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(54) **SYSTEM FOR A HEAT ENERGY RECOVERY**

WÄRMERÜCKGEWINNUNGSSYSTEM

SYSTÈME DE RÉCUPÉRATION D'ÉNERGIE

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Description

TECHNICAL FIELD

[0001] The present invention generally relates to a system for heat energy recovery in a vehicle comprising an internal combustion engine, such as a diesel engine. The invention also relates to a corresponding method for operating such a system.

BACKGROUND OF THE INVENTION

[0002] Recent advances in efficient operation of internal combustion engines include the use of thermodynamic engines, particularly Rankine cycle engines, for recuperation of waste heat. As commonly known, a Rankine cycle engine is an engine that converts heat into work. The heat is applied externally to a preferably closed working fluid circuit which may use water or other suitable liquids as working fluids. A pump is used to pressurize the liquid working fluid received from a condenser which is then heated and thereby converted into its gaseous phase. Subsequently, the gaseous working fluid is transported to a steam engine, where the thermal energy is converted to kinetic energy. In a further step the gaseous working fluid is converted back to its liquid phase in the condenser.

[0003] A common working fluid is water as it is easy to supply, already present on a vehicle and harmless to the environment. Even if water has some attractive properties, it also has some drawbacks. For example, if the steam is mixed with air, the functionality of the steam engine drops. Additionally, small amounts of air in the steam can be rather aggressive to the construction material. For avoiding air accumulating in the steam it has been suggested to keep the pressure in the working fluid above ambient air pressure. Disadvantageously, this results in a constraint in the efficiency, since the condensing temperature needs to be relatively high (particularly above 100 degree Celsius). However, during a longer standstill (night, weekend, etc.) it is difficult to avoid a pressure drop below ambient pressure in the system, which in turn results in air leaking into the system. Further, in some designs it is even preferred to have lower pressure than ambient pressure in some parts of the Rankine cycle for a good efficiency.

[0004] There exists further problems water as the working fluid, for example as water freezes at 0 °C. US2010212304 tries to solve the freezing problem by mixing the water with small amounts of ammonia or alcohol, so that the freezing point is lowered. Additionally, ammonia or alcohol also lowers the dew-point so that the condensing can be performed at lower temperatures.

[0005] Disadvantageously, ammonia is both caustic and hazardous. Therefore, ammonia has to be handled with great care and should not be released to the environment. However, such a release is necessary for instance in case of an accident involving the thermody-

amic engine or a vehicle comprising such an engine (e.g. a collision of the vehicle with another vehicle) or during maintenance of the thermodynamic engine and/or of the vehicle. Up to now, a bypass of the expander device is used for releasing the pressure in the working fluid and providing safe maintenance possibilities. Disadvantageously, this procedure is very time consuming so that stand-still periods of the vehicle in a workshop are unnecessarily prolonged and/or waiting times for safe access to a vehicle, for e.g. a rescue team, are unacceptable long.

[0006] Further attention is drawn to US 2013/327041A1 relating to a waste heat utilization device for an internal combustion engine, in particular of a motor vehicle having a waste heat utilization circuit. A working medium is circulated in waste heat utilization circuit by means of a pumping device provided for pressurizing the working medium. The waste heat utilization circuit is in communication with a pressure store capable of maintaining a pressure for setting and ensuring a predetermined adjustable minimum pressure of the working medium in the waste heat utilization circuit.

SUMMARY OF THE INVENTION

[0007] According to an aspect of the invention, the above is at least partly alleviated by an exhaust gas system for a vehicle, comprising an arrangement for conveying an exhaust gas stream, a thermodynamic engine comprising a heat exchanger positioned in the exhaust gas stream for recovery of heat from the exhaust gas stream, the thermodynamic engine comprising a working fluid circulation circuit holding a working fluid, the working fluid comprising a first base component mixed with a first additional component at a selected concentration, and a first container for storing an amount of at least the first additional component of the working fluid, the first container fluidly connected to the working fluid circulation circuit, wherein the first container is connected downstream of the heat exchanger at a gaseous phase of the working fluid circulation circuit, and that the exhaust gas system is further configured to allow adjustment of a pressure of the working fluid at the gaseous phase of the working fluid circulation circuit to conform with one of a plurality of predetermined conditions, wherein the plurality of predetermined conditions are dependent on different operational conditions for the vehicle.

[0008] The general use of the exhaust gas system according to the invention is for achieving useful recovery of waste heat from an internal combustion engine typically provided with the vehicle. By the advantageous introduction of the first container fluidly connected at the gaseous phase of the working fluid circulation circuit it will be possible to allow for a swift alternation of the, typically, gaseous pressure in case of a deviation from one of a predetermined condition. As such, it may be possible to fine tune the working fluid to be optimized towards an operational state of the vehicle, possibly including con-

ditions within the surrounding of the vehicle, for example in relation to a temperature within the surrounding of the vehicle.

[0009] The pressure detector may in one exemplary embodiment be comprised with the exhaust gas system and arranged at the gaseous phase of the working fluid circulation circuit. However, it may as an alternative be possible to acquire the detected pressure using an alternatively arranged pressure detector, possibly not explicitly provided for use with the exhaust gas system, but rather as an element of a complete vehicle system.

[0010] The first container may preferably be configured to provide for both an increase and a decrease of the pressure within the gaseous phase of the working fluid circulation circuit for example using a thereto connected pump. As such, the first container may be provided with a bi-directional and valve control connection to the working fluid circulation circuit. However, in a preferred embodiment of the invention the exhaust gas system further comprises a second container connected to the working fluid circulation circuit at the gaseous phase of the working fluid circulation circuit, wherein the second container in some stages of operation of the system is configured to be used for decreasing the gaseous pressure within the working fluid circulation circuit, again e.g. using a pump. Accordingly, the first container will in such an embodiment essentially be used for increasing the gaseous pressure (e.g. introduction of an "excess amount" of working fluid) within the working fluid circulation circuit. As such, the first and the second container will work together for optimizing the gaseous pressure within the working fluid circulation circuit to correspond to at least one of the above mentioned predetermined conditions.

[0011] Such predetermined conditions may further to the above general introduction relate to a safety condition concerning the vehicle. For example, in case of servicing of the vehicle or of the exhaust gas system it may be desirable to reduce the pressure within the working fluid circulation circuit, thus making the exhaust gas system easier to service. Similarly, in case of an emergency or accident such a pressure reduction may also be desirable for the purpose of reducing any risks for response personnel involved with handling the following procedure of the emergency/accident.

[0012] Furthermore, the introduction of an excess amount of working fluid within the gaseous phase of the working fluid circulation circuit may at some conditions allow for a reduction of air accumulation tendency of the thermodynamic engine due to ambient air leaking into the system. Such conditions typically arise when the vehicle is in a stand-still mode (shutdown), for example during nights and weekends when the vehicle is not used. Preferably this supply takes place if a pressure below ambient pressure is detected at the high pressure side of the circuit so that the additional amount of working fluid may compensate the pressure drop.

[0013] Within the context of the invention it is possible to adjust the pressure either by introducing a further

amount of the working fluid to the working fluid circulation circuit or by adjusting the selected concentration of the first additional component in relation to the first base component. A typical scenario when this is possible is when the first base component of the working fluid is water and the first additional component of the working fluid is ammonia.

[0014] In a preferred embodiment of the invention, the exhaust gas system further comprises a working fluid release means and an exhaust gas treatment unit, such as a selective catalytic reduction unit (SCR). Accordingly, also the SCR may be used for storage of a temporary excess of working fluid for reducing the pressure within the working fluid circulation circuit. This is specifically advantageous in a case where the working fluid comprises a combination of water and ammonia. Specifically, using a selective catalytic reduction unit, which uses ammonia for reducing emissions of nitrogen oxides (NO_x), allows for the possibility to make good use of the "released" temporarily excessive working fluid as a catalyst component of the SCR may temporarily store the ammonia and then use it in the NO_x reduction process, i.e. not being directly released into the atmosphere.

[0015] In some embodiment the SCR will also be feed with a further source of ammonia, that it, not only through the release of water/ammonia from the working fluid circulation circuit through the working fluid release means. The synergistic effects provided thereby allow for a system which provides a release of working fluid without problems as well as a recuperation of waste energy of the internal combustion engine.

[0016] However, in some conditions it may be possible to make use of the water/ammonia from the working fluid circulation circuit rather than acquiring the ammonia from the further source (e.g. an externally arranged tank provided with the vehicle). Such conditions may for example relate to cold start of the vehicle, where a warm provision of ammonia may be released from the working fluid circulation circuit as compared to what may be achieved in release from the further source.

[0017] It should be noted that it according to the invention may be possible to "refill" e.g. the first and/or the second container with ammonia from the further source, e.g. from the externally arranged tank provided with the vehicle. There may be a direct connection between the external tank and the first and/or the second container, alternatively a chemical process may be introduced in an intermediate step for "reconstructing" the e.g. urea stored in the tank to make it suitable for use in relation to the working fluid circulation circuit.

