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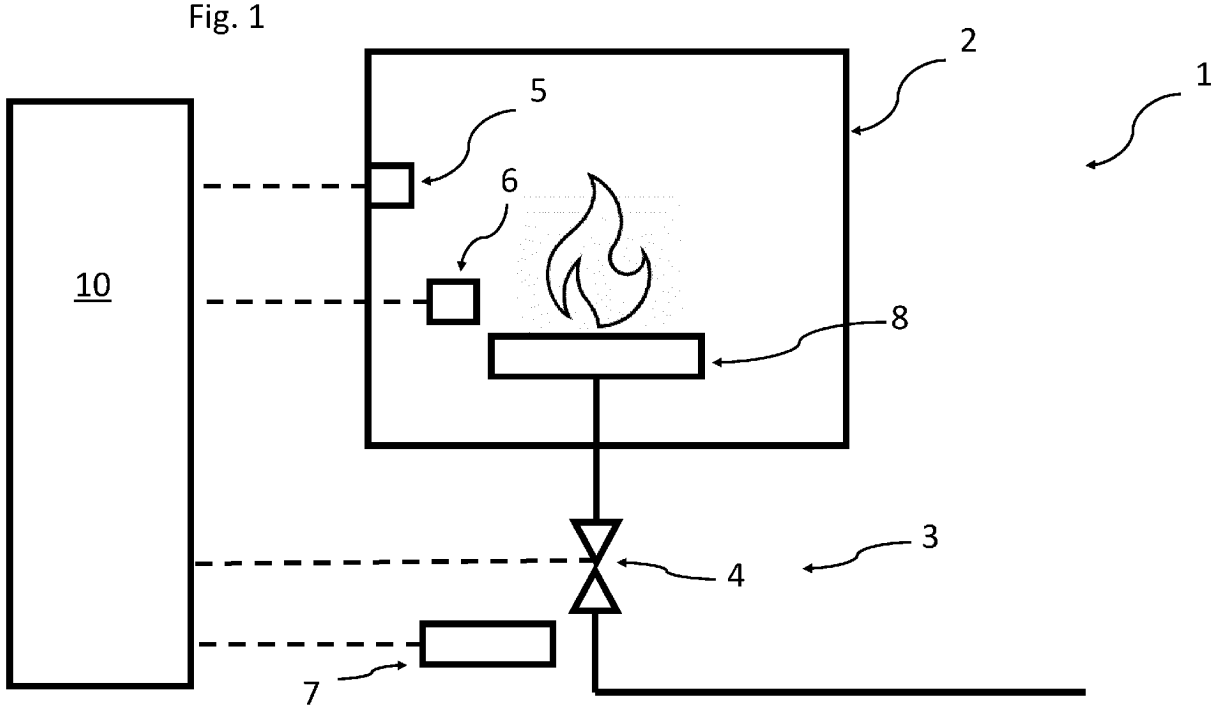
# (54) GAS BURNING APPLIANCE AND METHOD FOR STARTING UP A GAS BURNING APPLIANCE

(57) The invention relates to method for starting up a gas burning appliance (1). The method comprises an ignition sequence comprising:
- activating an igniter (6) for a predetermined ignition time,
- opening a gas supply (3) for a predetermined safety time to supply combustible gas to a burning chamber (2), the combustible gas being a hydrogen comprising gas,
- detecting the presence of a flame by means of a flame detector (5),
- closing the gas supply (3) if no flame has been detected at the end of the predetermined safety time. The combustible gas comprises more than 20 mol% of hydrogen and activation of the igniter commences at a predetermined pre-ignition time interval before opening the gas supply (3).

Fig. 1

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## Description

**[0001]** The invention relates to a method for starting up a gas burning appliance. In addition, the invention relates to a gas burning appliance, the use of such as gas burning appliance and a computer program product.

**[0002]** Gas burning appliances are commonplace for heating purposes and for providing hot domestic / tap water. Such appliances typically have a burning chamber, in which a mixture of air and combustible gas, e.g. natural gas, is introduced. At start-up, a spark electrode is activated to create ignition and a stable flame.

**[0003]** Delayed ignition is a known problem and occurs when ignition doesn't take place immediately, while combustible gas continues to flow into the burning chamber causing a build-up of combustible gas. A delayed ignition, i.e. ignition of the accumulated combustible mixture, may cause an explosion with associated damage and noise. Delayed ignition may have different reasons, such as a malfunctioning spark electrode, insufficient flow of combustible gas or a nonoptimal air-natural gas ratio.

