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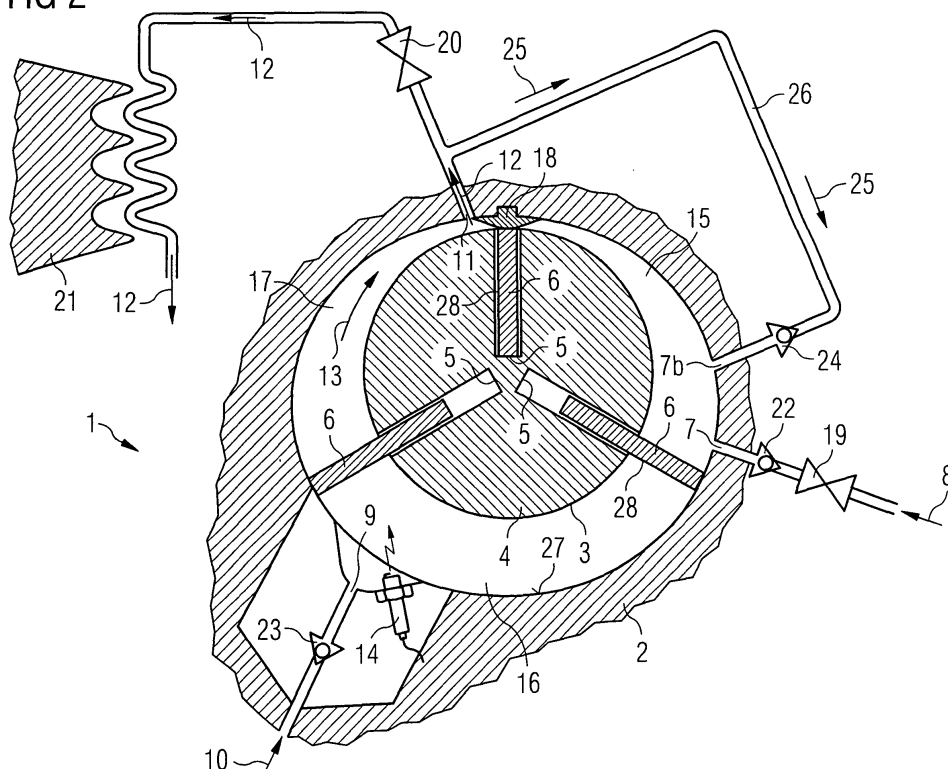
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(54) **Compressor and method for compressing gaseous fuel**

(57) A method for compressing gaseous fuel is disclosed, which comprises the steps: a) ingesting gaseous fuel into a chamber; b) ingesting air into the chamber and mixing the gaseous fuel with the air; c) igniting and partially combusting the resulting mixture of gaseous fuel and air in a confined space such that a predominant fraction of the gaseous fuel is not combusted, causing an increased temperature and therefore an increased pres-

sure of the fraction of the gaseous fuel which is not combusted; and d) discharging the resulting compressed gaseous fuel. Moreover, a compressor (1) is provided, comprising a casing (2), a rotor (3) with at least three vanes (6), at least one inlet (7) for gaseous fuel, at least one outlet (11) for gaseous fuel, at least one air inlet (9) and at least one igniter (14). Furthermore, a gas turbine comprising an inventive compressor (1) is disclosed.

FIG 2



Description

[0001] The present invention relates to a method for compressing gaseous fuel, to a compressor and to a gas turbine.

[0002] Modern gas turbines are evolving towards higher peak cycle pressures in order to increase fuel efficiency. Since the fuel, which is induced at a peak pressure, must be supplied with sufficient overpressure to account for valve losses, ingestion speeds and other flow issues, the fuel supply pressure must also rise. However, gas supply networks and pipelines have been designed for a fixed pressure and the huge infrastructure costs mean that these pressures will stay fixed for a considerable period.

[0003] It is observed that at extreme operating conditions the pipeline may not have sufficient fuel pressure to supply the gas turbine. This difficulty may be increasingly encountered in the further evolution of gas turbine technology. Up to now at off-design conditions either the power output of the engine can be limited, which may cause customer dissatisfaction, or a motor-driven fuel gas compressor can be used, which may add costs and erode efficiency because of the power drain.

[0004] It is an objective of the present invention to provide an advantageous method for compressing gaseous fuel. It is another objective of the present invention to provide an advantageous compressor. A last objective is to provide an advantageous gas turbine. The first objective is solved by a method for compressing gaseous fuel as claimed in claim 1. The second objective is solved by a compressor as claimed in claim 13 and the third objective is solved by a gas turbine as claimed in claim 27. The depending claims define further developments of the invention.

[0005] The inventive method for compressing gaseous fuel comprises the steps: a) ingesting gaseous fuel into a chamber; b) ingesting air into the chamber and mixing the gaseous fuel with the air; c) igniting and partially combusting the resulting mixture of gaseous fuel and air in a confined space such that a predominant fraction of the gaseous fuel is not combusted, causing an increased temperature and therefore an increased pressure of the fraction of the gaseous fuel which is not combusted; and d) discharging the resulting compressed gaseous fuel. This means, that part of the energy of the fuel is used to perform the compression by means of partial combustion.

[0006] The partial combustion the mixture of gaseous fuel and air such that a predominant fraction of the gaseous fuel is not combusted, causes an increased temperature of the combusted fraction which raises the pressure of all the combusted and uncombusted fuel present in the substantially fixed volume chamber.

[0007] For ingesting air, air with a higher pressure than the pressure of the gaseous fuel may be injected into the chamber. Moreover, the volume of the chamber can be decreased for discharging the compressed gaseous fuel.

[0008] Advantageously the steps a) to d) can be repeated after finishing step d). At least one of the steps a) to d) may be performed at least twice before the next step is performed. Moreover, the gaseous fuel may be, for example, introduced into a chamber with an increasing volume.

[0009] The basic principle of the invention is that fuel and air at the same time or afterwards are sucked in, the air is mixed with all or part of the fuel, the mixture is burned or explodes in a confined space and the part-burned fuel at higher pressure is pushed out.

[0010] The gaseous fuel may be compressed to a pressure with a pressure ratio between the compressed gaseous fuel and the uncompressed gaseous fuel of between 1.1:1 and 5:1. Preferably the pressure ratio reaches a value of 2:1.

[0011] The air may be induced such that it is given a swirling or vortex character. This provides a controlled mixture between the induced air and the gaseous fuel. Furthermore, the mixture of gaseous fuel and air can be continuously ignited. Advantageously the mixture of gaseous fuel and air is ignited and partially combusted in a chamber with a constant volume. Moreover, the compressed gaseous fuel may be cooled at constant pressure.

[0012] The inventive compressor comprises a casing, a rotor with at least three vanes, at least one inlet for gaseous fuel, at least one outlet for gaseous fuel, at least one air inlet, and at least one igniter. The rotor is placed in the casing such that at least three variable-volume chambers part-bounded by the vanes are formed during a rotor revolution. The inlet for gaseous fuel is placed in the casing such that the inlet for gaseous fuel is connected to a first location where a chamber has an increasing volume during a revolution of the rotor. The air inlet and the igniter are placed in the casing in a second location, where a chamber has an increasing, decreasing or constant volume during a revolution of the rotor. The outlet for gaseous fuel is placed in the casing in a third location, where a chamber has a decreasing volume during a revolution of the rotor. Advantageously the air inlet and the igniter can be connected to a second location, where a chamber has a constant or at least nearly constant volume during a revolution of the rotor.

