

TITLE: Carbon capture system comprising a gas turbine with two burners**Field of the invention**

The present invention relates to the field of carbon capture technology with CO₂ extraction in a so-called Hot Potassium Carbonate (HPC) unit for a CO₂ producing
5 flue gas source directed to a flue gas compressor part of a gas turbine such that a partial flue gas pressure of the carbon capture process is increased.

More specifically, it is a CO₂ capture process with a gas turbine comprising two
10 burners with combustion chambers. A first burner, preburner, designed for further burning the CO₂ rich compressed flue gas with low oxygen from the flue gas compressor before further supplying a heat exchanger on the route to a HPC unit, and a second burner, afterburner, design for heating up returning CO₂-lean flue gas from said heat exchanger, after the HPC unit, before a turbine expander.

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Background of the invention

The applicant has worked with carbon capture system utilizing hot potassium carbonate in the process for decades and they have published two patent applications WO2019172772 and WO2021210989 which uses design with gas
20 turbine comprising a flue gas compressor, one burner with combustion chamber and a turbine expander, and wherein a flue gas is led to a burner after said flue gas compressor and then to a heat exchanger on the path to said HPC unit.

A known challenge with today's hot potassium carbonate CO₂ extraction plant is to
25 increase the partial pressure of the CO₂ rich gas. This can be solved by utilizations of a gas turbine compressor, but other challenges occurs, as to maintain a sustainable efficiency rate of that gas turbine, especially due to heat loss, and to keep a mass balance for gas turbine.

30 The present invention is generally concerned with solving at least one, but preferably several, of the challenges which exist with the prior art. More particularly, it has been an object of the invention to develop.

Brief summary of the invention

35 The invention is defined by the independent claim 1 which is a carbon capture system comprising
- a CO₂-containing flue gas producing source connected to

- a first flue gas compressor of a gas turbine with a corresponding first turbine expander and a generator driven by said gas turbine,
- said gas turbine comprising
 - a first burner with a first combustion chamber arranged for burning a compressed flue gas and
 - a second burner with a second combustion chamber arranged for afterburning a relatively hot compressed CO₂-lean flue gas, wherein
- said second burner receiving compressed flue gas from said compressor, said compressed flue gas for cooling a second combustion chamber shell of said second combustion chamber,
- said second combustion chamber shell further connected via a coaxial pipe with a coaxial piping shell for further transporting said compressed flue gas flow to
- a first combustion chamber shell of a first burner for cooling said first combustion chamber and being fed into said first combustion chamber for combustion with compressed air and fuel to produce a first compressed preburned flue gas,
- said first compressed preburned flue gas being fed to a first heat exchanger for cooling, transferring heat to a downstream produced relatively cold compressed CO₂-lean flue gas, forming a first compressed preburned cooled flue gas,
- said first compressed preburned cooled flue gas sent to a hot potassium process CO₂ absorber plant for returning said relatively cold compressed CO₂-lean flue gas back to said first heat exchanger for being heated to a first relatively hot compressed CO₂-lean flue gas for feeding to said second burner,
- said first relatively hot compressed CO₂-lean flue gas being mixed and afterburned by said second burner with a compressed air flow and at least a non-carbon fuel such as Hydrogen or Ammonia, so as for increasing a temperature of said first relatively hot compressed CO₂-lean flue gas to a second relatively hotter compressed CO₂-lean flue gas for being fed into said first expander.

Further, inventive embodiments of the invention are set out in the dependent claims.

Figure captions

Embodiments of the present invention will now be described, by way of example only, with reference to the following figures, wherein:

Figure 1 shows the schematic of three main parts of the invention a Gas Turbine, Two Burners and a Heat Exchanger and a HPC Unit.

Figure 2 shows the schematic of the three main parts, as mentioned for Figure 1, but now also including a branch line from the returning gas line from

the HPC Unit to a gas turbine for cooling and to an afterburner (B2) for temperature barrier.

Figure 3a shows a principle flow diagram of a generic gas turbine (GT) burner versus Karbon afterburner (B2).

