⁶/Int.Cl.⁶ F24J 3/00

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(54) Titre : PROCEDE ET DISPOSITIF DE PRODUCTION D'ENERGIE
(54) Title: A METHOD OF AND DEVICE FOR PRODUCING ENERGY



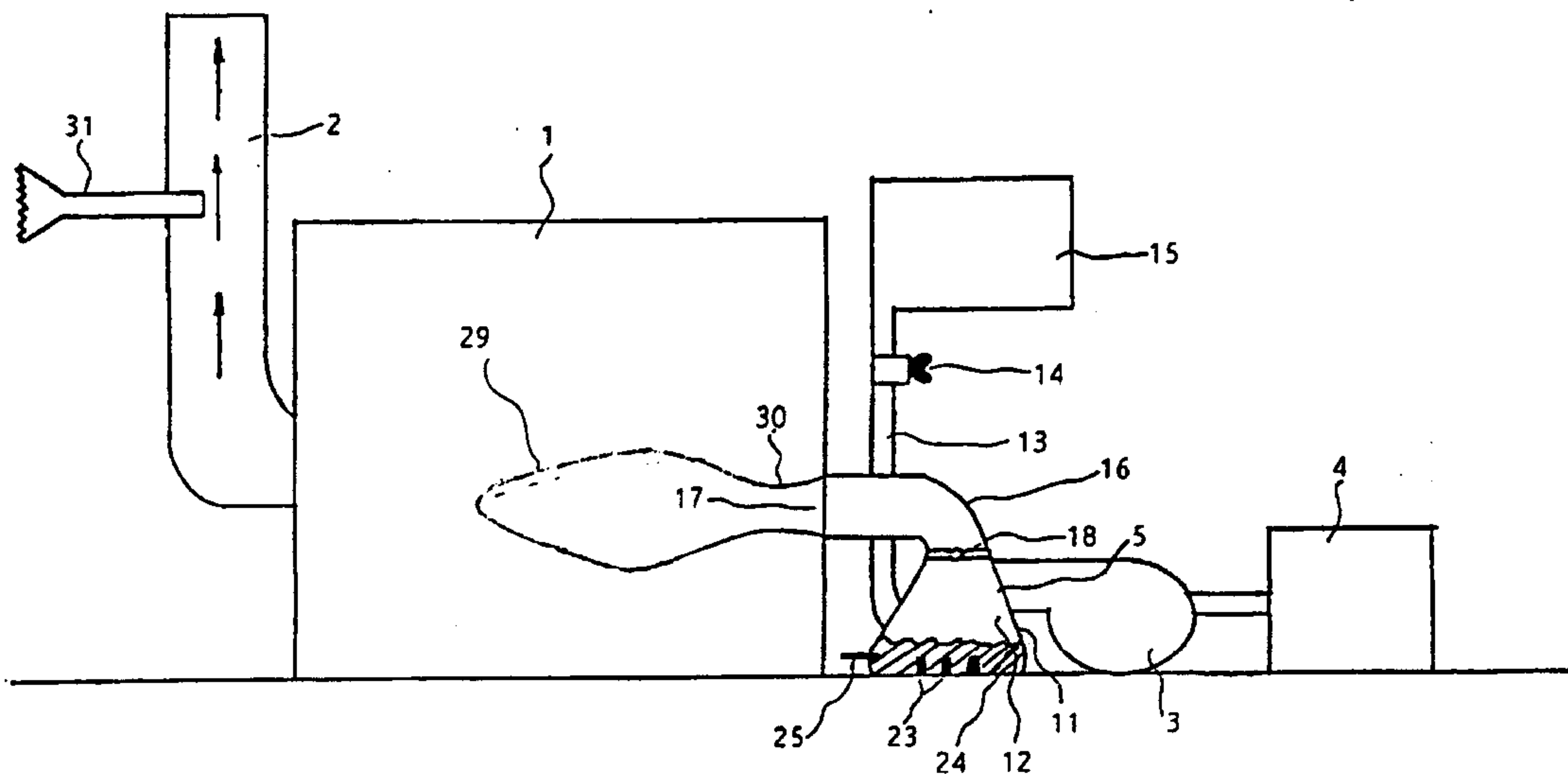
The application concerns a method and a device for producing heat energy by contacting water with hot oil in a reaction vessel (11), which leads to a violent reaction outputting a flame-like eruption of very hot gases, the generated heat energy being more than can be obtained by simply burning only the oil.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : F24J 3/00, F23C 11/00	A1	(11) International Publication Number: WO 95/23942 (43) International Publication Date: 8 September 1995 (08.09.95)
(21) International Application Number: PCT/EP95/00786 (22) International Filing Date: 3 March 1995 (03.03.95) (30) Priority Data: 94103210.4 3 March 1994 (03.03.94) EP (34) Countries for which the regional or international application was filed: AT et al. 94104951.2 29 March 1994 (29.03.94) EP (34) Countries for which the regional or international application was filed: AT et al. (71) Applicant (for all designated States except US): PENDOLO CORPORATION N.V. [NL/NL]; Ite, Piscadera Bay, Curaçao (AN). (72) Inventors; and (75) Inventors/Applicants (for US only): POMPEI, Ladislao [IT/IT]; Via Acqui, 43, I-10090 Cascine Vica-Rivoli (IT). PARISI, Guido, U. [IT/IT]; Corso Giulio Cesare, 155, I-10155 Torino (IT). (74) Agents: RIEDERER VON PAAR, Anton et al.; Lederer, Keller & Riederer, Postfach 26 64, D-84010 Landshut (DE).		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published With international search report.