[0013] The rotation axis of the rotor may be eccentrically placed relative to the centreline of the casing. The casing and/or the rotor may have a circular cross section, an elliptical cross section, or a curved cross section with curvature discontinuities or inflexions. The igniter may, for example, be a plasma igniter or a spark plug. Advantageously, the igniter is placed at the air inlet. Generally the igniter can be placed where the mixture between air and fuel has taken place, for example near the air inlet.

[0014] Furthermore, a seal can be placed between the casing and the rotor to provide a seal between a location where a chamber with a decreasing volume is formed and a location where a chamber with an increasing volume is formed. This can minimise leakage and maximise

the evacuation of the third chamber through the outlet.

[0015] The compressor may comprise one or more additional sets of three chambers in parallel or series. The sets can be disposed about the rotor periphery so that they at least partly balance out radial and axial forces acting on the rotor. Furthermore, such disposition may be designed to allow some of the pressure produced to be sacrificed as a driving force for the rotor. For example, the different sets of three chambers can be positioned side by side on the same rotor, but with sequences rotated relative to each other.

[0016] The compressor may comprise six or twelve chambers. In these cases the compression can be performed twice or four times during one rotor revolution. An additional advantage of these arrangements is that the radial and axial forces acting on the rotor and the casing are in balance resulting in low bearing reaction forces and hence losses. This arrangement also has a positive impact on vibrations and unbalances generated by the compressor during operation.

[0017] The compressor can comprise a cooling device for cooling the compressed gaseous fuel at constant pressure. Such a cooling device can, for example, be fitted in the exhaust from the compressor where the volume is no longer confined. The benefit of this cooling is for controlling fuels which are sensitive to pre-ignition when mixed with air in the combustor.

[0018] The compressor may further comprise a gaseous fuel supply with an adjustable valve and/or a delivery line with an adjustable valve, the delivery line being connected to the outlet for gaseous fuel. Furthermore, the compressor can comprise an air supply with a non-return valve and/or a gaseous fuel supply with a non-return valve and/or a second gaseous fuel supply with a non return valve, the second gaseous fuel supply being connected to the outlet for gaseous fuel to lead an overrun of compressed gaseous fuel into the chamber with an increasing volume.

[0019] The rotor may comprise a rotor body with slots and at least a portion of each vane is adapted to move in and out of a slot such that the vane is in sliding contact with an inner surface of the casing. The in and out movement provides a simple means for forming the variable-volume chambers during a rotor revolution.

[0020] Generally each vane may comprise a tip with a seal to provide a seal between the inner surface of the casing and the vane. These seals can be used additionally or alternatively to the previously mentioned seal (stator seal). Moreover, abradable material may be placed between the inner surface of the casing and the vane tip and/or between the stator seal and the vane tip.

[0021] The rotor can be connected to an engine. The engine may comprise a motor or a turbine, for example.

[0022] The inventive gas turbine comprises a compressor as previously described. A typical gas turbine comprises a compressor to compress air, a combustor and a turbine. In the combustor a mixture of air and gaseous fuel can be combusted. The inventive compressor

can be used to compress at least part of the gaseous fuel, which may then be combusted in the combustor of the gas turbine.

[0023] Generally the invention has the following advantages: If the fuel conduit from the compressor to the gas turbine is insulated, the heat loss will be low and the fuel energy spent on compression can be recuperated in the turbine during the expansion and in the waste heat recovery unit if one is fitted, for example, in a combined cycle unit. On the other hand if the fuel is cooled down after compression, which is an option with intermediate storage, an energy loss like for conventional gas compression occurs. Due to the highly concentrated heat release provided by the combustion the through-flow capacity of the compressor is much higher for a given geometrical size compared to cycles based on heat exchange across a wall and using an external heat source such as flue gases.

[0024] Moreover, because the rotor is only moving gas around the drive requires far less energy than mechanical compression.

[0025] Further features, properties and advantages of the present invention will become clear from the following description of embodiments in conjunction with the accompanying drawings.

[0026] Fig. 1 schematically shows an inventive compressor in a sectional view.

[0027] Fig. 2 schematically shows an inventive compressor, as it is shown in figure 1, with a cooling device and a pressure compensation pipe.

[0028] Fig. 3 schematically shows an alternative inventive compressor with six chambers in a sectional view.

[0029] Fig. 4 schematically shows an inventive compressor with twelve chambers in a sectional view.

[0030] Fig. 5 schematically shows an alternative inventive compressor with twelve chambers in a sectional view.

[0031] Fig. 6 schematically shows another alternative inventive compressor with twelve chambers in a sectional view.

[0032] Fig. 7 schematically shows two inventive compressors piped in series.

[0033] Fig. 8 schematically shows two inventive compressors piped in parallel.

[0034] A first embodiment of the invention will now be described with reference to figure 1 and 2. Figure 1 schematically shows an inventive compressor 1 in a sectional view. Figure 2 schematically shows an inventive compressor, as it is shown in figure 1, with a cooling device and a pressure compensation pipe. The compressor 1 in figure 1 and 2 comprises a casing 2 and a rotor 3. The rotor comprises a rotor body 4, three slots 5 and three vanes 6. The angle between two neighbouring vanes 6 has a value of 120°. The rotor body 4 has a circular cross section. Generally, the rotor body 4 and/or the inner surface 27 of the casing 2 can have an oval, elliptic, circular or another appropriate cross section.

[0035] The rotor 3 is eccentrically placed inside the

casing 2. Each vane 6 is at least partially located inside a slot 5 and protrudes radially outwards from the rotor body 4. Each vane 6 comprises a portion 28, which is adapted to move in and out of the slot 5 such that the vane 6 is in sliding contact with the inner surface 27 of the casing 2. Additionally, each vane 6 may comprise a seal at the tip of the vane 6 to provide a seal between the vane 6 and the inner surface 27 of the casing 2.

[0036] Between the inner surface 27 of the casing 2 and the rotor 3 three variable-volume chambers 15, 16, 17 part-bounded by the vanes 6 are formed. During a revolution of the rotor 3 in the direction, which is indicated by an arrow 13, a chamber assumes an increasing volume 15, an approximately constant volume 16, and a decreasing volume 17.

[0037] The casing 2 comprises an inlet 7 for gaseous fuel, an air inlet 9, an igniter 14, and an outlet 11 for gaseous fuel. The inlet 7 for gaseous fuel is located at a position where a chamber assumes increasing volume 15. The igniter 14 is located at the air inlet 9, such that it can ignite a mixture between air and fuel. Both are located at a position where a chamber assumes approximately constant volume 16. The outlet 11 for gaseous fuel is located in the casing 2 at a position where a chamber assumes decreasing volume 17.