[0018] In addition, the use of ammonia as a first additional component of the working fluid will minimize the risk of problems when operating the vehicle in cold, e.g. winter, conditions as the ammonia will act as an anti-freeze component. It may of course be possible to use another (or further in combination) type or antifreeze component, such as alcohol. Preferably, the concentration of ammonia and/or alcohol can be adapted on a daily,

weekly and/or a monthly basis depending on the expected temperature variations, for example measured using a temperature sensor surveying the ambient temperature surrounding the vehicle. Of course it is also possible to adapt the concentration on a shorter time scale or an even longer time scale.

[0019] In case ammonia is used as the first additional component of the working fluid, the first container may be adapted to be heated to a temperature where the ammonia in the first container has a pressure above ambient air pressure and/or above the pressure in the working fluid circuit at the connection of the first container. This has the advantage that no additional pump (as mentioned above) is necessary for propelling flow of ammonia from the ammonia reservoir/tank to the working fluid circuit. The ammonia is preferably provided in form of urea.

[0020] According to a further preferred embodiment, the second container is adapted to store liquid ammonia and/or an ammonia adsorbing material, preferably CaCl₂ and/or MgCl₂ and/or SRC12 an ammonia compound preferably urea, ammonium carbamate and/or ammonium carbonate. Preferably, ammonia adsorbing materials or ammonia compounds are used since working with liquid ammonia calls for additional safety precautions.

[0021] In a preferred embodiment of the invention the exhaust gas system further comprising a control unit being electrically connected to the pressure detector and configured to adjust, using at least one controllable valve operatively connected to the control unit, the pressure of the working fluid at the gaseous phase of the working fluid circulation circuit. As such, the control unit is typically electrically connected to the pressure detector for acquiring a current pressure within the working fluid circulation circuit, and use this measure and an input for controlling valves relating to the first and the second container as well as the working fluid release means providing a controllable connection between the working fluid circulation circuit and the SCR. The control unit typically comprises processing means for regulating the pressure within the working fluid circulation circuit to correspond to at least one of the above discussed plurality of predetermined vehicle conditions. In addition, the control unit typically controls the concentration of the antifreeze component within the working fluid circulation circuit.

[0022] According to another aspect of the present invention there is provided a method for controlling an exhaust gas system for a vehicle, the exhaust gas system comprising an arrangement for conveying an exhaust gas stream, a thermodynamic engine comprising a heat exchanger positioned in the exhaust gas stream for recovery of heat from the exhaust gas stream, the thermodynamic engine comprising a working fluid circulation circuit holding a working fluid, the working fluid comprising a first base component mixed with a first additional component at a concentration, and a first container for storing an amount of at least a first additional component of the working fluid, the first container fluidly connected to the

working fluid circulation circuit, the method comprising the steps of detecting a pressure of the working fluid at a gaseous phase of the working fluid circulation circuit, and adjusting the pressure to conform with one of a plurality of predetermined conditions, wherein the plurality of predetermined conditions are dependent on different operational conditions for the vehicle. This aspect of the invention provides similar advantages as discussed above in relation to the previous aspect of the invention.

[0023] In an embodiment, the method further comprises the step of arranging a pressure detector downstream of the heat exchanger at the gaseous phase of the working fluid circulation circuit, wherein the step of adjusting the pressure is dependent on a pressure detected by the pressure detector.

[0024] In another embodiment, the step of adjusting the pressure is dependent on an ambient temperature detected by a temperature sensor. The pressure may be adjusted by adjusting the selected concentration of the first additional component in relation to the first base component.

[0025] In an embodiment, the method further comprises the step of fluidly connecting a second container to the working fluid circulation circuit at the gaseous phase of the working fluid circulation circuit, wherein the first container is configured for allowing an increase of the pressure at one of the predetermined conditions, and the second container is configured for reducing the pressure at another one of the predetermined conditions.

[0026] According to a still further aspect of the invention there is provided a computer program product comprising a computer readable medium having stored thereon computer program means for controlling an exhaust gas system for a vehicle, wherein the computer program product comprises code for performing the steps as discussed above in relation to the previous aspect of the invention. Also this aspect provides similar advantages as discussed in relation to the previous aspects of the invention.

[0027] The computer program product is typically executed using a control unit, preferably including a micro processor or any other type of computing device. Similarly, a software executed by the control unit for operating the inventive exhaust gas system may be stored on a computer readable medium, being any type of memory device, including one of a removable nonvolatile random access memory, a hard disk drive, a floppy disk, a CD-ROM, a DVD-ROM, a USB memory, an SD memory card, or a similar computer readable medium known in the art. The present invention may be thus implemented using a combination of software and hardware elements.

[0028] Further features of, and advantages with, the present invention will become apparent when studying the appended claims and the following description. The skilled addressee realize that different features of the present invention may be combined to create embodiments other than those described in the following, without departing from the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The various aspects of the invention, including its particular features and advantages, will be readily understood from the following detailed description and the accompanying drawings, in which:

Fig. 1 illustrates a vehicle equipped with an exhaust gas system according to a currently preferred embodiment of the invention;

Fig. 2 shows an example of a prior art exhaust gas system, and

Figs. 3 - 6 provide schematic drawings of currently preferred embodiments of the exhaust gas system according to the invention.

DETAILED DESCRIPTION

[0030] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided for thoroughness and completeness, and fully convey the scope of the invention to the skilled addressee. Like reference characters refer to like elements throughout.

[0031] Referring now to the drawings and to Fig. 1 in particular, there is depicted an exemplary vehicle, here illustrated as a truck 500. The truck 500 is provided with a source of motive power 12 for propelling the truck via a driveline connecting the power source to the wheels. The power source 12 is constituted by an internal combustion engine in the form of a diesel engine. It will in the following for ease of presentation be referred to as an internal combustion engine 12. The vehicle 500 is provided with a tank for storage 502 holding an amount of urea to be used in an emission reduction process as discussed above.

[0032] Fig. 2 shows an example of a prior art exhaust gas system 100 preferably for being used in conjunction with the internal combustion engine 12, adapted for a recuperation of waste energy of the internal combustion engine 12, and for allow a reduction of emission of nitrogen oxides (NO_x) by means of an exhaust gas treatment unit 20. The exhaust gas treatment unit 20 is formed by using a selective catalytic reduction unit (SCR) using ammonia for reducing a NO_x amount of the exhaust gas. The ammonia, typically in the form of urea, is stored in the externally arranged storage tank 502.

[0033] The exhaust gas system 100 comprises an arrangement 17 for conveying an exhaust gas stream 80 to the exhaust gas treatment unit 20 comprised with the arrangement 17. The exhaust gas system 100 further comprises a thermodynamic engine 1, operating in parallel with the exhaust gas treatment unit 20, connected to the exhaust gas stream conveying arrangement 17 for

recovery of heat from the exhaust gas stream 80. The thermodynamic engine 1 comprises a working fluid circulation circuit 11. The thermodynamic engine 1 may for example operate in accordance with a Rankine cycle. In the embodiment illustrated in Fig. 2 the working fluid circulation circuit 11 is closed.

[0034] The exhaust gas conveying arrangement 17 is arranged such that it receives exhaust gases from the internal combustion engine 12. Further, the waste heat of the internal combustion engine 12 is used as heat source for the thermodynamic engine 1, wherein the thermodynamic engine forms at least part of a waste heat recovery system for the internal combustion engine.

[0035] The thermodynamic engine 1 further comprises a pump device 2 for circulating the working fluid, a heating device 4 for heating the working fluid and thereby converting a liquid working fluid to the gaseous phase working fluid, an expander device 8 for converting thermal energy of the gaseous phase working fluid into kinetic energy and a condensation device 10, which are interconnected by the working fluid circuit 11. The heating device 4 is formed by a first heat exchanger, which is positioned in the exhaust gas stream 80 from the internal combustion engine 12. In other words, the first heat exchanger 4 is in heat exchanging connection to an exhaust gas side of the internal combustion engine 12.

[0036] A turbocharger 13 is arranged for charging an incoming air to the internal combustion engine 12. The turbocharger 13 comprises a turbine 14 positioned in the exhaust gas stream 80 from the internal combustion engine 12 and a compressor 15 positioned in an inlet air stream to the internal combustion engine 12. The turbine 14 and compressor 15 are rotationally rigidly interconnected via a shaft in a known way. The exhaust gas stream 80 is conveyed via an exhaust gas duct 18. Further, the internal combustion engine 12 comprises a gas intake side, where fuel and air are mixed in the known way and fed to the internal combustion engine 12.

[0037] Even if the exhaust gas treatment unit 20 is depicted as single unit in the figures it is clear for a person skilled in the art that an exhaust after treatment system may comprise a plurality of units. Preferably, the exhaust gas after treatment system comprises at least a particulate filter for removing particulates from the exhaust gas stream 80 entering the atmosphere, the filter arranged following the selective catalytic reduction unit in a direction of the gas stream 80. The exhaust gas after treatment unit 20 and the heat exchanger 4 may be integrated into a single device. In the case of a single heat exchanger 4 in the exhaust gas stream 80, which is arranged downstream of the exhaust gas after treatment system 20, the exhaust gas of the combustion engine 12 is not cooled before it reaches the exhaust gas after treatment system 20.