5 Figure 3b shows a principle schematic illustration of a generic gas turbine (GT) burner versus a Karbon afterburner (B2).

Figure 4 shows an illustration of Karbon's afterburner (second burner - B2) and preburner (first burner - B1) and the connection between said two burners.

10 Figure 5 shows the schematic general overview of a carbon capture system with a first burner (B1) and a second burner (B2).

Figure 6 shows the schematic extended overview of a carbon capture system with a first burner (B1) and a second burner (B2).

15 Figure 7 shows the schematic overview of a carbon capture system with two burners (B1, B2), two turbine expanders (TE1, TE2) and a branch pipe for external cooling of said turbine expanders (TE1, TE2) and for temperature barrier at said second burner (B2).

20 Embodiments of the present invention will now be described, by way of example only, with reference to the above mentioned Figures.

Embodiments of the invention

The present invention provides a carbon capture system comprising a CO₂-containing flue gas (FG)-producing source (1) connected to

25 - a first flue gas compressor (FGC) of a gas turbine (GT) with a corresponding first turbine expander (TE1) and a generator (G) driven by said gas turbine (GT),

- said gas turbine (GT) comprising

- a first burner (B1) with a first combustion chamber (CC1) arranged for burning (as in heating) a compressed flue gas (CFG) and

30 - a second burner (B2) with a second combustion chamber (CC2) arranged for afterburning (as in afterheating) a relatively hot compressed CO₂-lean flue gas (CLFG1H), wherein

- said second burner (B2) receiving compressed flue gas (CFG) from said flue gas compressor (FGC), said compressed flue gas (CFG) for cooling a second

35 combustion chamber shell (CC2S) of said second combustion chamber (CC2),

- said second combustion chamber shell (CC2S) further connected via a coaxial pipe (P12) with a coaxial piping shell (PS12) for further transporting said compressed flue gas flow (CFG) to
- a first combustion chamber shell (CC1S) of a first burner (B1) for cooling said first combustion chamber (CC1) and being fed into said first combustion chamber (CC1) for combustion with compressed air (CA1) and fuel (G) to produce a first compressed preburned flue gas (CFG1),
- said first compressed preburned flue gas (CFG1) being fed to a first heat exchanger (HE1) for cooling, transferring heat to a downstream produced relatively cold compressed CO₂-lean flue gas (CLFG1C), forming a first compressed preburned cooled flue gas (CFG1C),
- said first compressed preburned cooled flue gas (CFG1C) sent to a hot potassium process CO₂ absorber plant (HPC) for returning said relatively cold compressed CO₂-lean flue gas (CLFG1C) back to said first heat exchanger (HE1) for being heated to a first relatively hot compressed CO₂-lean flue gas (CLFG1H) for feeding to said second burner (B2),
- said first relatively hot compressed CO₂-lean flue gas (CLFG1H) being mixed and afterburned by said second burner (B2) with a compressed air flow (CA2) and at least a non-carbon fuel such as Hydrogen (H₂) or Ammonia (NH₃), so as for increasing a temperature of said first relatively hot compressed CO₂-lean flue gas (CLFG1H) to a second relatively hotter compressed CO₂-lean flue gas (CLFG2H) for being fed into said first expander (TE1). An advancement behind this arrangement is to increase the temperature for the inlet gas to said first expander (TE1) to increase the gas turbine (GT) efficiency rate. Simulation example shows that the efficiency rate for a gas turbine, type "SGT6-2000E", will be increased from about 25% to about 34%, with a second burner (B2), that lifts an inlet gas temperature from 750°C to about 1150°C before the turbine expander. Another advancement is that said first heat exchanger (HE1) inlet temperature can be controlled and regulated such that said heat exchanger (HE1) will not be exposed for temperatures above about 900°C.