[0038] Between the inner surface 27 of the casing 2 and the rotor body 4 a seal 18 may be placed at a position where the radial distance between the inner surface 27 of the casing 2 and the rotor body 4 is minimal. This means that the seal provides a seal between the chamber 17 with decreasing volume and the chamber 15 with increasing volume. The seal 18 can, for instance, be a brush seal. The seal if used must be so formed that the moving vanes can smoothly travel over it.

[0039] The inventive compressor 1, as it is shown in figure 1 and 2, uses three chambers 15, 16, 17. Gaseous fuel is ingested into the chamber 15 with increasing volume through the inlet 7. The direction of the gaseous fuel flow is indicated by an arrow 8. During the rotation of the rotor 3 in direction 13 the chamber with gaseous fuel ingested reaches the location 16 where its volume stays constant. Air is induced into the gaseous fuel in the chamber 16 with approximately constant volume through the air inlet 9, as indicated by the arrow 10. The pressure of the induced air is higher than the pressure of the gaseous fuel in the chamber 16. This is achieved principally by the incoming air pressure. The inlet 7 is placed such that the chamber 16 is completely filled before the chamber 16 reaches its maximum volume and before it reaches the igniter 14. Additionally or alternatively a throttle can be placed at the gas inlet 7 which can be used when necessary, for instance at part load or when low overall pressure boost is required. If no boost is required, it is also possible to throttle the air or to switch off the ignition.

[0040] The induced air is mixed with the gaseous fuel. Advantageously the air is induced such that it is given a swirling or vortex character. The mixture of gaseous fuel and air is ignited and partially combusted in chamber 16,

while it is still in the location where it has a constant or at least a nearly constant volume. The igniter 14 may be a plasma igniter or a spark plug.

[0041] The pressure of the gaseous fuel, which leaves the compressor 1 through the outlet 11, must be higher than the air pressure to be able to drive the gas turbine combustor, for instance. The pressure rise of the gaseous fuel is achieved by a temperature rise from combusting a small fraction of the gaseous fuel in the chamber 16 with a, at least nearly, constant volume. The part-burned gaseous fuel at higher pressure is pushed out of the chamber 17, which has a decreasing volume and comprises the outlet 11. The direction of the compressed gaseous fuel flow is indicated by an arrow 12.

[0042] After the combustion when the chamber is in the location 16 the uncombusted predominant fraction of the gaseous fuel is further compressed in chamber 17 because of the decreasing volume of chamber 17.

[0043] Alternatively, the inlet for gaseous fuel can be placed at a position which is indicated in figure 1 by reference numeral 7a, the air inlet can be placed at a position which is indicated by reference numeral 9a and the igniter can be placed at a position which is indicated by reference numeral 14a.

[0044] The seal 18 near the outlet 11 is used to minimise leakage and maximise the evacuation of the chamber 17.

[0045] A stratified charge approach, which means that lean burn pressurises the remaining gas, might reduce the pressure ratio significantly but would entail a compromise on the NO_x-emission. With a stratified charge approach cavities can be built into the rotor 3, but more preferably into the casing 2, to minimise displacement losses during the discharge phase. A stratified charge approach maintains burning with less air but at the expense of achievable pressure rise.

[0046] Figure 2 schematically shows the inventive compressor 1, as it is described with reference to figure 1, but additionally equipped with a cooling device 21 and a pressure compensation pipe 26. The casing 2 in figure 2 comprises two inlets 7 for gaseous fuel, which are placed at a position where the chamber 15 with increasing volume is located. One inlet 7 for gaseous fuel is connected to a common gaseous fuel supply. This inlet 7 is further equipped with an adjustable valve 19 and with a non-return valve 22. In the flow direction 8 the gaseous fuel passes at first the adjustable valve 19 and then the non-return valve 22. The adjustable valve 19 can act as an accelerator when throttled. It can, for instance, be fully closed during start-up and low loads. The adjustable valve 19, which is the gaseous fuel supply valve, may be ordered by an adjustable governing valve 20, which is placed at the outlet 11 for compressed gaseous fuel.

[0047] Between the outlet 11 and the adjustable governing valve 20 a pressure compensation pipe 26 is mounted, which leads to the second inlet 7b into the chamber with increasing volume 15. A non-return valve 24 is mounted at the inlet 7b of the pressure compensa-

tion pipe 26 in chamber 15. This non-return valve 24 prevents a backflow from chamber 15 into the pressure compensation pipe 26. During transients such as load shedding the fuel pressure and the fuel flow, which is delivered by the compressor, might be higher than needed. In this case the adjustable governing valve 20 at the outlet 11 is restricting the flow and the overrun of compressed gaseous fuel is routed back to chamber 15 through the pressure compensation pipe 26. In this case only overrun of gaseous fuel cycles the system, while no ignition and combustion is performed, until the pressure is below the demand of the adjustable governing valve 20. The direction of the compressed gaseous fuel flow in the pressure compensation pipe 26 is indicated by arrows 25.

[0048] The air inlet 9 of the compressor 1 in figure 2 comprises a non-return valve 23, which prevents a backflow. When the combustion commences the pressure might rise above the air supply pressure and in this case a backflow must be prevented.

[0049] The compressor 1, which is shown in figure 2, further comprises a cooling device 21, which cools the compressed gaseous fuel at constant pressure. The direction of the compressed gaseous fuel flow is indicated by the arrows 12.

[0050] Now a second embodiment will be described with reference to figure 3. Elements corresponding to elements of the first embodiment will be designated with the same reference numerals and will not be described again. Figure 3 schematically shows an alternative inventive compressor 101 with six chambers 15A, 15B, 16A, 16B, 17A, 17B in a sectional view.

[0051] Differing from figure 1 and 2 the compressor 101 in figure 3 comprises a casing 2, which has an inner surface 27 with an elliptical cross section. The rotor body 4 of the rotor 3 has a circular cross section, as in the first embodiment. The rotor 3 is concentrically placed inside the casing 2. The rotor 4 further comprises six vanes 6, which are located in slots 5, as described in the first embodiment.

[0052] The compressor 101 in figure 3 comprises six variable-volume chambers 15A, 15B, 16A, 16B, 17A, 17B part-bounded by the vanes 6. The vanes 6 are arranged in the rotor 3 such that the angle between two neighbouring vanes 6 has a value of 60°. The chambers 15A, 15B, 16A, 16B, 17A, 17B are formed such that in rotation direction 13 a chamber assumes increasing volume 15A followed by an at least nearly constant volume 16A, followed by a decreasing volume 17A, followed by an increasing volume 15B and so forth. This means that the two chambers with increasing volume 15A and 15B are situated opposite to each other regarding the centre of the rotor body 4. The chambers with constant volume 16A and 16B as well as the chambers with decreasing volume 17A and 17B are also situated opposite to each other.