2184609

(54) Title: A METHOD OF AND DEVICE FOR PRODUCING ENERGY**(57) Abstract**

The application concerns a method and a device for producing heat energy by contacting water with hot oil in a reaction vessel (11), which leads to a violent reaction outputting a flame-like eruption of very hot gases, the generated heat energy being more than can be obtained by simply burning only the oil.

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A Method of and Device for Producing Energy

The invention refers to a method of producing heat energy through a partially self-sustaining process using oil and water, and to a device for carrying out the method.

5 It is known to use oil as a heat vehicle in heat exchangers for steam production. Thus, US-A-2222575 describes cooling of hot oil by direct contact of the oil with cooling water which evaporizes immediately, generating steam for use. The hot oil is pumped into a chamber with a
10 temperature of approximately 343°C and water is sprayed over its surface from a plurality of nozzles. The reaction is that the water evaporizes, thereby cooling the oil which is then replaced by new, hot oil. Also, US-A-4164202 describes cooling of hot oil: the hot oil (about 350°C) and water are
15 both introduced into a vessel and both are sprayed in little droplets in the interior of the vessel so that the droplets meet, whereby the water evaporizes and the oil, cooled to some extent, falls down and collects at the bottom. US-A-4207840 describes a steam generator comprising a bath of oil
20 in a spherical vessel which is permanently heated from below, e.g. by a wood combustion. For generating steam, water is injected into the heated oil under the oil level, the water in intimate contact with the heated oil evaporizing and rising to the surface of the oil from which
25 the steam further rises and is discharged from the spherical vessel. The oil itself does not take part in producing, but only in transporting the heat energy.

The invention aims at producing heat energy using oil and water, wherein a much higher heat can be gained and
30 a much higher temperature is obtained in a technically exploitable manner than when only burning the oil. For the method of the invention, a reaction vessel is used

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containing a reaction chamber which includes a controllable supply line connected to a supply of oil, a source of heat energy, at least one input nozzle connected to a supply of water and of air and an output flue. The method comprises

5 the steps of: admitting oil into the chamber through the controllable supply line up to a level below the connection point of any input nozzle; applying energy to the oil to preheat the oil to a temperature slightly less than the ignition point of the oil used; continuously spraying a

10 mixture of water and air supplied from the supply of water and air over the surface of the preheated oil from at least one of the input nozzle(s); discontinuing the application of heat energy to the oil after a reaction between the oil, air and water has begun; maintaining the level of the oil above

15 a minimum level for as long as it is desired to maintain the reaction by adding oil through the controllable supply line; and collecting heat energy discharged from the reaction chamber through the output flue. Thus, in short, in a continuous process, water is contacted with the oil, which

20 beforehand has been heated to a temperature that depends on the nature of the respective oil but in any case is more than 250°C, and the process is made to take place in a vessel into which air is admitted. By such handling, an eruption of heat is caused which is comparable to an

25 enormous and very hot flame-like phenomenon. This means that an extremely strong combustion with heat release takes place, and the heat can be collected for some industrial purpose.