[0038] The thermodynamic engine 1 has at least four stages. In the first stage I, upstream of pump device 2, the working fluid of the thermodynamic engine 1 is in its liquid phase and has a pressure around ambient air pres-

sure. In a second stage II, downstream of the pump device 2, the working fluid is still in its liquid phase but pressurized to a predetermined pressure by pump device 2. In the subsequent stage III downstream of the heat exchanger 4, the working fluid has been transferred into its gaseous phase and is pressurized to a predetermined pressure above ambient air pressure. In its fourth stage IV downstream of expander device 8, the working fluid is still in its gaseous phase, but has a pressure around ambient air pressure.

[0039] Therefore, the cycle can be divided in different sides (see also table 1):

- A low pressure side which is downstream of expander device 8 and upstream of the pump device 2 (stages II and III) and a high pressure side which is downstream of the pump device 2 and upstream of expander device 8 (stages I and IV); or
- A cold side which is downstream of the condenser device 10 and upstream of the heat exchanger 4 (stages I and II), and a hot side which is downstream of the heat exchanger 4 and upstream of the condenser device 10 (stages III and IV).

Table 1

Stage I Cold, Liquid phase Low pressure	Stage II Cold, Liquid phase High pressure
Stage IV Hot, Gaseous phase Low pressure	Stage III Hot, Gaseous phase High pressure

[0040] In the following the working principle of the thermodynamic engine 1 will be explained. In the first stage I the cool liquid working fluid streams to the pump device 2, where the cool liquid working fluid is pressurized to a predetermined pressure above ambient air pressure. Then the pressurized liquid working fluid is transported to the heat exchanger 4 where it is heated and converted from its liquid phase to its gaseous phase. Due to the conversion into the gaseous phase the pressure may be increased once more. The pressurized gaseous phase working fluid then streams to the expander device 8, where the thermal energy is converted to mechanical or electrical energy. Mechanical energy can be generated by e.g. a displacement engine (not shown), such as a piston engine, where the pressurized working fluid operates a piston, or may be generated by a turbine (not shown). Alternatively, the expander device 8 may operate a generator (not shown) for generating electrical energy. The pressure of the working fluid is used to displace e.g. the piston or to operate the turbine or the generator. Consequently, the pressure of the working fluid drops so that in the fourth stage IV, the working fluid has low pressure, even if it is still in its gaseous phase. The low pressure gaseous phase working fluid is subsequently transported to the condenser device 10, where the hot working

fluid is cooled below its dew point and thereby converted back into its liquid phase.

[0041] The working fluid for such a thermodynamic engine 1 can be a pure liquid e.g. water or a mixture of water and for example a first additional component, such as e.g. ammonia or ethanol. In case the further component influences the thermodynamic phase transition points of the working fluid, as is the case e.g. with the ammonia-water mixture and/or the ethanol-water mixture, the first additional component may advantageously be adapted to lower the freezing point of e.g. water so that it serves as anti-freeze protection for the working fluid.

[0042] As discussed above, it is advantageous to be able to adjust the concentration of the anti-freeze component as well as to be able to adjust the gaseous pressure within the gaseous phase of the thermodynamic engine 1, typically within stage III of the thermodynamic engine 1.

[0043] This is according to the invention achieved, with further reference to Fig. 3, by fluidly connecting a first container, illustrated as a working fluid storage tank 40, holding an amount of the working fluid (e.g. being a mixture of the first base component and the first additional component), or only an amount of the first additional component, e.g. ethanol, or ammonia. As mentioned above, the working fluid storage tank 40 is fluidly connected to the high pressure side, i.e. stage III, of the working fluid circuit 11. More specifically, the working fluid storage tank 40 is connected to the working fluid circuit 11 downstream of the heating device 4 and upstream of the expander device 8. The exhaust gas system 100 comprises a working fluid storage tank valve 42 configured to control working fluid flow between the working fluid storage tank 40 and the working fluid circuit 11. The exhaust gas system 100 further comprises a working fluid storage tank conduit 44, which fluidly connects the working fluid storage tank 40 with the working fluid circuit 11. The working fluid storage tank valve 42 is positioned in the conduit 44.

[0044] The working fluid storage tank 40 may be pressurized to a pressure above the pressure present at the high pressure side III or, alternatively, the ammonia may be transported to the working fluid circuit by means of a pump (not shown).

[0045] As mentioned above, the leaking in of air is, besides the freezing, one of the main disadvantages of the known thermodynamic engines. Particularly during standstill, the high pressure side III may cool down to such a degree that the pressure drops below ambient air pressure. This results in air leaking into the working fluid circuit 11 which in turn compromises the efficiency of the thermodynamic engine 1. Additionally, air, particularly in the form of bubbles or cavities can be rather aggressive to the construction materials of the thermodynamic engine parts.

[0046] Since the problem of air leaking in arises only during cool down and when the pressure drops below ambient pressure, the valve 42 arranged in the connection duct 44 between the working fluid storage tank 40

and the working fluid circuit 11 can be opened in dependence of a detected pressure drop or engine operation status so that additional ammonia may stream into the working fluid circuit 11. Thereby, as discussed above, the pressure in the working fluid circuit 11 can be increased to a level around ambient air pressure, which prevents air from leaking in.

[0047] Besides the above discussed possibility to flood the working fluid circuit 11 with working fluid during cool down and thereby preventing air from leaking in, the provision of the working fluid storage tank 40 enables an adaptation of the ammonia concentration in the working fluid to the local climate and/or a sensed ambient temperature. Advantageously, at cold temperatures a high ammonia concentration can be used as anti-freeze protection so that an increased ammonia amount during cold temperatures, i.e. during wintertime, is provided, wherein at higher temperatures a lower ammonia concentration is provided so that the condenser can operate at higher temperatures.

[0048] Preferably, the ammonia concentration can be adapted on a daily, weekly and/or a monthly basis depending on the expected temperature variations. Of course it is also possible to adapt the ammonia concentration on a shorter time scale or an even longer time scale.

[0049] The working fluid storage tank 40 may also be used e.g. in a case where the pressure in the working fluid circuit 11 exceeds a predetermined pressure threshold, and thus be configured to receive any surplus amount of the working fluid within the working fluid circuit 11. Such an operational condition of the truck 500 may for example include startup of the thermodynamic engine 1, where the surplus of working fluid can again be received by the working fluid storage tank 40. For achieving such functionality it may be possible to use the above discussed pump (not shown) in a backward manner, i.e. for transporting working fluid from the working fluid circuit 11 to the working fluid storage tank 40. It may also be possible to adjust a temperature surrounding the working fluid storage tank 40, i.e. to cool down the working fluid storage tank 40 such that the pump only will be an optional component of the system 100.

[0050] Further operational conditions for the truck 500 exists where it may be desirable to lower the pressure within the working fluid circuit 11, e.g. in case of a collision or for maintenance purposes of the thermodynamic engine 1 and/or the truck 500.

[0051] Turning now to Fig. 4, which shows a further development of the embodiment example of Fig. 3. The exhaust gas system 100 comprises the first and an additional second container, implemented as the working fluid storage tank 40 and as an additional working fluid storage tank 50, which are fluidly connected to the high pressure side, i.e. stage III, of the working fluid circulation circuit 11. The additional working fluid storage tank 50 forms in this embodiment a collector, thus the release of e.g. ammonia from the working fluid circuit 11 to the work-

ing fluid storage tank 50 works the same way but in contrast to the general functionality of the working fluid storage tank 40. A controllable valve 52 is arranged at a connection duct 54 between the working fluid storage tank 50 and the working fluid circuit 11. As such, the working fluid storage tank 40 will be used for increasing the pressure within the working fluid circuit 11 and the working fluid storage tank 50 will be used for decreasing the pressure within the working fluid circuit 11. It may be possible to include a further pump (not shown) together with the working fluid storage tank 50. However, the working fluid storage tank 50 may also be cooled or kept cool so that also a pressure difference between the working fluid circuit 11 and the working fluid storage tank 50 is provided, i.e. making the pump optional.

[0052] Turning now to Fig. 5, which shows a still further development of the embodiment example of Figs. 3 and 4. As an alternative to using the working fluid storage tank 50 for decreasing the amount of working fluid within the working fluid circuit 11, it may instead be possible to branch off the working fluid circuit 11 using a working fluid release means 24 comprising a controllable valve 26 arranged at the high pressure side III of the working fluid circuit 11. As such, the working fluid, e.g. ammonia can be released from the working fluid circuit 11 to the catalytic treatment unit 20 in the exhaust gas after treatment system for a catalytic treatment of the released working fluid. Accordingly, the working fluid release means 24 may serve as safety release or generally as release possibility for the working fluid in a similar manner as discussed above. However, it should be noted that it may be possible, as is indicated in Fig. 5, to include both the working fluid storage tank 50 and the working fluid release means 24 with the system 100 (i.e. further to the first working fluid storage tank 40). That is, the working fluid storage tank 50 and the working fluid release means 24 may be controlled individually, for example dependent on different operational conditions of the truck 500. In any case, it will be possible to make good use of the released working fluid, without releasing it to the atmosphere.