[0053] The compressor 101 comprises two seals 18. Each seal 18 is mounted between a chamber with decreasing volume 17A or 17B and a chamber with increas-

ing volume 15B or 15A. The seals 18 are formed such that the moving vanes can smoothly travel over it. The casing 2 of the compressor 101 comprises two inlets 7 for gaseous fuel, which are located opposite to each other at positions where chambers with increasing volume 15A and 15B are located. The casing 2 further comprises two outlets 11 for compressed gaseous fuel, which are located opposite to each other at positions where chambers with decreasing volume 17A and 17B are formed. Moreover, the casing 2 comprises two air inlets 9 and two igniters 14, which are located at positions where chambers with constant volume 16A and 16B are formed. This means that the igniters 14, as well as the air inlets 9 are situated opposite to each other regarding the rotation axis of the rotor 3.

[0054] In the compressor 101 of figure 3 the compressing process is performed twice during one revolution of the rotor 3.

[0055] Now a third embodiment of the present invention will be described with reference to figures 4 to 6. Elements corresponding to elements of the previous embodiments will be designated with the same reference numerals and will not be described again.

[0056] Figure 4 shows an alternative inventive compressor 201 with twelve chambers in a sectional view. The casing 2 and the rotor body 4 of the compressor 201 in figure 4 have the same shape as in the compressor 101, which is described in the second embodiment. In contrast to the second embodiment, the rotor 3 in the figures 4 to 6 comprises twelve vanes 6 which form twelve chambers 29A, 29B, 30A, 30B, 31A, 31B, 32A, 32B, 33A, 33B, 34A, 34B. The angle between two adjacent vanes 6 has a value of 30°. Two similar chambers 29A, 29B, 30A, 30B, 31A, 31B, 32A, 32B, 33A, 33B, 34A, 34B are located opposite to each other relating to the rotation axis of the rotor 3. In the direction of rotation 13 chamber 29A is followed by chamber 30A, which is followed by chambers 31A, 32A, 33A, and 34A. Chamber 34A is then again followed by the second chamber 29B and so forth.

[0057] The chambers 29A, 29B, 30A, 30B, 31A and 31B are in a state of rotation where they have an increasing volume. The chambers 32A, 32B, 33A, 33B, 34A and 34B are in a state where they have a decreasing volume. At the location of the chambers 30A and 30B inlets 7 for gaseous fuel are provided. The chambers 31A, 31B, 32A and 32B comprise an air inlet 9 and an igniter 14, which have the characteristics as described in the previous embodiments. The chambers 33A, 33B, 34A and 34B have a decreasing volume. The chambers 34A and 34B comprise an outlet 11 for gaseous fuel. In the compressor 201, as it is shown in figure 4, the temperature rise and the pressure rise is divided into two stages. Thus the control of the combustion can more accurately lead to an improved combustion performance with lower emissions.

[0058] Figure 5 schematically shows a compressor 301, which is a variation of the compressor 201, which is shown in figure 4. In contrast to figure 4, the compressor 301 in figure 5 comprises two inlets 7 and two outlets 11

for gaseous fuel per each half revolution of the rotor 3, this means per compression cycle.

[0059] At the location of the chambers 29A and 29B and the chambers 30A and 30B the compressor 301 comprises an inlet 7 for gaseous fuel and at the location of the chambers 33A and 33B and the chambers 34A and 34B the compressor 301 comprises an outlet 11 for compressed gaseous fuel. In this case the advantage is that the chambers 29A, 29B, 30A, 30B, 33A, 33B, 34A and 34B can be gradually filled and gradually emptied. In particular in the discharge sector, which is defined by the chambers 33A, 33B, 34A and 34B, this has the advantage that the mechanical compression work due to volume change is reduced. The ingestion, which takes place in the chambers 29A, 29B, 30A and 30B, as well as the discharge, which takes place in the chambers 33A, 33B, 34A and 34B, does not have to be arranged in discrete locations as shown in figure 4. It can also be arranged as slots between the two chambers 29A and 30A as well as between the two chambers 29B and 30B and/or between the chambers 33A and 34A and/or between the chambers 33B and 34B. Thereby a more continuous ingestion and discharge can be achieved.

[0060] Another alternative compressor 401 is schematically shown in figure 6. In contrast to figures 4 and 5 the compressor 401 comprises an outlet 11 for gaseous fuel at the location of the chambers 32A and 32B. Moreover, at the location of the chambers 33A and 33B the compressor 401 comprises an air inlet 9 and an igniter 14. This means that a combustion zone is located between two discharge sectors, which are defined in this variation by the locations of the chambers 32A, 32B, 34A and 34B. By dividing the discharge into two sectors, i.e. the locations of the chambers 32A, 32B and 34A, 34B, two different pressure levels of fuel can be delivered without raising the pressure to the highest of the two discharge levels. This may, for example, be used if a gas turbine has two combustion chambers operating in series with an intermediate turbine stage, thus having two air pressure levels. The same arrangement can also be used if two different pressure levels are required in one combustor, for example a higher pressure for a pilot burner compared to a main burner. The difference in fuel composition for the two discharges can also be used to operate the pilot burner and the main burner in advantageous ways for emission control. In this case the compressed gaseous fuel, which leaves the compressor 401 at the locations of the chambers 34A and 34B and has been ignited twice, can be used as pilot fuel.

[0061] Obviously two or more inventive compressors 1, 101, 201, 301, 401, as described in the embodiments, can be arranged to operate in series, with or without inter cooling. This is schematically shown in figures 7 and 8. Figure 7 schematically shows two inventive compressors 501, 601 piped in series. The outlet for gaseous fuel 11 of the compressor 601 is connected to the inlet for gaseous fuel 7 of the compressor 501. Figure 8 schematically shows two inventive compressors 701, 801 piped in par-

allel.

[0062] Generally, the compressors 1, 101, 201, 301, 401, 501, 601, 701, 801 as described in the embodiments, can be actuated by means of an engine, for example by means of a motor or a turbine. Because the rotor is only moving gas around the drive requires far less energy than mechanical compression.

10 Claims

1. A method for compressing gaseous fuel, comprising the steps:

- a) ingesting gaseous fuel into a chamber;
- b) ingesting air into the chamber and mixing the gaseous fuel with the air;
- c) igniting and partially combusting the resulting mixture of gaseous fuel and air in a confined space such that a predominant fraction of the gaseous fuel is not combusted, causing an increased temperature and therefore an increased pressure of the fraction of the gaseous fuel which is not combusted; and
- d) discharging the resulting compressed gaseous fuel.

2. The method as claimed in claim 1, wherein

for ingesting air, air with a higher pressure than the pressure of the gaseous fuel is injected into the chamber.

3. The method as claimed in claim 1 or 2, wherein

the volume of the chamber is decreased for discharging the compressed gaseous fuel.

4. The method as claimed in any of the claims 1 to 3, wherein the steps a) to d) are repeated after finishing step d).

5. The method as claimed in any of the claims 1 to 4, wherein

at least one of the steps a) to d) is performed at least twice before the next step is performed.

6. The method as claimed in any of the claims 1 to 5, wherein

gaseous fuel is introduced into a chamber (15, 29, 30) with an increasing volume.

7. The method as claimed in any of the claims 1 to 6, wherein

the gaseous fuel is compressed to a pressure with a pressure ratio between the compressed gaseous fuel and the uncompressed gaseous fuel of between 1.1:1 and 5:1.