Figure 5 shows a schematic embodiment of the invention as described above, wherein a CO₂-containing flue gas (FG) from any flue gas producing source (1) is led to gas turbine (GT) flue gas compressor (FGC) to be compressed from about 1 barg to about 12-13 barg, to a compressed flue gas (CFG). The compressed flue gas is then led to a second burner's (B2) second combustion chamber shell (CCS2) as cooling aid before returning also as compressed flue gas (CFG) to the first burner's (B1) first combustion chamber shell (CCS1) as cooling aid, before entering into the

first burner's combustion chamber shell (CCS1) through apertures and participates in the combustion with fuel, such as natural gas e.g. methane, and forming a first compressed preburned flue gas (CFG1) with a temperature about 900°C. Said compressed flue gas (CFG) can as an option, also apply as a cooling aid for a first heat exchanger (HE1), wherein the compressed flue gas (CFG) is led to a heat exchanger shell after said second combustion chamber shell (CCS2) but before said first combustion chamber shell (CCS1) (not shown in the Figure 5, but shown in Figure 4). Said first compressed preburned flue gas (CFG1) is then led through a first heat exchanger (HE1), for cooling down to a first compressed preburned cooled flue gas (CFG1C) to about 135 °C further led to a hot potassium process CO2 absorber plant (HPC) for extracting CO2 from said CO2-containing flue gas (FG), and for returning a relatively cold compressed CO2-lean flue gas (CLFG1C) with temperature about 95°C back to said first heat exchanger (HE1) for heating said relatively cold compressed CO2-lean flue gas (CLFG1C) into a relatively hot compressed CO2-lean flue gas (CLFG1H) to about 750°C for being fed into said second burner and mixed with at least a non-carbon fuel such as ammonia (NH3) or hydrogen (H2) for heating up said first relatively hot compressed CO2-lean flue gas (CLFG1H) into second relatively hotter compressed CO2-lean flue gas (CLFG2H) with temperature about 1300°C for feeding a first turbine expander (TE1). To utilize non-carbon fuel or a mix of non-carbon fuel and low carbon fuel in the second burner gives non- or low CO2 emissions in combination with increased efficiency for said gas turbine first turbine expander (TE1). Figure 5 further shows that after said first turbine expander (TE1) a first expanded relative hot CO2-lean flue gas is led to the stack or atmosphere.

In an embodiment of the invention, wherein said second combustion chamber (CC2) forms part of said coaxial pipe (P12) feeding the first expander (TE1), said coaxial pipe (P12) running from said first heat exchanger (HE1) to said second combustion chamber (CC2), said coaxial pipe (P12) having said piping shell (PS12). The reasoning behind this arrangement is to feed the compressed flue gas to cool the coaxial shell about the second combustion chamber, the coaxial pipe, the heat exchanger, and the first combustion chamber. This reduces the surface temperatures of the pressure shells of the combustion chambers and the piping.

Figure 4 shows a schematic illustration of an embodiment of the invention, wherein said second burner (B2), afterburner, is designed as an inlet burner such as it is integrated in the coaxial pipe (P12) with a coaxial pipe shell (P12S). The Figure

shows a fuel supply pipe for pure or mixtures of gases as NG, NH₃ and/or H₂ and a supply pipe for a second compressed air (CA2) both connected to a nozzle part for mixture and spraying said gases into a second combustion chamber (CC2) for burning and heating up said first relatively hot compressed CO₂-lean flue gas (CLFG1H) from about 850°C into a second relatively hotter compressed CO₂-lean flue gas (CLFG2H) with temperature about 1300°C. The Figure illustrates that a compressed flue gas (CFG) is entering the second burner's (B2) second combustion chamber shell (CCS2), annulus, and continues in said coaxial pipe shell (P12S), annulus, towards said first heat exchanger (HE1).

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In an embodiment of the invention, wherein said coaxial piping shell (PS12) connected to a heat exchanger shell (HE1S) of said first heat exchanger (HE1), said heat exchanger shell (HE1S) further connected to a first combustion chamber shell (CC1S) of said first combustion chamber (CC1), said first combustion chamber shell (CC1S) arranged for feeding said compressed flue gas (CFG) to said first combustion chamber (CC1). The reason for this arrangement is to heat up said compressed flue gas (CFG) before entering into said first combustion chamber (CC1) for burning out any residuals of unburned gases from said CO₂-containing flue gas producing source and to heat up the compressed flue gas (CFG) into a first compressed preburned flue gas (CFG1) to about 900°C before the first heat exchanger (HE1).