[0053] It should be stressed that the catalyst component of the SCR may temporarily store a fair amount the ammonia and then use it in the NO_x reduction process, i.e. not being directly released into the atmosphere. Generally, the SCR will be feed with a further source of ammonia, such as from the tank 502.

[0054] It is advantageous to branch off the working fluid release means 24 upstream of the expander device 8 and downstream of the heat exchanger 4, where the highest pressure is to be expected. Since the pressure at the high pressure side is usually higher than the pressure in the exhaust gas duct 18, further means for propelling flow of the working fluid to the exhaust gas duct 18 is not necessary.

[0055] The released working fluid or the released part of the working fluid is subsequently catalytically treated in the exhaust gas after treatment unit 20 and thereby

converted into harmless compounds which can be released to the atmosphere. Thereby it should be noted that the location where the part of the working fluid is released into the exhaust gas after-treatment system depends on the type of working fluid. E.g. when ammonia is used, it is preferred to introduce the released working fluid into the exhaust gas after treatment system upstream of the selective catalytic reduction unit. If alcohol is comprised in the working fluid, it is advantageous to release the working fluid into the exhaust gas after treatment system upstream of the oxidation catalyst.

[0056] Branching off working fluid release means 24 at the high temperature and high pressure side of the working fluid circuit 11 has the additional advantage that the exhaust gas streaming through the exhaust gas duct 18 is not excessively cooled down so that operation of the exhaust gas after treatment system is not compromised. Typically, the operation temperature for the exhaust gas after treatment system is above 250° Celsius.

[0057] Turning finally to Fig. 6 which shows an additional further embodiment example of Figs. 3 - 5. The exhaust gas system 100 comprises a control unit 110 for implementing the control method as discussed above and which is operatively connected to the controllable valves 42, 52 and 26 for opening and/or closing the valves 42, 52 and 26. The exhaust gas system 100 comprises at least one pressure detector 102 arranged in the working fluid circuit 11. Further, the control unit 110 is operatively connected to the pressure detector 102 for controlling the opening and/or closing of the valves 42, 52 and 26 in dependence on a detected pressure. More specifically, the pressure detector 102 is arranged in the high pressure side, i.e. stage III, of the working fluid circuit 11. The control unit 110 is configured to control the valves 42, 52 and 26 in dependence on different operational conditions of the truck 500 in a manner as discussed above. Further, the exhaust gas system 100 comprises a manually operable means 106, which is connected to the control unit 100 for manually controlling opening and/or closing of the valves 42, 52 and 26.

[0058] Although the figures may show a specific order of method steps, the order of the steps may differ from what is depicted. Also two or more steps may be performed concurrently or with partial concurrence. Such variation will depend on the software and hardware systems chosen and on designer choice. All such variations are within the scope of the disclosure. Likewise, software implementations could be accomplished with standard programming techniques with rule based logic and other logic to accomplish the various connection steps, processing steps, comparison steps and decision steps. Additionally, even though the invention has been described with reference to specific exemplifying embodiments thereof, many different alterations, modifications and the like will become apparent for those skilled in the art.

[0059] Variations to the disclosed embodiments can be understood and effected by the skilled addressee in

practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. Furthermore, in the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

Claims

1. An exhaust gas system (100) for a vehicle (500), comprising:
 - an arrangement (17) for conveying an exhaust gas stream (80);
 - a thermodynamic engine (1) comprising a heat exchanger (4) positioned in the exhaust gas stream (80) for recovery of heat from the exhaust gas stream (80), the thermodynamic engine (1) comprising a working fluid circulation circuit (11) holding a working fluid, the working fluid comprising a first base component mixed with a first additional component at a selected concentration, and
 - a first container (40) for storing an amount of at least the first additional component of the working fluid, the first container (40) being fluidly connected to the working fluid circulation circuit (11),

characterized in that the first container (40) is connected downstream of the heat exchanger (4) at a gaseous phase of the working fluid circulation circuit (11), and that the exhaust gas system (100) is further configured to allow adjustment of a pressure of the working fluid at the gaseous phase of the working fluid circulation circuit (11) to conform with one of a plurality of predetermined conditions, wherein the plurality of predetermined conditions are dependent on different operational conditions for the vehicle (500).
2. The exhaust gas system (100) according to claim 1, further comprising a pressure detector (102) arranged downstream of the heat exchanger (4) at the gaseous phase of the working fluid circulation circuit (11), wherein the adjustment of the pressure of the working fluid at the gaseous phase of the working fluid circulation circuit (11) is dependent on a pressure detected by the pressure detector (102).
3. The exhaust gas system (100) according to any one of claims 1 and 2, wherein the pressure of the working fluid at the gaseous phase of the working fluid circulation circuit (11) is adjusted by adjusting the selected concentration of the first additional component in relation to the first base component.
4. The exhaust gas system (100) according to any one

of the preceding claims, wherein the selected concentration of the first additional component in relation to the first base component is adjusted based on an ambient temperature detected by a temperature sensor.

5. The exhaust gas system (100) according to any one of the preceding claims, further comprising a second container (50) fluidly connected to the working fluid circulation circuit (11) at the gaseous phase of the working fluid circulation circuit (11), wherein the first container (40) is configured for allowing an increase of the pressure at one of the predetermined conditions, and the second container (50) is configured for reducing the pressure at another one of the predetermined conditions.
6. The exhaust gas system (100) according to any one of the preceding claims, further comprising a working fluid release means (24) and an exhaust gas treatment unit (20), wherein the working fluid release means (24) is configured to provide a fluid connection between the working fluid circulation circuit (11) and the exhaust gas treatment unit (20), and the first container (40) is configured for allowing an increase of the pressure at one of the predetermined conditions, and the exhaust gas treatment unit (20) in combination with the working fluid release means (24) is configured for reducing the pressure at another one of the predetermined conditions.
7. The exhaust gas system (100) according to claim 6, wherein the exhaust gas treatment unit (20) is formed by a selective catalytic reduction unit (SCR).
8. The exhaust gas system (100) according to any one of claims 6 and 7, wherein the working fluid release means (24) is connected downstream of the heat exchanger (4) at the gaseous phase of the working fluid circulation circuit (11).
9. The exhaust gas system (100) according to any one of the preceding claims, wherein the first additional component is at least one of ammonia and alcohol.
10. The exhaust gas system (100) according to claim 5, wherein at least one of the first (40) and the second (50) container is configured to store liquid ammonia and/or an ammonia adsorbing material.
11. The exhaust gas system (100) according to claim 2, further comprising a control unit (110) being electrically connected to the pressure detector (102) and configured to adjust, using at least one controllable valve (42) operatively connected to the control unit (110), the pressure of the working fluid at the gaseous phase of the working fluid circulation circuit (11).

12. A method for controlling an exhaust gas system (100) for a vehicle (500), the exhaust gas system (100) comprising an arrangement (17) for conveying an exhaust gas stream (80), a thermodynamic engine (1) comprising a heat exchanger (4) positioned in the exhaust gas stream (80) for recovery of heat from the exhaust gas stream (80), the thermodynamic engine (1) comprising a working fluid circulation circuit (11) holding a working fluid, the working fluid comprising a first base component mixed with a first additional component at a concentration, and a first container (40) for storing an amount of at least the first additional component of the working fluid, wherein the first container (40) is fluidly connected downstream of the heat exchanger (4) at a gaseous phase of the working fluid circulation circuit (11), **characterized in that** the method comprises the steps of:

- detecting a pressure of the working fluid at a gaseous phase of the working fluid circulation circuit (11); and
- adjusting the pressure to conform to one of a plurality of predetermined conditions, wherein the plurality of predetermined conditions are dependent on different operational conditions for the vehicle (500).

13. The method according to claim 12, further comprising the step of:

- fluidly connecting a working fluid release means (24) between the working fluid circulation circuit (11) and an exhaust gas treatment unit (20) provided with the vehicle (500),

wherein the first container (40) is configured for allowing an increase of the pressure at one of the predetermined conditions, and the exhaust gas treatment unit (20) in combination with the working fluid release means (24) is configured for reducing the pressure at another one of the predetermined conditions.

14. The method according to any one of claims 12 and 13, further comprising the steps of:

- determining a current operational condition for the vehicle (500), and
- controlling a least one controllable valve (42) dependent on the determined current operational condition for the vehicle (500) for adjusting the pressure of the working fluid at the gaseous phase of the working fluid circulation circuit (11).

15. Computer program product comprising a computer readable medium having stored thereon computer program means for controlling an exhaust gas sys-

tem (100) for a vehicle (500), wherein the computer program product comprises code for performing the steps according to claim 12.