It is important to point out that at the beginning

30 of the process the temperature of the oil normally should be lower than that of self combustion, the oil has not to burn before the contact with the water: it is the contact with water that causes the beginning of the reaction. It is

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possible that some oils have to be heated under a higher pressure than the atmospheric, to the aim of obtaining the necessary temperature without combustion before the contact between oil and water.

5 The method has proved very effective since, in the special chamber, the water is sprayed over the upper surface of the hot oil, which beforehand has been heated e.g. electrically, which heating can be terminated upon the beginning of the process that keeps the oil sufficiently hot
10 by itself in spite of the continuous introducing of cold water (at 10 to 20°C). An ordinary oil burner supplied with water instead of oil can be used for spraying water and introducing air into the vessel.

 The oil to be used for the purpose is preferably a
15 fat oil, such as fat animal or fat vegetable oil. Vegetable oil has proved particularly effective, the necessary starting temperature in such case being about 310°C. But also light vegetable oil has been proved to be successful. The starting temperature, on the other hand, should not be
20 too high so that the oil may not be chemically disintegrated beforehand.

 For a rough process control, the relation of the oil to the water in the vessel should be approximately 40:60 per weight, a relation which, however, can be bettered, i.e.
25 using less oil, if the process parameters such as the supply with oil, water and air and the output-jet diameter are finely, particularly electronically, controlled.

 The use of sea water is possible and could even increase the performance of the system. For the chamber, a
30 vessel conically tapering to a top opening is preferred.

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A feasibility study for the use of this basic process in endothermic type engines has been carried out with entirely satisfying parameters and the loss in the energy transformation process can be maintained with minimum values. The final appliances can be very wide ranging from planes, rockets, helicopters, hovercrafts, tanks, automobile cars, boats and conveyance means or any other appliance related to the combustion process, while the basic process can be applied, as described, to heating systems for home and industry as well as burning furnaces for industry processes.

The danger of a possible explosion has been completely eliminated, since the single components are not inflammable until the precise starting conditions of the process are reached.

In this new innovative process there is also present a very low level of NO_x , generally no more than 8-10 ppm in the combustion, while in general this level is much higher likely no less than 50 ppm.

According to another aspect, a device for carrying out the inventive process comprises a reaction vessel containing a reaction chamber; first means for providing a controllable supply of oil to the reaction chamber; second means for providing a controllable supply of water and air to the reaction chamber; third means for providing heat to the bottom of the reaction chamber; and fourth means for collecting and discharging the heat energy generated, wherein the reaction chamber communicates with a flue which opens into a furnace adapted for evaluating the produced heat.

The method of the invention can be used primarily to generate heat energy, and secondarily to supply with

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driving energy an engine such as a turbo-engine or an endothermic engine.

Further details, advantages and developments of the invention will be seen from the following description of preferred embodiments and of an equipment to carry out the method, with reference to the enclosed drawings.

Fig. 1 shows a heating furnace set equipped to exploit the method of the invention;

Figs. 2 and 3 show schematic elevational sections through reactor vessels also useable in the equipment for carrying out the invention.

The equipment of Fig. 1 comprises a furnace 1 having an exhaust flue 2, e.g. a furnace as used for a boiler or for a heating, and a usual burner 3 of the type usually used to spray heating oil and air into the furnace. The burner 3 is connected to a tank 4 which may be a tank like a usual oil tank as used for heating boilers, and is equipped with a nozzle 5 sputting off the material the burner 3 receives from tank 4.

In the described equipment, the burner 3 is not directly connected to the furnace 1 but is connected to a reaction vessel 11 containing a reaction chamber 12 into which a supply line 13 opens which comes, via a control valve 14, from a further tank 15.

The vessel 11, and thus also the chamber 12, is conically shaped tapering towards its upper end which opens into some sort of a flue 16 ending as a jet 17 into the furnace 1. The flue 16 contains a flap valve 18.

At the bottom of the vessel 11, electric heating wires 23 connected to a (not shown) power source are

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arranged. Alternatively, a gas burner or another heating facility may be provided.