8. The method as claimed in claim 7, wherein the gaseous fuel is compressed to a pressure with a pressure ratio between the compressed gaseous fuel and the uncompressed gaseous fuel of 2:1. 5
9. The method as claimed in any of the claims 1 to 8, wherein the air is induced such that it is given a swirling or vortex character. 10
10. The method as claimed in any of the claims 1 to 9, wherein the mixture of gaseous fuel and air is continuously ignited. 15
11. The method as claimed in any of the claims 1 to 10, wherein the mixture of gaseous fuel and air is ignited and partially combusted in a chamber (16) with a constant volume. 20
12. The method as claimed in any of the claims 1 to 11, wherein the compressed gaseous fuel is cooled at constant pressure. 25
13. A compressor (1, 101, 201, 301, 401, 501, 601, 701, 801), comprising a casing (2), a rotor (3) with at least three vanes (6), at least one inlet (7) for gaseous fuel, at least one outlet (11) for gaseous fuel, at least one air inlet (9) and at least one igniter (14), wherein the rotor (3) is placed in the casing (2) such that at least three variable-volume chambers (15, 16, 17, 29-34) part-bounded by the vanes (6) are formed during a rotor revolution, the inlet (7) for gaseous fuel is placed in the casing (2) such that the inlet (7) for gaseous fuel is connected to a first location where a chamber (15, 29, 30) has an increasing volume during a revolution of the rotor (3), the air inlet (9) and the igniter (14) are placed in the casing (2) in a second location where a chamber (16, 31, 32, 33) has an increasing, decreasing or constant volume during a revolution of the rotor (3), and the outlet (11) for gaseous fuel is placed in the casing in a third location where a chamber (17, 32, 33, 34) has a decreasing volume during a revolution of the rotor (3). 30 35 40 45
14. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in claim 13, wherein the rotation axis of the rotor (3) is eccentrically placed relative to the centreline of the casing (2). 50
15. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in claim 13 or 14, wherein the casing (2) and/or the rotor (3) have a circular cross section, an elliptical cross section or a curved cross section with curvature discontinuities or inflexions. 55
16. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 15, wherein the igniter (14) is a plasma igniter or a spark plug.
17. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 16, wherein the igniter (14) is placed at the air inlet (9).
18. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 17, wherein a seal (18) is placed between the casing (2) and the rotor (3) to provide a seal between a location where a chamber (17, 34) with a decreasing volume is formed and a location where a chamber (15, 29) with an increasing volume is formed.
19. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 18, wherein the compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) comprises at least one additional set of three chambers (15, 16, 17, 29-34) in parallel or in series.
20. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 19, wherein the compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) comprises six or twelve chambers (15, 16, 17, 29-34).
21. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 20, wherein the compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) comprises a cooling device (21) for cooling compressed gaseous fuel at constant pressure.
22. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 21, wherein the compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) comprises a gaseous fuel supply with an adjustable valve (19) and/or a delivery line with an adjustable valve (20), the delivery line being connected to the outlet (11) for gaseous fuel.
23. The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 22, wherein

the compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) comprises an air supply with a non return valve (23) and/or a gaseous fuel supply with a non return valve (22) and/or a second gaseous fuel supply with a non return valve (24), the second gaseous fuel supply being connected to the outlet (11) for gaseous fuel to lead an overrun of compressed gaseous fuel into a chamber (15, 29, 30) with an increasing volume.

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- 24.** The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 23, wherein
the rotor (3) comprises a rotor body (4) with slots (5) and at least a portion (28) of each vane (6) is adapted to move in and out of a slot (5) such that the vane (6) is in sliding contact with an inner surface (27) of the casing (2).
- 25.** The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 24, wherein
the rotor (3) is connected to an engine.
- 26.** The compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in claim 25, wherein
the engine comprises a motor or a turbine.
- 27.** A gas turbine, comprising a compressor (1, 101, 201, 301, 401, 501, 601, 701, 801) as claimed in any of the claims 13 to 26.