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Figure 4 shows further a schematic illustration of the first burner's (B1), preburner, first combustion chamber (CC1) with combustion chamber shell (CC1S) directly connected to said first heat exchanger (HE1), wherein said coaxial pipe (12) is connected to said second burner (B2) for receiving said first relatively hot compressed CO₂-lean flue gas (CLFG1H), and said first heat exchanger is receiving said compressed flue gas (CFG) from said coaxial pipe shell (P12S), annulus, and leads said compressed flue gas (CFG) through a pipe and into a first heat exchanger shell (HE1S) and further down to said combustion chamber shell (CC1S) and then into apertures in first combustion chamber (CC1) for combustion with natural gas (NG) and a first compressed air (CA1).

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In an embodiment of the invention, wherein said relatively cold compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said second burner (B2) as a temperature barrier (10). This arrangement provides an obstacle in a nozzle for

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backfiring into a fuel service line (FSL), especially important while utilizing hydrogen (H₂) and/or ammonia (NH₃) as fuel.

- Figure 4 also shows said relatively cold compressed CO₂-lean flue gas (CLFG1C) about 95°C is returning after said hot potassium process CO₂ absorber plant (HPC) for working as a temperature barrier or shield for said second burner (B2), such as the temperature in a fuel supply nozzle (FSN), such as hydrogen (H₂) and ammonia (NH₃), will not increase enough for self-ignition in said fuel service line (FSL).
- 10 In an embodiment of the invention, wherein relatively cold compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said first gas turbine expander (TE1) as cooling agent. Use the relatively cold compressed CO₂-lean flue gas (CLFG1C) flow around 95°C as a cooling agent supply for said gas turbine (GT) and replacing an internal cooling by utilization of carbon rich compressed flue gas (CFG)
- 15 with said relatively cold compressed CO₂-lean flue gas (CLFG1C) flow reduces CO₂ emissions, as after cooling said first turbine expansion (TE1) said cooling agent is routed directly to the atmosphere.

- Figure 7 shows a schematic illustration of a branch pipe from said relatively cold compressed CO₂-lean flue gas (CLFG1C) at about 95°C which is led towards a first turbine expander (TE1) and a second turbine expander (TE2) as cooling agent. Figure 7 also shows a third branch from said relatively cold compressed CO₂-lean flue gas (CLFG1C) routed to said second burner as temperature barrier / shield.
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- 25 In an embodiment of the invention, wherein said second relatively hotter compressed CO₂-lean flue gas (CLFG2H) being fed into said first expander (TE1) for driving a shaft coupled to said generator (G) and for generating a first expanded relative hot CO₂-lean flue gas (ELFGH) further connected to a first heat recovery and steam generator unit (HRSG1). This arrangement is for further utilize said first expanded
- 30 relative hot CO₂-lean flue gas (ELFGH) leaving said turbine expander (TE1) with about 500°C.

- In a further embodiment of the invention, wherein said first heat recovery and steam generation unit (HRSG1) is for production of a first steam (ST1) further connected to heat exchange with a stripper unit included in said hot potassium process CO₂ absorber unit (HPC). Said stripping unit is shown on Figure 1 and Figure 2.
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In another embodiment of the invention,, wherein said first heat recovery and steam generation unit (HRSG1) is for production of a second steam (ST2) further connected to a steam generator (SG) for production of electrical power.

- 5 Figure 6 shows a schematic illustration of said first expanded relative hot CO₂-lean flue gas (ELFGH) leaving said turbine expander (TE1) with about 500°C to said first heat recovery and steam generation unit (HRSG1) for further providing said hot potassium process CO₂ absorber plant (HPC) with a first steam (ST1) and a steam turbine generator (STG) with a second steam (ST2) for producing electricity.

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In an embodiment of the invention, wherein said first turbine expander (TE1) is constructed to expand additional mass flow from said second burner (B2). If additional mass flow is added to the process after the flue gas compressor [FGC], an oversized expander can be the solution to keep the mass balance if needed.