**[0004]** Delayed ignition is in particular a problem when the combustible gas comprises a high amount of hydrogen, as an explosion caused by a delayed ignition of a combustible air-hydrogen mixture may not only damage internal components of the appliance, but also damage internal components, which may even be ejected from the boiler case of the appliance. Moreover, the high sound levels that such an explosion produces, could potentially lead to hearing damage of people who are in the vicinity of such an appliance.

**[0005]** To address the issue of delayed ignition, a controller may be provided that, at start up, activates the spark electrode for ignition and opens the gas valve to allow the fuel gas to flow into the burning chamber for a pre-set ignition safety time. The gas valve remains open if ignition and a stable flame is achieved during the pre-set ignition safety time. If not, the gas valve is closed, to prevent build-up of natural gas in the burning chamber.

**[0006]** EP4015904A1 discloses a method and device for protecting a heater during the ignition of a mixture of air and hydrogen-containing fuel gas. A method and corresponding device for igniting a combustion process in a combustion chamber of a heating device is provided, which is operated with hydrogen or a fuel gas containing hydrogen, and a flame monitor for detecting a flame with a response time after the beginning of the supply of an ignitable mixture of air and combustible gas to the combustion chamber. An ignition process is triggered for a maximum of the duration of a predeterminable ignition time interval, which is shorter than a safety time interval, after the end of which the supply of an ignitable mixture is terminated if no flame has been detected up to this point. According to this document this increases safety when starting a heating device operated with hydrogen or a fuel gas containing hydrogen and enables particularly gentle and safe ignition processes.

**[0007]** Since hydrogen molecules are smaller compared to for instance methane, there is an increased chance of leakage of hydrogen into the burning chamber when the gas supply is still closed. This may result in creation of an ignitable mixture, in particular since hydrogen has a lower flammability limit and lower ignition energies compared to natural gas.

**[0008]** This may also reduce in dangerous situations during ignition. Although a proper sealing of the gas valve is required when gas supply is off, mal function of a gas valve could result in leakage even when the valve is off.

**[0009]** Other approaches to safely ignite hydrogen burning appliances are provided by the prior art.

**[0010]** EP3971475A describes an alternative manner of dealing with delayed ignition, i.e. by describing an air-gas mixture burning appliance that comprises a burning unit for burning a combustible air-gas mixture, a flame detector for sensing presence of a flame in the burning unit, an air-gas mixing unit that is arranged upstream of the burning unit for mixing of air and gas to form the combustible air-gas mixture, and a gas supply unit that is arranged upstream of the air-gas mixing unit, wherein the gas supply unit is adapted to regulating a flow of gas to the air-gas mixing unit such that the combustible air-gas mixture has a variable equivalence ratio between gas and air that is based on whether the flame detector senses the presence of the flame in the burning unit or fails to sense the presence of a flame in the burning unit.

**[0011]** WO2021078949 relates to a surface stabilized fully premixed gas premix burner for burning hydrogen gas, and method for starting such burner. A method is provided for starting a burner wherein a premixed gas comprising a combustible gas and air is supplied, wherein the combustible gas comprises at least 50% by volume of hydrogen. The method comprises the following steps: during a start-up phase: supplying premixed gas having a first lambda-value to the burner surface, wherein the first lambda-value is at least 1.85, and igniting the supplied premixed gas having the first lambda-value using an ignition source. During an operation phase after the premixed gas has been ignited: supplying premixed gas having a second lambda-value to the burner surface, wherein the first lambda-value is larger than the second lambda-value. The lambda-value is defined as a ratio between an actually supplied quantity of air and the quantity of air required for stoichiometric combustion of the premixed gas.

**[0012]** The object of the invention is therefore to provide a gas burning appliance and a method of operating such a gas burning appliance with a reduced risk of uncontrolled combustion or explosions. A further object is to reduce the risk of delayed ignition, by reducing the chance of delayed ignition occurring and/or by reducing the consequences of an unwanted delayed ignition.