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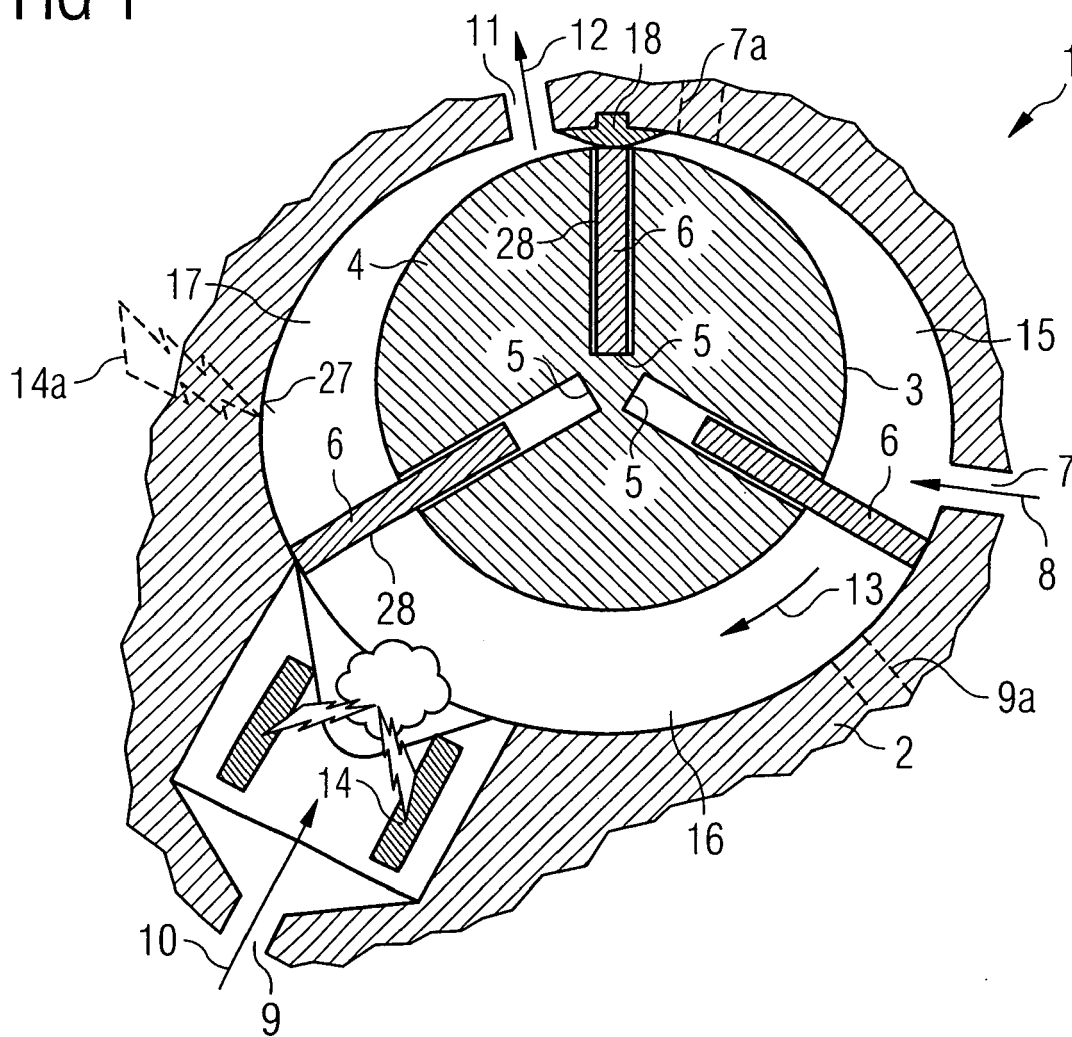
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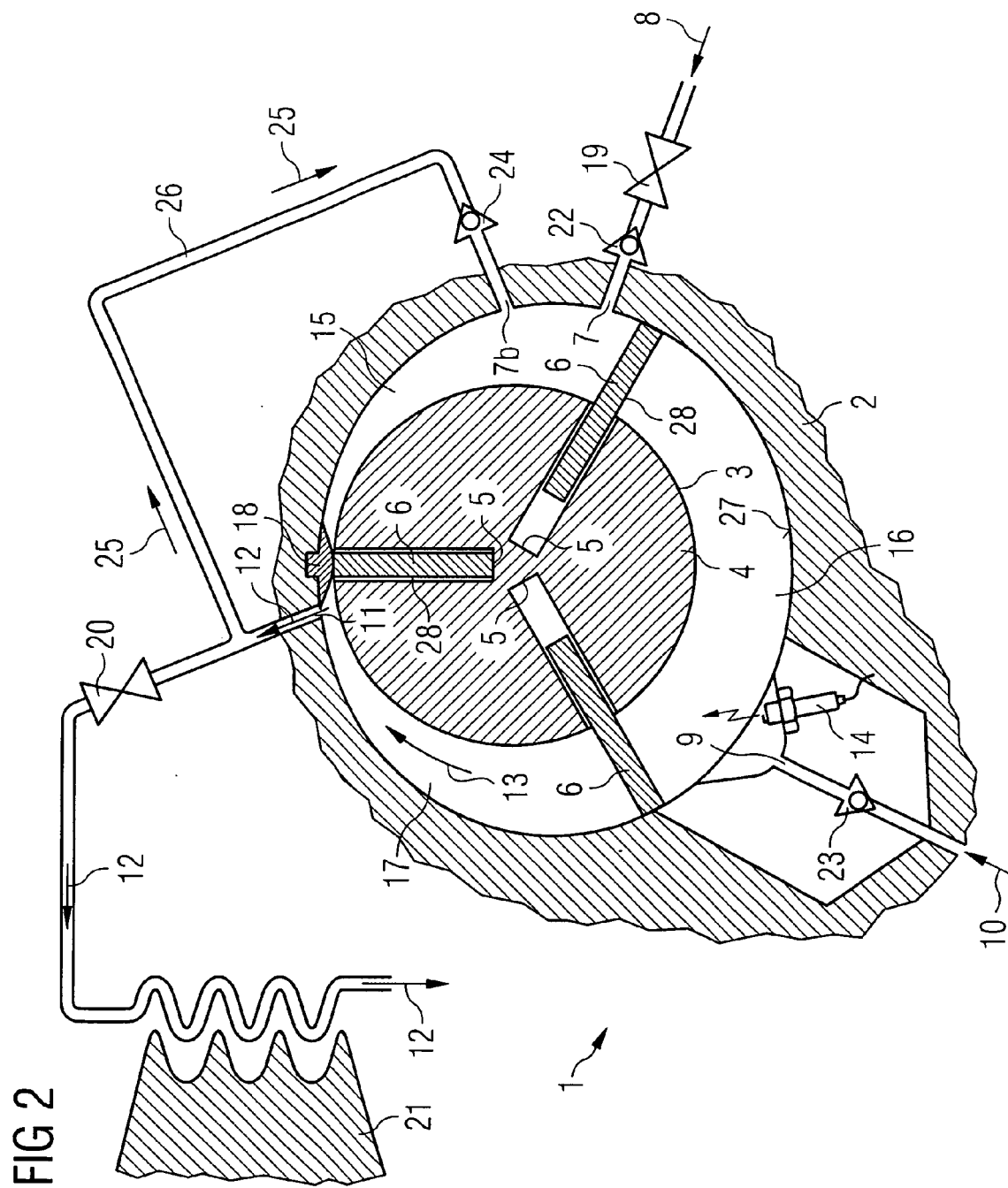
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FIG 1