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- In an embodiment of the invention, wherein said second relatively hotter compressed CO₂-lean flue gas (CLFG2H) is being fed into said first expander (TE1) and a second turbine expander (TE2) in parallel with said first expander (TE1). This is another solution if additional mass flow is added to the process after the flue gas compressor [FGC], to keep the mass balance from compress flue gas, extracted CO₂ and added fuel and air in first and second burner (B1, B2).

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- In an embodiment, wherein said second expander (TE2) is installed in parallel to the first expander (TE1) operating at the same inlet pressure and temperature. This is necessary to avoid excessive flow and pressure on said first expander (TE1) that will result in surge of the flue gas compressor.

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- In an embodiment, wherein a first expander (TE1) can be utilized to produce electricity and a second expander (TE2) can be utilized for steam production for the heat exchanger at the stripping unit included in the HPC unit.

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- In Figure 7 it is shown a schematic diagram of an embodiment with two turbine expanders (TE1, TE2), receiving second relatively hotter compressed CO₂-lean flue gas (CLFG2H) with same pressure and temperature. The Figure shown further that they are delivering to a first heat recovery and steam generation unit (HRSG1). A second heat recovery and steam generation unit (HRSG2), is shown as an option on the

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Figure, connected after the first heat exchanger (HE1) receiving a first compressed preburned cooled flue gas (CFG1C) and returning a second compressed preburned cooled flue gas (CFG2C) to said Hot Potassium Carbonate CO₂-absorber unit (HPC).

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In Figure 7 two air compressors are shown, a first air compressor (AC1), for compressing a first compressed air (CA1) to said first burner (B1) and a second air compressor (AC2), for compressing a second compressed air (CA2) to said second burner (B2).

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In an embodiment of the invention, wherein said relatively cold compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said first gas turbine expander (TE1) and said second turbine expander (TE2) as cooling agent. See specially Figure 7.

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In an embodiment of the invention, wherein said first compressed preburned cooled flue gas (CFG1C) is led to a second heat recovery unit and steam generator (HRSG2), and further cooling the said first compressed preburned cooled flue gas (CFG1C) to a second compressed preburned cooled flue gas (CFG2C) which is further led to said Hot Potassium Carbonate CO₂-absorber unit (HPC). Such configuration will contribute to decrease the gas temperature of the relatively cold compressed CO₂-lean flue gas (CLFG1C) even further down than 95°C. This is an advantage both for the utilization of said relatively cold compressed CO₂-lean flue gas (CLFG1C) as a cooling agent for said turbine expanders (TE1, TE2) but also for said first heat exchanger (HE1). Another scenario, said relatively cold compressed CO₂-lean flue gas (CLFG1C) has a temperature set point at 95°C after said Hot Potassium Carbonate CO₂-absorber unit (HPC), by utilization of said second heat recovery and steam generation unit (HRSG2) the heat transfer in said first heat exchanger (HE1) can be reduced, simplify the heat balance of the first heat exchanger (HE1). See Figure 7.

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In an embodiment of the invention, wherein said extracted CO₂ by said Hot Potassium Carbonate CO₂-absorber unit (HPC) is led to a CO₂ compressor and then cooled down before utilized in an enhanced oil recovery sequestration (EOR/S). Reference to Figure 6, which shows such schematic diagram for said extracted CO₂.

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In an embodiment of the invention, wherein said second burner (B2) only uses non-carbon fuel, such as hydrogen (H_2) or ammonia (NH_3), to eliminate any further CO_2 emissions.

5 Figure 1 shows a schematic overview of an embodiment of the invention with two burners. The Figure also indicates temperatures differences after each unit and the initial partial pressure after a gas turbine compressor. Figure 1 shows the three main elements: Gas Turbine, Burner and Heat Exchanger and HPC unit.

Figure 2 shows a schematic overview of an embodiment of the invention with two
10 burners and a cooling line after the absorber unit. The Figure further describes that the exhaust gas, CO_2 containing flue gas, can vary from with CO_2 containment form 3% to 12%, dependent on the CO_2 emitting source.