Patentansprüche

1. Abgassystem (100) für ein Fahrzeug (500), umfassend:

- eine Anordnung (17) zum Fördern eines Abgasstroms (80);
- eine thermodynamische Maschine (1) umfassend einen zur Rückgewinnung von Wärme aus dem Abgasstrom (80) in dem Abgasstrom (80) positionierten Wärmetauscher (4), wobei die thermodynamische Maschine (1) einen ein Arbeitsfluid enthaltenden Arbeitsfluidzirkulationskreislauf (11) umfasst, wobei das Arbeitsfluid eine erste Basiskomponente umfasst, die mit einer ersten zusätzlichen Komponente in einer ausgewählten Konzentration gemischt ist, und
- einen ersten Behälter (40) zum Aufnehmen einer Menge wenigstens der ersten zusätzlichen Komponente des Arbeitsfluids, wobei der erste Behälter (40) mit dem Arbeitsfluidzirkulationskreislauf (11) in Fluidverbindung steht,

dadurch gekennzeichnet, dass der erste Behälter (40) stromabwärts von dem Wärmetauscher (4) in einer gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) verbunden ist, und dass das Abgassystem (100) ferner dazu konfiguriert ist, die Einstellung eines Drucks des Arbeitsfluids in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) so zu erlauben, dass er mit einer Vielzahl von vorgegebenen Bedingungen übereinstimmt, wobei die Vielzahl von vorgegebenen Bedingungen von unterschiedlichen Betriebsbedingungen für das Fahrzeug (500) abhängig ist.

2. Abgassystem (100) nach Anspruch 1, ferner umfassend einen Druckdetektor (102), der stromabwärts von dem Wärmetauscher (4) in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) angeordnet ist, wobei die Einstellung des Drucks des Arbeitsfluids in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) von einem durch den Druckdetektor (102) detektierten Druck abhängig ist.
3. Abgassystem (100) nach einem der Ansprüche 1 und 2, wobei der Druck des Arbeitsfluids in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) durch Einstellen der ausgewählten Konzentration der ersten zusätzlichen Komponente bezüglich der ersten Basiskomponente eingestellt wird.

4. Abgassystem (100) nach einem der vorhergehenden Ansprüche, wobei die ausgewählte Konzentration der ersten zusätzlichen Komponente in Bezug auf die erste Basiskomponente basierend auf einer durch einen Temperatursensor detektierten Umgebungstemperatur eingestellt wird.

5. Abgassystem (100) nach einem der vorhergehenden Ansprüche, ferner umfassend einen zweiten Behälter (50), der in Fluidverbindung mit dem Arbeitsfluidzirkulationskreislauf (11) in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) steht, wobei der erste Behälter (40) dazu konfiguriert ist, eine Erhöhung des Drucks bei einer der vorgegebenen Bedingungen zu erlauben, und der zweite Behälter (50) dazu konfiguriert ist, den Druck bei einer anderen der vorgegebenen Bedingungen zu senken.

6. Abgassystem (100) nach einem der vorhergehenden Ansprüche, ferner umfassend eine Arbeitsfluidfreigabeeinrichtung (24) und eine Abgasbehandlungseinheit (20), wobei die Arbeitsfluidfreigabeeinrichtung (24) dazu konfiguriert ist, eine Fluidverbindung zwischen dem Arbeitsfluidzirkulationskreislauf (11) und der Abgasbehandlungseinheit (20) bereitzustellen, und der erste Behälter (40) dazu konfiguriert ist, eine Erhöhung des Drucks bei einer der vorgegebenen Bedingungen zu erlauben, und die Abgasbehandlungseinheit (20) in Kombination mit der Arbeitsfluidfreigabeeinrichtung (24) dazu konfiguriert ist, den Druck bei einer anderen der vorgegebenen Bedingungen zu senken.

7. Abgassystem (100) nach Anspruch 6, wobei die Abgasbehandlungseinheit (20) durch eine Einheit zur selektiven katalytischen Reduktion (SCR) gebildet ist.

8. Abgassystem (100) nach einem der Ansprüche 6 und 7, wobei die Arbeitsfluidfreigabeeinrichtung (24) stromabwärts von dem Wärmetauscher (4) in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufs (11) verbunden ist.

9. Abgassystem (100) nach einem der vorhergehenden Ansprüche, wobei die erste zusätzliche Komponente Ammoniak und/oder Alkohol ist.

10. Abgassystem (100) nach Anspruch 5, wobei der erste (40) und/oder der zweite (50) Behälter dazu konfiguriert ist, flüssiges Ammoniak und/oder ein Ammoniak absorbierendes Material aufzunehmen.

11. Abgassystem (100) nach Anspruch 2, ferner umfassend eine Steuereinheit (110), die mit dem Druckdetektor (102) elektrisch verbunden und dazu konfiguriert ist, unter Verwendung wenigstens eines

funktionell mit der Steuereinheit (110) verbundenen steuerbaren Ventils (42) den Druck des Arbeitsfluids in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufts (11) einzustellen.

12. Verfahren zum Steuern eines Abgassystems (100) für ein Fahrzeug (500), wobei das Abgassystem (100) eine Anordnung (17) zum Fördern eines Abgasstroms (80), eine thermodynamische Maschine (1) umfassend einen zur Rückgewinnung von Wärme aus dem Abgasstrom (80) in dem Abgasstrom (80) positionierten Wärmetauscher (4), wobei die thermodynamische Maschine (1) einen ein Arbeitsfluid enthaltenden Arbeitsfluidzirkulationskreislauf (11) umfasst, wobei das Arbeitsfluid eine erste Basiskomponente umfasst, die mit einer ersten zusätzlichen Komponente in einer ausgewählten Konzentration gemischt ist, und einen ersten Behälter (40) zum Aufnehmen einer Menge wenigstens der ersten zusätzlichen Komponente des Arbeitsfluids umfasst, wobei der erste Behälter (40) stromabwärts von dem Wärmetauscher (4) in einer gasförmigen Phase des Arbeitsfluidzirkulationskreislaufts (11) verbunden ist, **dadurch gekennzeichnet, dass** das Verfahren die Schritte umfasst:

- Detektieren eines Drucks des Arbeitsfluids in einer gasförmigen Phase des Arbeitsfluidzirkulationskreislaufts (11); und
- Einstellen des Drucks so, dass er mit einer einer Vielzahl von vorgegebenen Bedingungen übereinstimmt, wobei die Vielzahl von vorgegebenen Bedingungen von unterschiedlichen Betriebsbedingungen für das Fahrzeug (500) abhängig ist.

13. Verfahren nach Anspruch 12, ferner umfassend die Schritte:

- Bereitstellen einer Fluidverbindung für eine Arbeitsfluidfreigabeeinrichtung (24) zwischen dem Arbeitsfluidzirkulationskreislauf (11) und einer bei dem Fahrzeug (500) vorgesehenen Abgasbehandlungseinheit (20),

wobei der erste Behälter (40) dazu konfiguriert ist, eine Erhöhung des Drucks bei einer der vorgegebenen Bedingungen zu erlauben, und die Abgasbehandlungseinheit (20) in Kombination mit der Arbeitsfluidfreigabeeinrichtung (24) dazu konfiguriert ist, den Druck bei einer anderen der vorgegebenen Bedingungen zu senken.

14. Verfahren nach einem der Ansprüche 12 und 13, ferner umfassend die Schritte:

- Bestimmen einer derzeitigen Betriebsbedin-

gung für das Fahrzeug (500), und

- Steuern wenigstens eines steuerbaren Ventils (42) abhängig von den bestimmten derzeitigen Betriebsbedingungen für das Fahrzeug (500) zum Einstellen des Drucks des Arbeitsfluids in der gasförmigen Phase des Arbeitsfluidzirkulationskreislaufts (11).

15. Computerprogrammprodukt umfassend ein computerlesbares Medium, auf dem Computerprogramm-mittel zum Steuern eines Abgassystems (100) für ein Fahrzeug (500) gespeichert sind, wobei das Computerprogrammprodukt einen Code zum Durchführen der Schritte nach Anspruch 12 umfasst.

Revendications

1. Système de gaz d'échappement (100) pour un véhicule (500), comprenant :

- un agencement (17) pour transporter un flux de gaz d'échappement (80);
- un moteur thermodynamique (1) comprenant un échangeur de chaleur (4) positionné dans le flux de gaz d'échappement (80) pour récupérer de la chaleur du flux de gaz d'échappement (80), le moteur thermodynamique (1) comprenant un circuit de circulation de fluide actif (11) contenant un fluide actif, le fluide actif comprenant un premier composant de base mélangé avec un premier composant supplémentaire à une concentration sélectionnée, et
- un premier récipient (40) pour stocker une quantité d'au moins le premier composant supplémentaire du fluide actif, le premier récipient (40) étant relié de manière fluidique au circuit de circulation de fluide actif (11),

caractérisé en ce que le premier récipient (40) est relié en aval de l'échangeur de chaleur (4) au niveau d'une phase gazeuse du circuit de circulation de fluide actif (11), et **en ce que** le système de gaz d'échappement (100) est en outre configuré pour permettre l'ajustement d'une pression du fluide actif au niveau de la phase gazeuse du circuit de circulation de fluide actif (11) pour se conformer à l'une d'une pluralité de conditions prédéterminées, où la pluralité de conditions prédéterminées dépendent de différentes conditions de fonctionnement pour le véhicule (500).