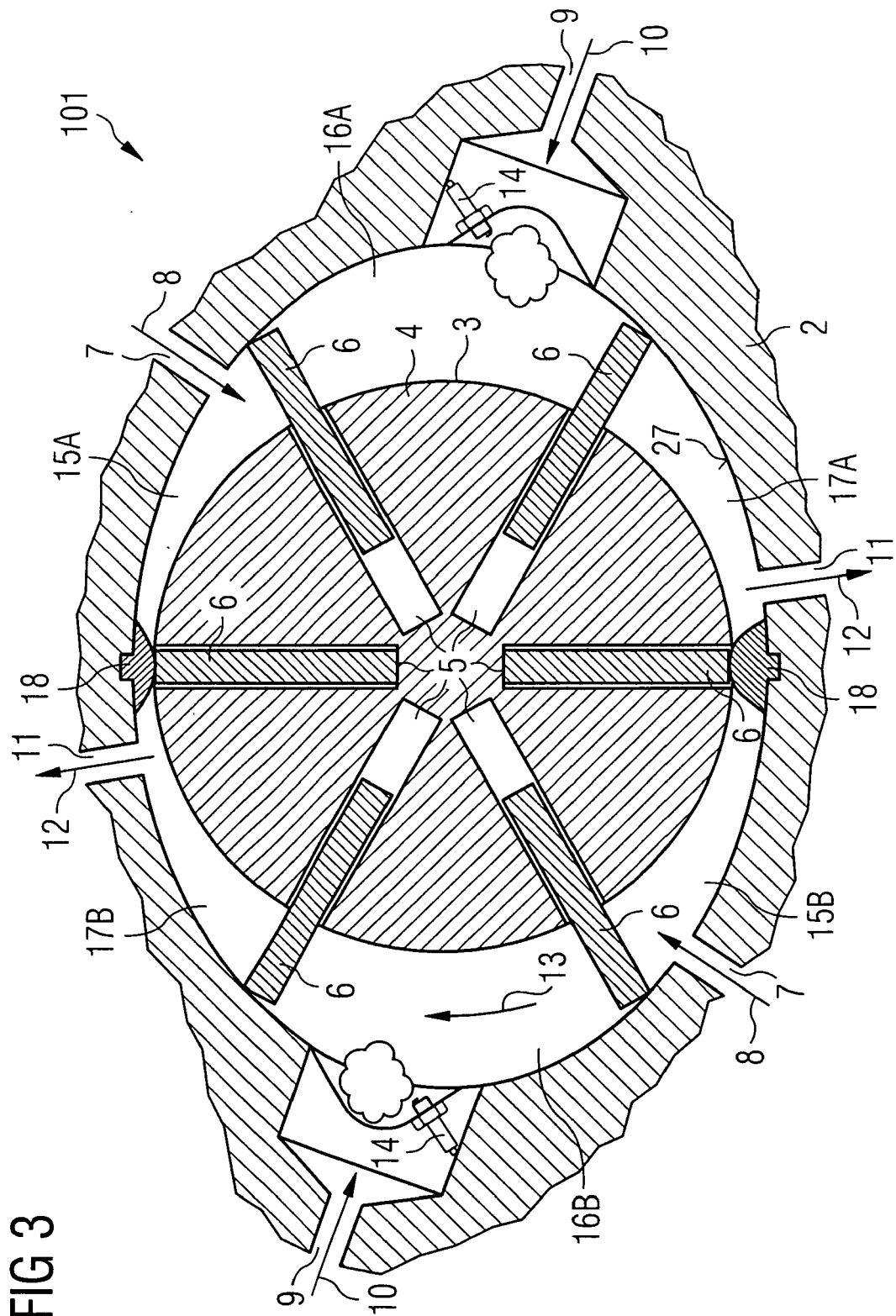


FIG 4

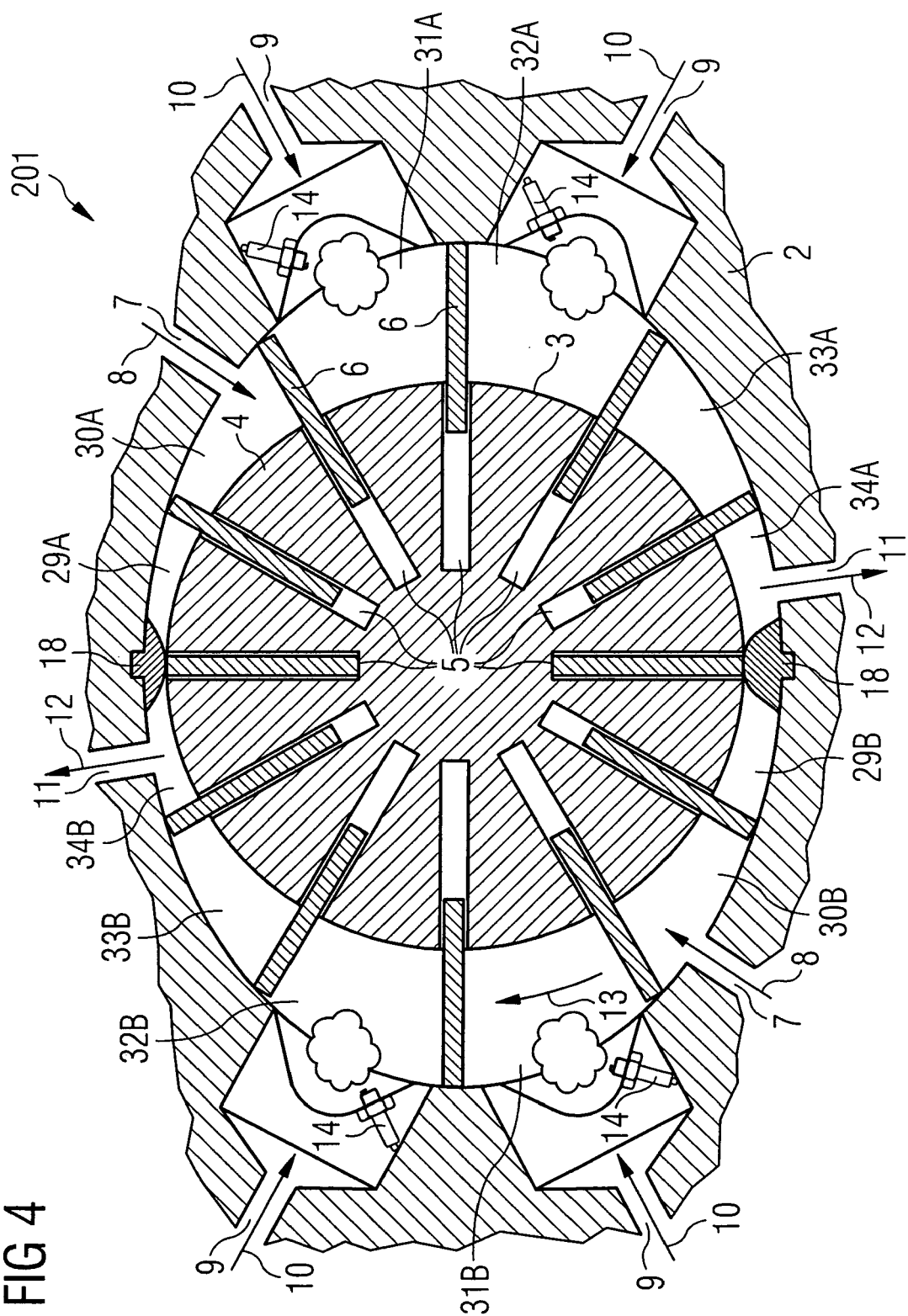
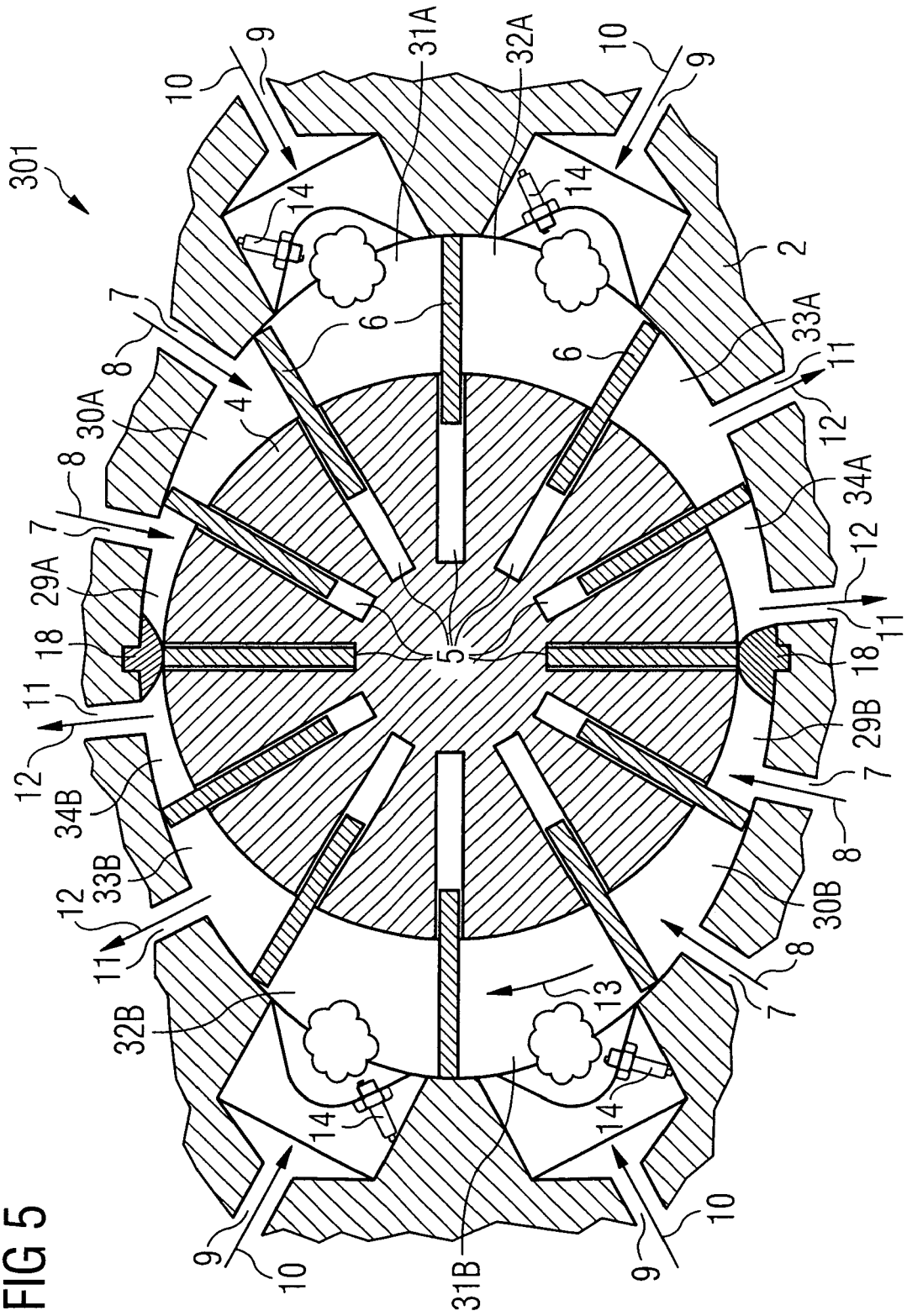