For carrying out the invention, the tank 4 is filled with water and the tank 15 is filled with a vegetable
5 oil. According to a particular way of carrying out the method, the

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vegetable oil may be a usual cooking oil. Under control of the valve 14, a limited amount of the oil is allowed to pass into the vessel 11, which in the depicted arrangement happens by gravity, in other arrangements by a pump. In the vessel 11, an amount of oil 24 is collected up to a level of e.g. 3 to 5 mm, so as to cover the heating wires 23. The amount of oil 24 in the vessel is heated to a temperature of approx. 330°C, the minimum for the used oil being 300°. A thermometer 25 serves for observing the temperature. If vegetable oil is used, a lot of little blue flames can be seen on the surface of the oil 24 collected in the chamber 12 upon reaching the starting temperature. Then, the burner 3 is started to spray water over the surface of the oil 24, at the same time supplying some air into the chamber 12. The water contacts the heated oil and leads to a very violent reaction with the consequence of an eruption of very hot material being discharged from the jet 17. The eruption consists of a flame-like bulb 29 of a white or blue glowing luminescent gas having a temperature of between 1200 and 2000°C, developing out of some sort of a non-luminant stem 30 of some limited length, e.g. 20 to 50 mm, which appears immediately behind the jet 17. The existence of stem 30 depends on the control and regulation of the arrangement.

For experimental purpose, a gas analyser 31 is inserted into the exhaust flue 2. By means of the gas analyzer 31, it has been found out that the process exhaust gas flow causes a minimum of pollution, typically 5 to 10 ppm for CO and 10 to 11 ppm for NO_x, in the case of a ratio water:oil = 6:4.

As concerns the continued reaction, the power supply for the heating wires 23 may be switched off since the reaction itself causes sufficient heat to keep the oil hot and to heat the further supply of oil coming from the tank 15.

Though it is supposed that the water is the main energy source, there is some consumption of oil. It is assumed that by a thorough control of the equipment, i.e. of the water and air supply by the burner 3 and of the valves 14 and 18, the consumption of oil with relation to water can be made to be approx. 1 to 9. The optimal process parameters will have to be found out by tests. In case of manual control and without much ambition to obtain the optimum, the percentage of oil has to be selected higher, e.g. oil:water = 4:6 per weight. The critical point is keeping the temperature of the oil 24 in the vessel 11

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above the minimum. The flap valve 18 which can also have a different valve construction assists to keep the temperature within vessel 11 at a value of about 320°C. It is possible to voluntarily stop the process by closing the valve 14; in doing so, the relative quantity of water continuously added will cool the reaction chamber below the starting temperature whereby the process is stopped. For an automatic control of the process, it will be necessary to continuously measure the temperature of the oil 24 in vessel 11 and in dependency of this temperature to control the supply with oil and water as well as with the air supplied by the burner.

- 10 The level of the oil 24 in chamber 12 should be maintained to a minimum of 3 to 4 mm to be sure that the process will continue; however, also a level of 1 mm of oil has been found working, however, with the risk of a sudden stop.

The reaction vessel 11 in Fig. 1 is supposed to be shaped as a truncated cone. This is not absolutely necessary, alternative possibilities would be e.g. a truncated pyramid or, though less preferable, a cylinder.

Fig. 2 shows a shape of the vessel 11 combined of a cylinder and a cone. The construction is different from the construction of Fig. 1 in that a plurality of nozzels 5 exist which spray altogether onto the level of the oil.

In Fig. 3, there are provided one nozzel 5 and a separate air supply 32 above the level of oil 24 into the chamber 12 in vessel 11, which chamber in this case is combined of a parallelepiped and a pyramid.

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According to Fig. 3, there are no electric heating wires 23 like in Figs 1 and 2, but for the initial heating of the oil, a gas flame 33 is used.

The size of vessel 11 is to be designed depending on the heating power. More particularly, it is recommended to dimension the vessel 11 directly proportional to the desired heating power. For example, in the arrangement of Fig. 1, for a heating power of the furnace and the burner of 400.000 J/h, the base diameter of the conical vessel shall be 200 to 250 mm. Larger diameters will lead to a higher heating power but at the same

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time to larger consumptions while smaller diameters will produce less heat but will lead to lower consumption of the oil and water. The consumption is directly proportional to the diameter of the vessel 11 or of the chamber 12 therein. The cone shape has the advantage of reflecting part of the generated heat back to the oil 24 so as to easier keep it hot. Also little drops of the water-oil mixture thrown around in the chamber 12 are reflected by such cone shape. It has to be taken into consideration that a too large size of the jets could possibly reduce the process temperature below the process activation temperature of the system which is about 300°C, in which case the process will be stopped.