2. Système de gaz d'échappement (100) selon la revendication 1, comprenant en outre un détecteur de pression (102) agencé en aval de l'échangeur de chaleur (4) au niveau de la phase gazeuse du circuit de circulation de fluide actif (11), où l'ajustement de la pression du fluide actif au niveau de la phase gazeuse du circuit de circulation de fluide actif (11) dé-

- pend d'une pression détectée par le détecteur de pression (102).
3. Système de gaz d'échappement (100) selon l'une quelconque des revendications 1 et 2, dans lequel la pression du fluide actif au niveau de la phase gazeuse du circuit de circulation de fluide actif (11) est ajustée par ajustement de la concentration sélectionnée du premier composant supplémentaire par rapport au premier composant de base. 5
 4. Système de gaz d'échappement (100) selon l'une quelconque des revendications précédentes, dans lequel la concentration sélectionnée du premier composant supplémentaire par rapport au premier composant de base est ajustée sur la base d'une température ambiante détectée par un capteur de température. 10
 5. Système de gaz d'échappement (100) selon l'une quelconque des revendications précédentes, comprenant en outre un deuxième récipient (50) relié de manière fluide au circuit de circulation de fluide actif (11) au niveau de la phase gazeuse du circuit de circulation de fluide actif (11), où le premier récipient (40) est configuré pour permettre une augmentation de la pression dans l'une des conditions prédéterminées, et le deuxième récipient (50) est configuré pour réduire la pression dans une autre condition des conditions prédéterminées. 15
 6. Système de gaz d'échappement (100) selon l'une quelconque des revendications précédentes, comprenant en outre un moyen de libération de fluide actif (24) et une unité de traitement de gaz d'échappement (20), où le moyen de libération de fluide actif (24) est configuré pour assurer une liaison fluide entre le circuit de circulation de fluide actif (11) et l'unité de traitement de gaz d'échappement (20), et le premier récipient (40) est configuré pour permettre une augmentation de la pression dans l'une des conditions prédéterminées, et l'unité de traitement de gaz d'échappement (20) en combinaison avec le moyen de libération de fluide actif (24) est configurée pour réduire la pression dans une autre condition des conditions prédéterminées. 20
 7. Système de gaz d'échappement (100) selon la revendication 6, dans lequel l'unité de traitement de gaz d'échappement (20) est formée par une unité de réduction catalytique sélective (SCR). 25
 8. Système de gaz d'échappement (100) selon l'une quelconque des revendications 6 et 7, dans lequel le moyen de libération de fluide actif (24) est relié en aval de l'échangeur de chaleur (4) au niveau de la phase gazeuse du circuit de circulation de fluide actif (11). 30
 9. Système de gaz d'échappement (100) selon l'une quelconque des revendications précédentes, dans lequel le premier composant supplémentaire est au moins l'un parmi l'ammoniac et l'alcool. 35
 10. Système de gaz d'échappement (100) selon la revendication 5, dans lequel au moins l'un des premier (40) et deuxième (50) récipients est configuré pour stocker de l'ammoniac liquide et/ou un matériau adsorbant l'ammoniac. 40
 11. Système de gaz d'échappement (100) selon la revendication 2, comprenant en outre une unité de commande (110) qui est électriquement reliée au détecteur de pression (102) et configurée pour ajuster, en utilisant au moins une soupape réglable (42) reliée de manière fonctionnelle à l'unité de commande (110), la pression du fluide actif au niveau de la phase gazeuse du circuit de circulation de fluide actif (11). 45
 12. Procédé de commande d'un système de gaz d'échappement (100) pour un véhicule (500), le système de gaz d'échappement (100) comprenant un agencement (17) pour transporter un flux de gaz d'échappement (80), un moteur thermodynamique (1) comprenant un échangeur de chaleur (4) positionné dans le flux de gaz d'échappement (80) pour récupérer de la chaleur du flux de gaz d'échappement (80), le moteur thermodynamique (1) comprenant un circuit de circulation de fluide actif (11) contenant un fluide actif, le fluide actif comprenant un premier composant de base mélangé avec un premier composant supplémentaire à une certaine concentration, et un premier récipient (40) pour stocker une quantité d'au moins le premier composant supplémentaire du fluide actif, où le premier récipient (40) est relié de manière fluide en aval de l'échangeur de chaleur (4) au niveau d'une phase gazeuse du circuit de circulation de fluide actif (11), **caractérisé en ce que** le procédé comprend les étapes consistant : 50
 - à détecter une pression du fluide actif au niveau d'une phase gazeuse du circuit de circulation de fluide actif (11) ; et
 - à ajuster la pression pour se conformer à l'une d'une pluralité de conditions prédéterminées, où la pluralité de conditions prédéterminées dépendent de différentes conditions de fonctionnement pour le véhicule (500).
 13. Procédé selon la revendication 12, comprenant en outre l'étape consistant : 55
 - à relier de manière fluide un moyen de libération de fluide actif (24) entre le circuit de circulation de fluide actif (11) et une unité de traitement de gaz d'échappement (20).

tement de gaz d'échappement (20) fournie avec le véhicule (500),

où le premier récipient (40) est configuré pour permettre une augmentation de la pression dans l'une des conditions prédéterminées, et l'unité de traitement de gaz d'échappement (20) en combinaison avec le moyen de libération de fluide actif (24) est configurée pour réduire la pression dans une autre condition des conditions prédéterminées.

14. Procédé selon l'une quelconque des revendications 12 et 13, comprenant en outre les étapes consistant :

- à déterminer une condition de fonctionnement actuelle pour le véhicule (500), et
- à commander au moins une soupape réglable (42) en fonction de la condition de fonctionnement actuelle déterminée pour le véhicule (500) pour ajuster la pression du fluide actif au niveau de la phase gazeuse du circuit de circulation de fluide actif (11).

15. Produit de programme informatique comprenant un support lisible par ordinateur sur lequel est stocké un moyen de programme informatique pour commander un système de gaz d'échappement (100) pour un véhicule (500), où le produit de programme informatique comprend un code pour effectuer les étapes selon la revendication 12.

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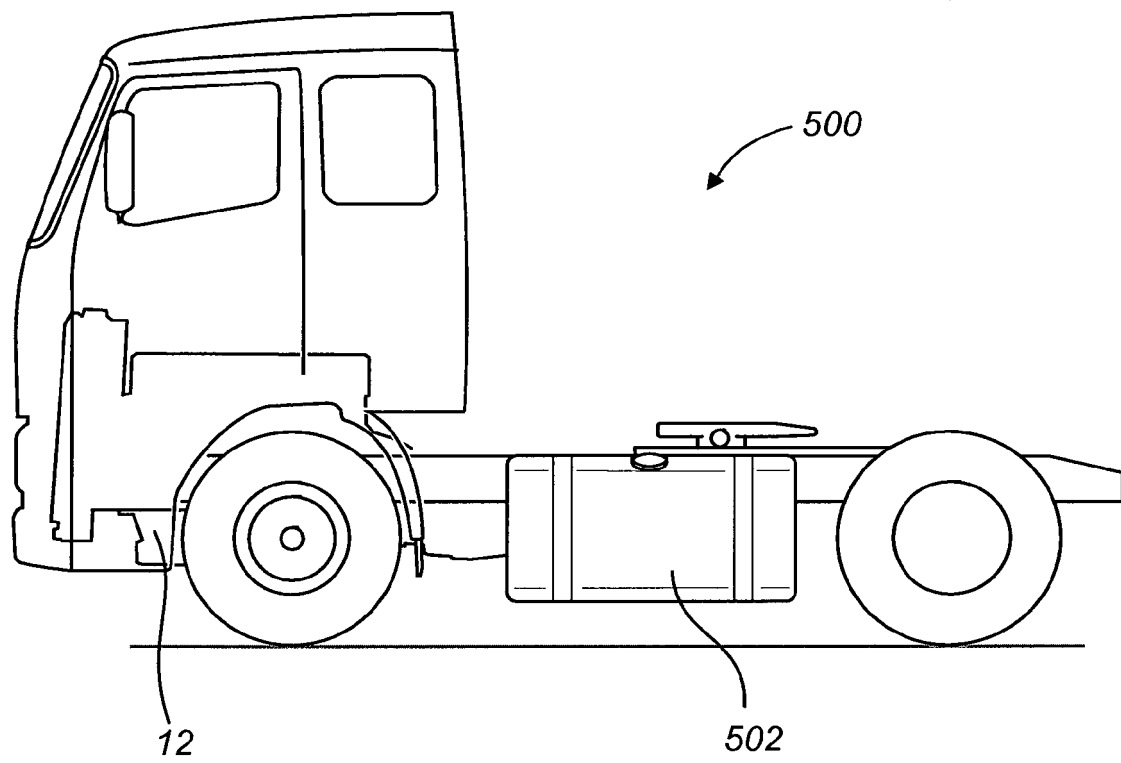