FIG 5



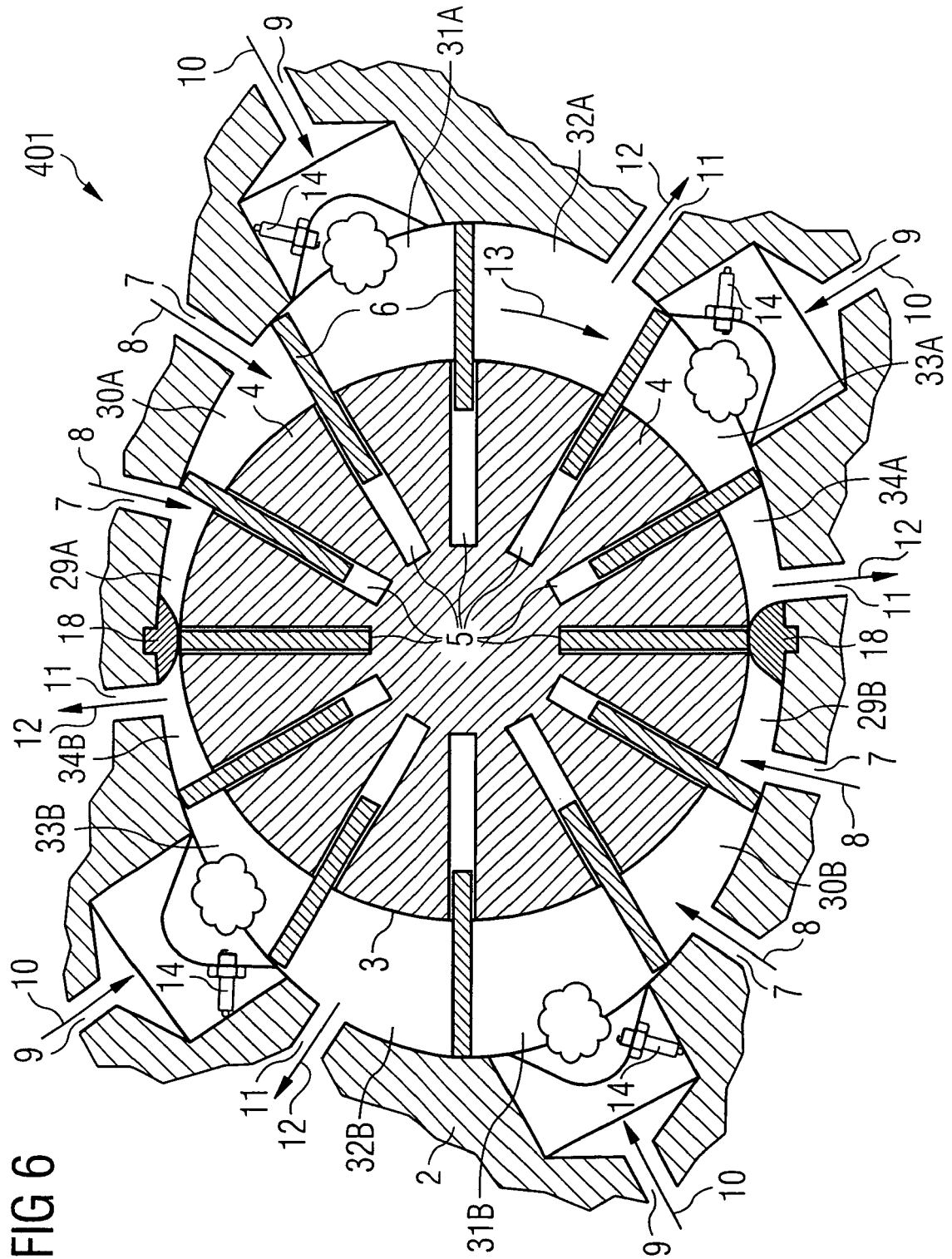


FIG 7

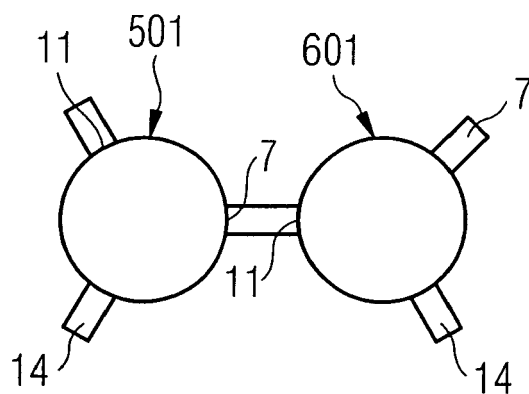
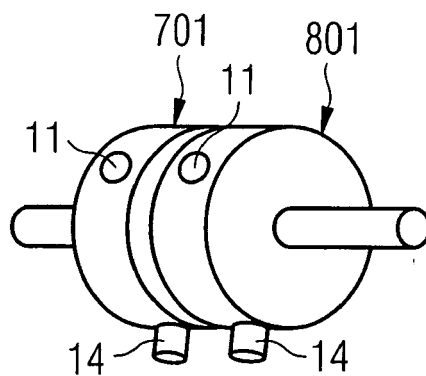


FIG 8





EUROPEAN SEARCH REPORT

Application Number
EP 08 00 4162

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 September 2008	Examiner Lequeux, Frédéric
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 September 2008	Examiner Lequeux, Frédéric
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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The members are as contained in the European Patent Office EDP file on
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