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Anyhow, due to the relation between diameter and power, which relation may be based on the dissociation volume of the water involved, it is possible to experimentally determine the exact size of the vessel 11 for different calorimetric potentials of different burners and furnaces.

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When starting the process, as mentioned, the oil quantity in vessel 11 has to be heated to e.g. 320°C. This temperature is slightly lower than the temperature of flammability of the oil, which represents a safety point because the oil can be stored safely without any problem or cooling necessity. As mentioned, the temperature depends on the oil used.

20

The shown embodiments describe the use of the process for heating purposes. Of course, the generation of heat energy can also be exploited in different manner, e.g. for driving an engine such as a hot air engine or also standard engines or turbines modified for the purpose.

25

The following examples show possible applications:

The method can be used with a usual turbine in the following way: a turbine has burners with combustion chambers on the external toroidal diameter and in this case the system can be easily applied with great advantage, taking in consideration the usually very high fuel consumption of such machines with an high NO_x output in the exhaust gases.

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A diesel engine can be modified like this:

- two injection pumps, one for the oil, one for the water (air comes in the intake manifold as standard engines);
- modification of pump timing:
 - 5 second pump injects water after few degrees after maximum height of the piston exactly a fraction of time after combustion;
- the engine must be positioned on a reverse basis 180° , i.e. the crankshaft is placed above of the pistons. This reverse position is required to allow a formation of a
 - 10 level of oil at the basis of the reversed cylinder. This level must be of the quantity necessary in the burning cycle because a too large quantity will raise excessively the compression ratio. This set up embodiment will work also for a gasoline injected engine.

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CLAIMS:

1. A method for producing heat energy through a partially self-sustaining process in a reaction vessel containing a reaction chamber which includes a controllable
5 supply line connected to a supply of oil, a source of heat energy, at least one input nozzle connected to a supply of water and of air and an output flue, comprising the steps of:

admitting oil into the chamber through the
10 controllable supply line up to a level below the connection point of any input nozzle;

applying energy to the oil to preheat the oil to a temperature slightly less than the ignition point of the oil used;

15 continuously spraying a mixture of water and air supplied from the supply of water and air over the surface of the preheated oil from at least one of the input nozzle(s);

discontinuing the application of heat energy to
20 the oil after a reaction between the oil, air and water has begun;

maintaining the level of the oil above a minimum level for as long as it is desired to maintain the reaction by adding oil through the controllable supply line; and

25 collecting heat energy discharged from the reaction chamber through the output flue.

2. The method of claim 1, wherein the oil used is a fatty oil.

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3. The method of claim 2, wherein the oil used is a fatty vegetable oil.

4. The method of any one of claims 1 to 3, wherein the temperature to which the oil is preheated is at least
5 320°C.

5. The method of any one of claims 1 to 4, wherein the relationship of oil to water used in the reaction vessel is 40:60 parts by weight.

6. The method of any one of claims 1 to 5, wherein
10 the level of oil in the chamber is maintained by means of the controllable supply line at at least 1 mm in depth but preferably between 3 and 5 mm in depth.

7. The method of any one of claims 1 to 6, wherein sea water is supplied to the reaction vessel.

15 8. A device for producing heat energy through a partially self-sustaining process by the method of any one of claims 1 to 7, involving a reaction between oil, water and air, comprising:

a reaction vessel containing a reaction chamber;

20 first means for providing a controllable supply of oil to the reaction chamber;

second means for providing a controllable supply of water and air to the reaction chamber;

25 third means for providing heat to the bottom of the reaction chamber; and

fourth means for collecting and discharging the heat energy generated,

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wherein the reaction chamber communicates with a flue which opens into a furnace adapted for evaluating the produced heat.

9. The device of claim 8, wherein said reaction
5 vessel and the reaction chamber are cone-shaped.

10. The device of claim 9, wherein the reaction vessel tapers conically from a wide bottom to a narrower top opening which is connected to the output flue.

11. The device of claim 9, wherein said reaction
10 vessel and the reaction chamber combine the shapes of a cylinder and a cone.

12. The device of claim 8, wherein said reaction vessel and the reaction chamber combine the shapes of a parallelepiped and a pyramid.