Fig. 1

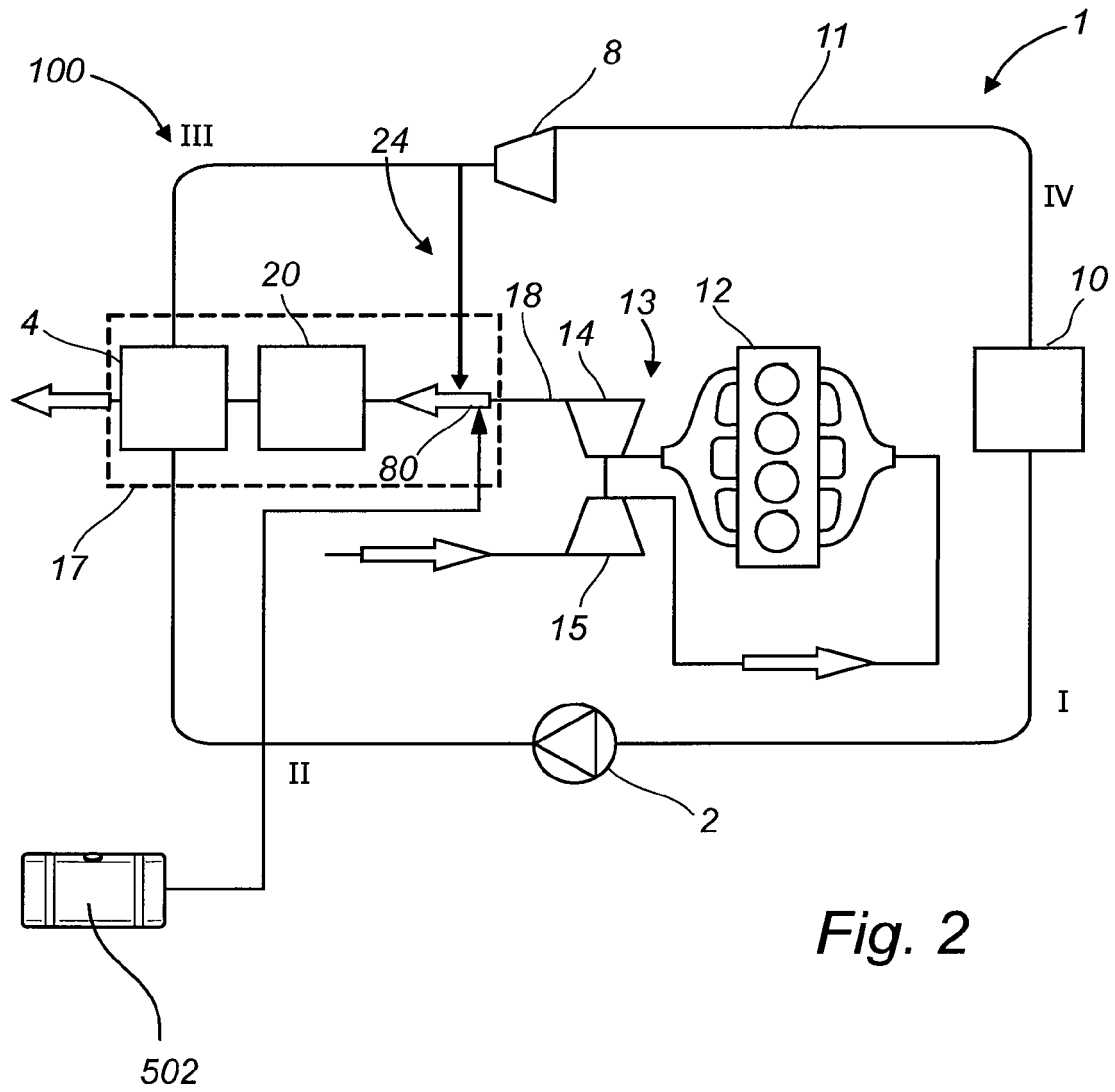


Fig. 2

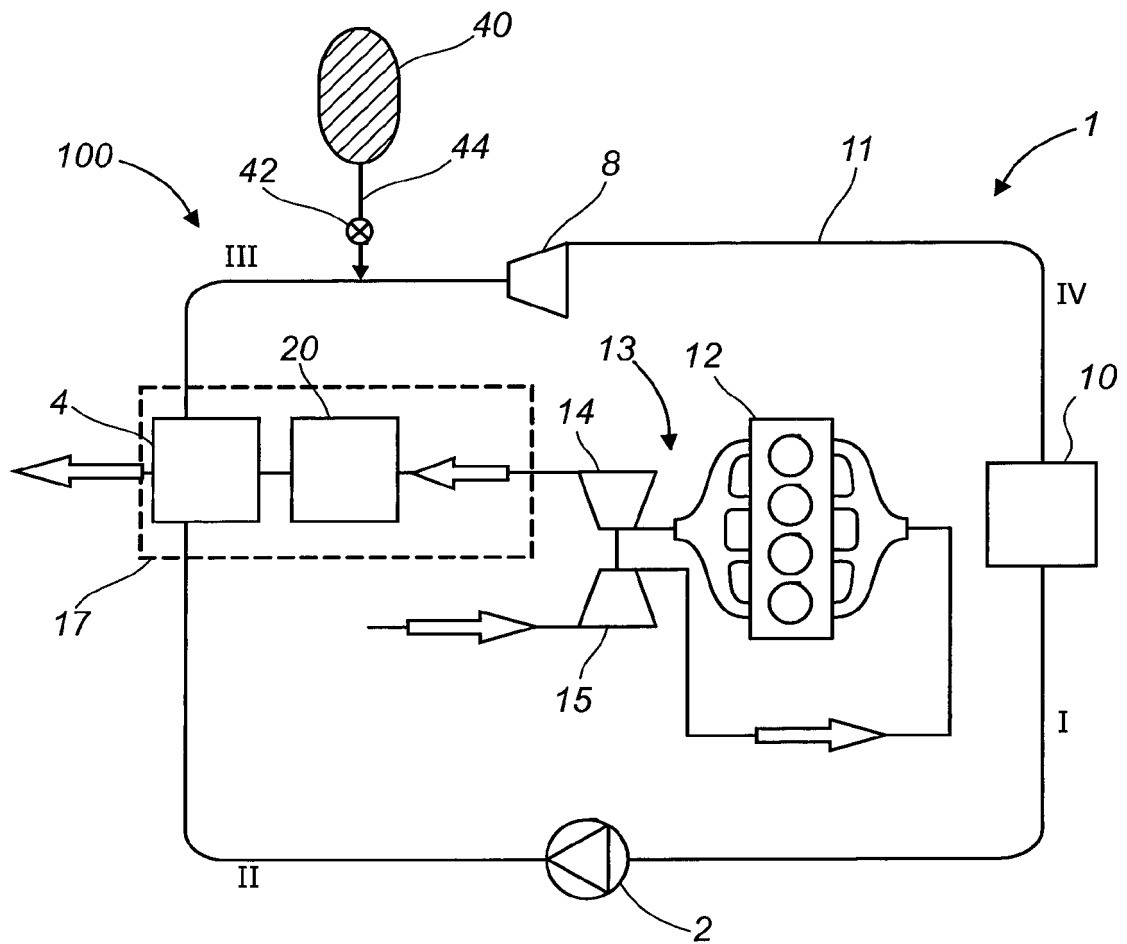


Fig. 3

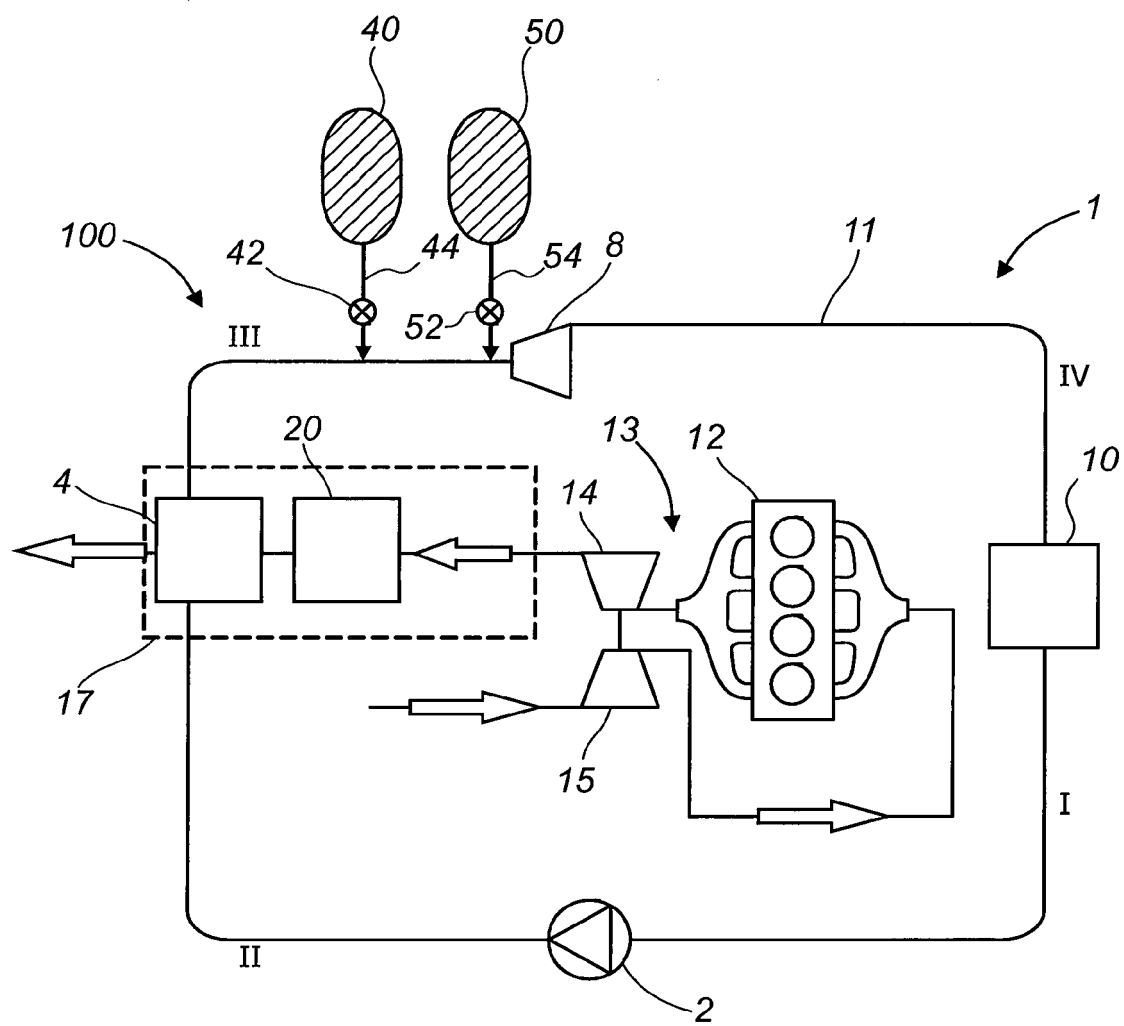


Fig. 4