Figure 3a and 3b shows a principle flow diagram and a schematic illustration of a
15 generic gas turbine burner, wherein the oxidizer is internally taken from the gas turbine compressor into the burner and wherein the cooling agent is also taken internally from the gas turbine compressor.

Figure 3a and 3b shows also a principle flow diagram and a schematic illustration of
an embodiment of the inventions afterburner, wherein the oxidizer is taken from
20 separately compressed air. The Figure further shows that the temperature barrier / shield is tapped after the HPC unit and that the CO_2 -lean (depleted) flue gas from first heat exchanger (HE1) is provided to second combustion chamber (CCS2), here named gas mixer, as this embodiment is provided with gas rotating vanes.

	Reference table (number, tag and description)	
1	1	Any CO ₂ producing source
2	10	Temperature barrier
3	GT	Gas turbine
4	FGC	Flue gas compressor
5	TE1	First turbine expander
6	TE2	Second turbine expander
7	G	Generator
8	HPC	Hot potassium carbonate - CO ₂ absorber unit
9	STG	Steam turbine generator
10	HRU	Heat recovery unit
11	HRSG	Heat recovery and steam generator
12	HRSG1	First heat recovery unit and steam generator
13	HRSG2	Second heat recovery unit and steam generator
14	EOR/S	Enhanced oil recovery sequestration
15	AC1	First air compressor
16	AC2	Second air compressor
17	B1	First burner / preburner
18	B2	Second burner / afterburner
19	CC1	First combustion chamber
20	CC2	Second combustion chamber
21	CC1S	First combustion chamber shell
22	CC2S	Second combustion chamber shell
23	P12	Coaxial pipe
24	PS12	Coaxial piping shell
25	HE1	First heat exchanger
26	HE1S	First heat exchanger shell
27	CA1	Compressed air from first air compressor
28	CA2	Compressed air from second air compressor
29	ST1	First steam
30	ST2	Second steam
31	NG	Natural gas fuel
32	H2	Hydrogen fuel
33	NH3	Ammonia fuel
34	CO2	Carbon dioxide

35	FG	Flue gas
36	CFG	Compressed flue gas
37	CFG1	First compressed preburned flue gas
38	CFG1C	First compressed preburned cooled flue gas
39	CFG2C	Second compressed preburned cooled flue gas
40	CLFG1H	First relatively hot compressed CO ₂ -lean flue gas
41	CLFG2H	Second relatively hotter compressed CO ₂ -lean flue gas
42	ELFGH	First expanded relative hot CO ₂ -lean flue gas
43	FSN	Fuel supply nozzle
44	FSL	Fuel supply line

Claims

1. A carbon capture system comprising:
- a CO₂-containing flue gas (FG) from any CO₂ producing source (1) connected to
 - 5 - a first flue gas compressor (FGC) of a gas turbine (GT) with a corresponding first turbine expander (TE1) and a generator (G) driven by said gas turbine (GT),
 - said gas turbine (GT) comprising
 - a first burner (B1) with a first combustion chamber (CC1) arranged for burning a compressed flue gas (CFG) and
 - 10 - a second burner (B2) with a second combustion chamber (CC2) arranged for afterburning a relatively hot compressed CO₂-lean flue gas (CLFG1H), wherein
 - said second burner (B2) receives compressed flue gas (CFG) from said flue gas compressor (FGC), said compressed flue gas (CFG) for cooling a second
 - 15 combustion chamber shell (CC2S) of said second combustion chamber (CC2),
 - said second combustion chamber shell is (CC2S) further connected via a coaxial pipe (P12) with a coaxial piping shell (PS12) for further transporting said compressed flue gas flow (CFG) to
 - a first combustion chamber shell (CC1S) of a first burner (B1) for cooling said first
 - 20 combustion chamber (CC1) and being fed into said first combustion chamber (CC1) for combustion with compressed air (CA1) and fuel (G) to produce a first compressed preburned flue gas (CFG1),
 - said first compressed preburned flue gas (CFG1) is fed to a first heat exchanger (HE1) for cooling, transferring heat to a downstream produced relatively cold
 - 25 compressed CO₂-lean flue gas (CLFG1C), forming a first compressed preburned cooled flue gas (CFG1C),
 - said first compressed preburned cooled flue gas (CFG1C) is sent to a hot potassium process CO₂ absorber plant (HPC) for returning said relatively cold compressed CO₂-lean flue gas (CLFG1C) back to said first heat exchanger (HE1)
 - 30 for being heated to a first relatively hot compressed CO₂-lean flue gas (CLFG1H) for feeding to said second burner (B2), and
 - said first relatively hot compressed CO₂-lean flue gas (CLFG1H) being mixed and afterburned by said second burner (B2) with a compressed air flow (CA2) and at least a non-carbon fuel such as Hydrogen (H₂) or Ammonia (NH₃), so as for
 - 35 increasing a temperature of said first relatively hot compressed CO₂-lean flue gas (CLFG1H) to a second relatively hotter compressed CO₂-lean flue gas (CLFG2H) for being fed into said first expander (TE1).