**[0013]** The object is solved by a method for starting up a gas burning appliance, the gas burning appliance comprising a burning chamber, a gas supply for supplying combustible gas to the burning chamber, a flame detector for detecting the presence of a flame in the burning cham-

ber and an ignitor for igniting the combustible gas in the burning chamber, wherein the method comprises an ignition sequence comprising:

- activating the igniter for a predetermined ignition time,
- opening the gas supply for a predetermined safety time to supply combustible gas to the burning chamber,
- detecting the presence of a flame by means of the flame detector,
- closing the gas supply if no flame has been detected at the end of the predetermined safety time,

wherein the combustible gas comprises more than 20 mol% of hydrogen and
wherein activation of the igniter commences at a predetermined pre-ignition time interval before opening the gas supply.

**[0014]** It has been found that the chance of delayed ignition, as well as the consequences of a delayed ignition, can be reduced for burning appliances that use hydrogen or a hydrogen comprising combustible gas, in particular combustible gas that comprise more than 20 mol% hydrogen.

**[0015]** By using a pre-ignition time as defined, a proper spark is ensured at the time the gas supply opens and the risk of a delayed ignition is reduced since sparking is initiated early. For instance, as a result of humidity, it may take time for the ignitor to function properly. An ignitor creating sparks by ignition pulses may not generate proper sparks at the first ignition pulses due to humidity. So, the margin for the delay time is increased.

**[0016]** Hydrogen has a higher flammable range, higher flame speed and requires lower ignition energies compared to natural gas. Therefore, lower safety times can be used to ignite a hydrogen boiler. However delayed ignition is more problematic so reducing the chance and severity of delayed ignition is preferred.

**[0017]** The safety time is the time that elapses between the order to open and the order to close the gas supply, in particular the hydrogen supply, to the burner in the event of ignition not taking place.

**[0018]** The pre-ignition time interval is the time interval in which the ignitor is activated and the gas valve, in particular the hydrogen valve, is closed. The pre-ignition time interval ends when the gas valve, in particular hydrogen valve, is opened. The predetermined ignition time can consist of the pre-ignition time interval and a remaining time in which the gas valve is open.

**[0019]** When using a predetermined pre-ignition time interval as described, the total sparking time may be increased. So, in case of ignition delay, the moment of ignition will be earlier with pre-ignition compared with the situation without pre-ignition. Therefore, the volume of combustible gas containing (potentially explosive) $H_2$ is reduced as well since the opening of the gas supply is relatively short at the moment of delayed ignition. Consequently, the impact thereof is reduced.

**[0020]** The chance of explosions caused by delayed ignition is thus reduced since the sparking starts earlier, and therefore in case of delayed ignition, the ignition will take place relatively earlier after opening of the gas supply.

**[0021]** Using a predetermined pre-ignition time interval in combination with hydrogen containing combustible gas (i.e., more than 20 mol% of hydrogen) is especially advantageous as with hydrogen the effects of a pre-ignition time interval is bigger since delayed ignition is more critical for $H_2$ and shorter ignition and safety times may be used. Thus, a proper and stable spark needs to be assured by starting sparking earlier even before the gas valve is opened to assure proper ignition.

**[0022]** Furthermore, in case of a leak in the gas supply, causing hydrogen to leak into the burning chamber before opening of the gas supply, the pre-ignition could be used to detect such a leak, since this ignition could result in combustion and therefore a detected flame before opening of the gas supply. A flame detected before opening of the gas supply may cause switching to an alarm state, which may comprise the start-up of the gas burning appliance to be aborded, switch to a blocking or locking state and/or to generate an alarm, like a sound or a message.

**[0023]** Detection of pre-ignition is important in the case of hydrogen, as for hydrogen the effects of pre-ignition are bigger since delayed ignition is more critical for hydrogen.

**[0024]** As combustible gas a mixture of air and fuel gas is understood. The fuel gas can be hydrogen or comprise hydrogen. The combustible gas is the gas that is supplied to the burner and burnt in the combustion chamber.

**[0025]** According to an embodiment the hydrogen comprising combustible gas comprises more than 40 mol% of hydrogen or more than 80 mol% of hydrogen or more than 90 mol% of hydrogen or more than 98 mol% of hydrogen.

**[0026]** Of course, when a flame has been detected before the end of the predetermined safety time, the fuel gas supply is kept open and the gas burning appliance continues to operate in a continuous operation modus.