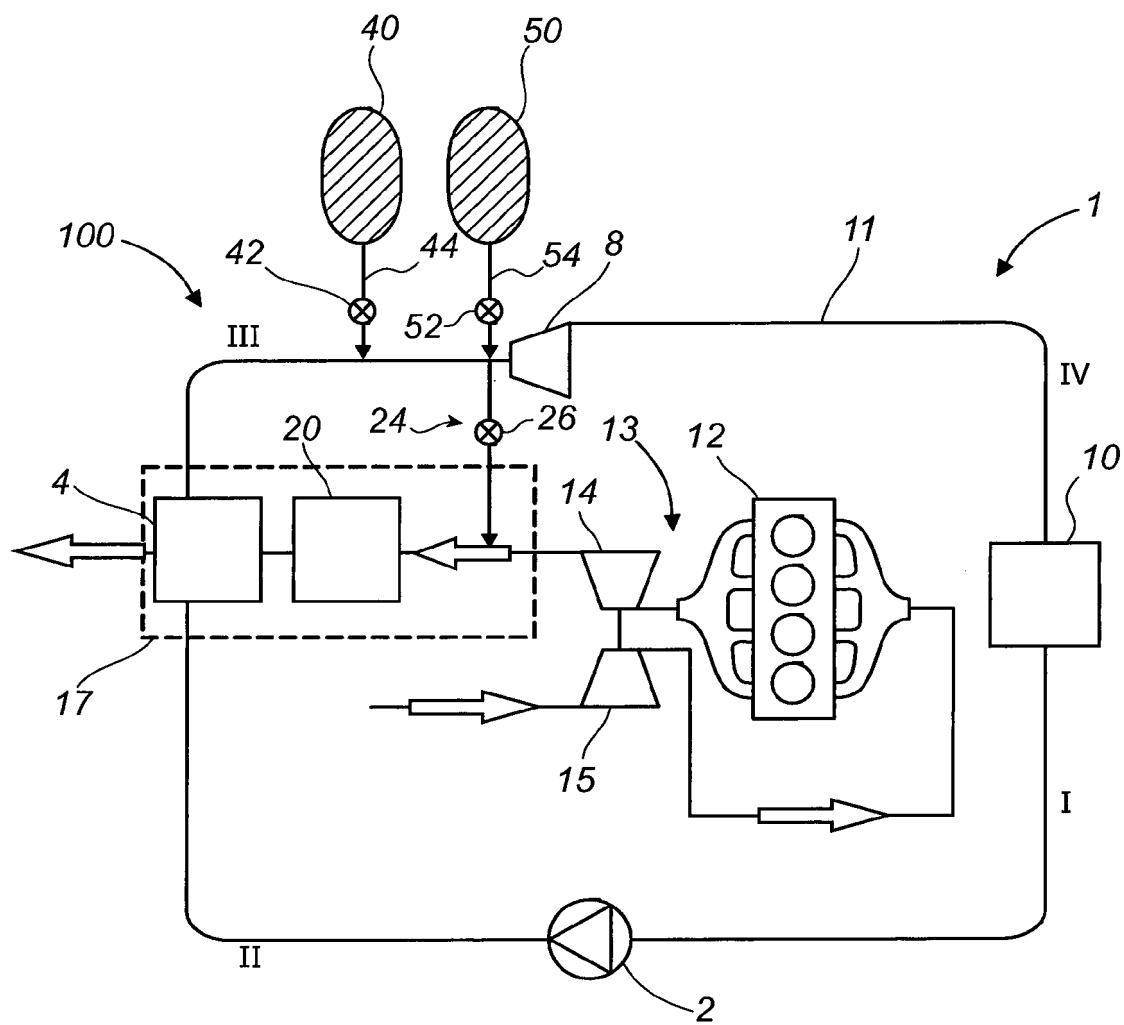


Fig. 5

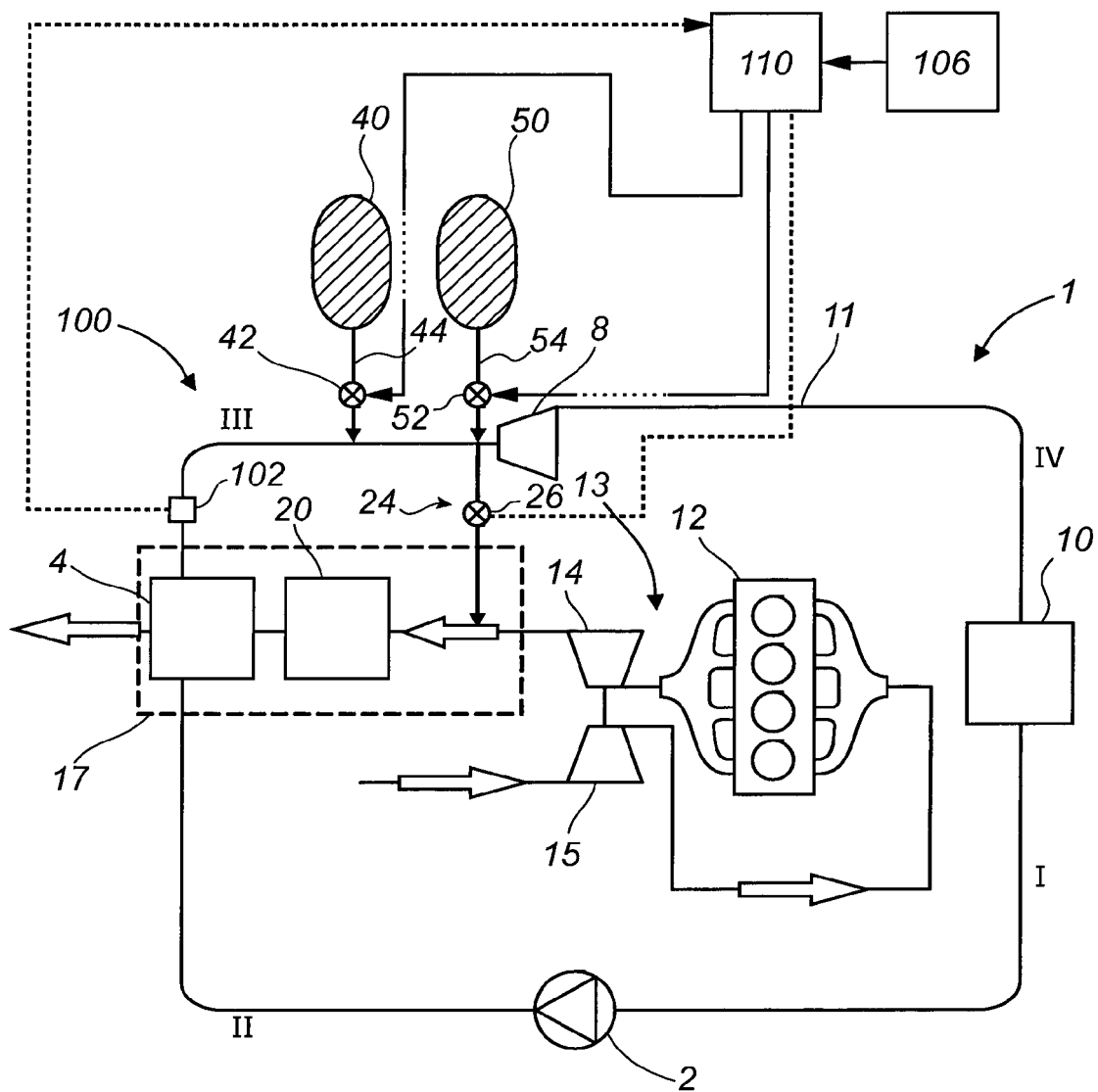


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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