15 13. The device of any one of claims 8 to 12, wherein the diameter of the base of the reaction chamber is proportional to the desired energy output in the ratio of approximately 225 mm:400,000 J/hr.

FETHERSTONHAUGH & CO.

PATENT AGENTS

OTTAWA, CANADA

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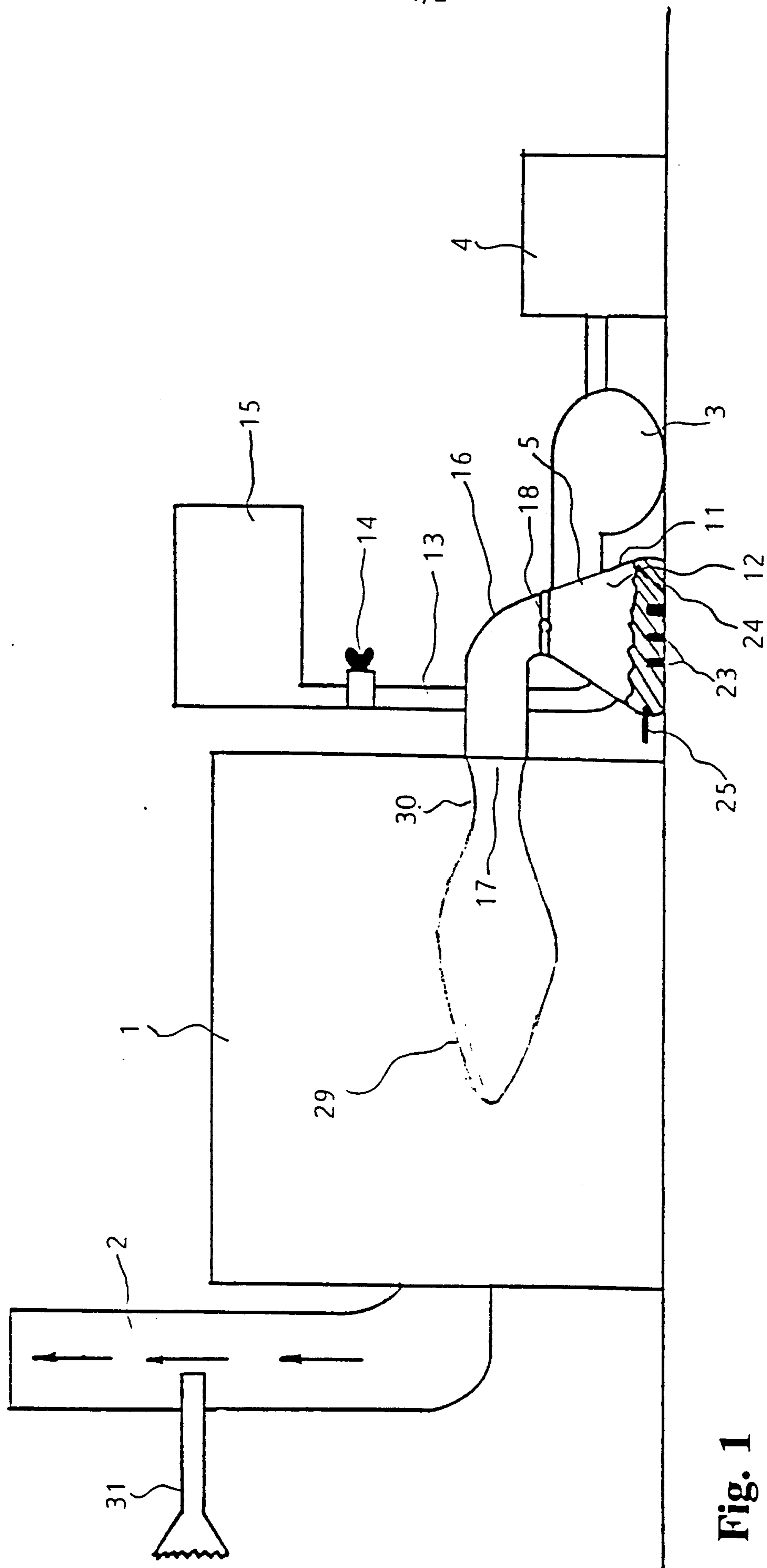


Fig. 1

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