2. The carbon capture system of claim 1, wherein said second combustion chamber (CC2) forms part of said coaxial pipe (P12) feeding the first expander (TE1), said coaxial pipe (P12) running from said first heat exchanger (HE1) to said second combustion chamber (CC2), said coaxial pipe (P12) having said piping shell (PS12).

3. The carbon capture system of claim 2, wherein said coaxial piping shell (PS12) is connected to a heat exchanger shell (HE1S) of said first heat exchanger (HE1), said heat exchanger shell (HE1S) being further connected to a first combustion chamber shell (CC1S) of said first combustion chamber (CC1), said first combustion chamber shell (CC1S) being arranged for feeding said compressed flue gas (CFG) to said first combustion chamber (CC1).

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4. The carbon capture system of claim 1, wherein said relatively cold compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said second burner (B2) as a temperature barrier (10).

5. The carbon capture system of claim 1, wherein said relatively cold compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said first gas turbine expander (TE1) as a cooling agent.

6. The carbon capture system of claim 1, wherein said second relatively hotter compressed CO₂-lean flue gas (CLFG2H) is fed into said first expander (TE1) for driving a shaft coupled to said generator (G) and for generating a first expanded relative hot CO₂-lean flue gas (ELFGH) further connected to a first heat recovery and steam generator unit (HRSG1).

7. The carbon capture system of claim 6, wherein said first heat recovery and steam generator unit (HRSG1) is for production of a first steam (ST1) further connected to heat exchange unit in a stripping unit included in said hot potassium process CO₂ absorber unit (HPC).

8. The carbon capture system of claim 6, wherein said first heat recovery and steam generator unit (HRSG1) is for production of a second steam (ST2) further connected to a steam generator (SG) for production of electrical power.

9. The carbon capture system of claim 1, wherein said first turbine expander (TE1) is constructed to expand additional mass flow from said second burner (B2).
- 5 10 The carbon capture system of claim 1, wherein said second relatively hotter compressed CO₂-lean flue gas (CLFG2H) is being fed into said first expander (TE1) and a second turbine expander (TE2) in parallel with said first expander (TE1).
11. The carbon capture system of claim 10, wherein said relatively cold
10 compressed CO₂-lean flue gas (CLFG1C) flow is partly divided and routed to said first gas turbine expander (TE1) and to said second turbine expander (TE2) as a cooling agent.
12. The carbon capture system of claim 1, wherein said first compressed
15 preburned cooled flue gas (CFG1C) is led to a second heat recovery unit and steam generator (HRSG2), and further cooling the said first compressed preburned cooled flue gas (CFG1C) to a second compressed preburned cooled flue gas (CFG2C) which is further led to said Hot Potassium Carbonate CO₂-absorber unit (HPC).
- 20 13. The carbon capture system of claim 1, wherein extracted CO₂ by said Hot Potassium Carbonate CO₂-absorber unit (HPC) is led to a CO₂ compressor and then cooled down before being utilized in an enhanced oil recovery sequestration (EOR/S).