**[0027]** According to an embodiment the predetermined pre-ignition time interval is at least 1,0 second, or at least 1,5 seconds, or at least 2,0 seconds, or at least 2,5 seconds, or at least 3,0 seconds.

**[0028]** According to an embodiment the predetermined pre-ignition time interval is shorter than a remaining part of the predetermined ignition time. This ensures that the igniter is igniting at least during part of the safety time, i.e. the time the gas supply is opened. The overlap may be at least 0,5 seconds, or 1.0 second, or 1,5 seconds or at least 2,0 seconds. During this overlap the gas burner appliance can ignite.

**[0029]** According to an embodiment the pre-ignition time interval plus the remaining part of the ignition time

is greater than or equal to the safety time. In other words, activation of the igniter is ended before the end of the safety time.

**[0030]** This is advantageous in situations when flame detection cannot take place during the ignition time, as an active igniter disturbs the flame detector. This may for instance be the case when using an ionisation-based flame detector or an UV-based flame detector, as the igniter could cause false flame detection.

**[0031]** Alternatively, in some embodiments the flame detection and the ignition can overlap. Thus, the flame can be detection during the ignition phase. This possible in gas burning appliances which have an ionization pin and an ignition pin.

**[0032]** According to an embodiment the predetermined safety time is less than 3,0 seconds. The predetermined safety time may be less than 2,5 seconds, less than 2,0 seconds, less than 1,5 seconds, less than 1,0 second or less than 0,5 second.

**[0033]** When the predetermined safety time is reduced, the opening time of the gas valve is reduced during ignition therefore the volume containing (potentially explosive) H2 mixture is reduced as well. Therefore, the impact in case delayed ignition takes place is reduced as less hydrogen or hydrogen comprising gas has built up in the burning chamber.

**[0034]** When using a relatively short, predetermined safety time, it is especially advantageous to use a pre-ignition time, as it is even more important to assure a proper and stable spark during the safety time by starting sparking earlier, i.e. even before the gas valve is opened to assure proper ignition.

**[0035]** According to an embodiment the ignition sequence comprises:

- obtaining an indication of the amount of hydrogen present in the combustible gas,
- setting the pre-ignition time interval and/or the safety time based on the obtained amount of hydrogen present in the combustible gas.

**[0036]** In case a boiler is capable of combusting both natural gas and combustible gas comprising more than 20 mol % hydrogen the control board is made such that it switches ignition safety times (in the safety core of the control board) based on gas type selection or gas type detection.

**[0037]** According to an embodiment the predetermined pre-ignition time interval and/or the safety time depends on the composition of the combustible gas.

**[0038]** For instance, if the combustible gas comprises more than 20 mol% hydrogen, the predetermined safety time is less than 3,0 seconds, less than 2,5 seconds, less than 2,0 seconds, less than 1,5 seconds, less than 1,0 second or less than 0,5 second.

**[0039]** When the combustible gas comprises a certain amount of hydrogen, in particular gas that comprise more than 20 mol% hydrogen, the predetermined safety time can be effectively reduced by using pre-set hydrogen specific safety times, preferably less than 3,0 seconds.

**[0040]** When the predetermined safety time is reduced, the opening time of the gas supply valve is reduced therefore the volume containing (potentially explosive) $H_2$ mixture is reduced as well. Therefore, the impact in case delayed ignition takes place is reduced as less hydrogen or hydrogen comprising gas has built up in the burning chamber.

**[0041]** It has been found that the chance of delayed ignition, as well as the consequences of a delayed ignition, can be reduced for burning appliances by choosing a predetermined safety time that depends on the composition of the combustible gas.

**[0042]** By making the predetermined safety time depended on the composition of the combustible gas, a gas burning appliance is provided that can deal with different gas compositions.

**[0043]** Having a higher hydrogen content results in higher flammable range, higher flame speed and requires lower ignition energies. Therefore, the higher the hydrogen content, the more the predetermined safety time can be effectively reduced. Also, higher hydrogen contents could result in a higher impact of delayed ignition, making it even more advantageous to make the predetermined safety time depended on the composition of the combustible gas.

**[0044]** According to an embodiment the method further comprises switching to an alarm state if a flame is detected during the predetermined pre-ignition time interval. The alarm state may involve closing or not opening the gas supply, switching to a blocking or locking state, generate an alarm (sound, message) and/or aborting the ignition.

**[0045]** According to an embodiment the combustible gas supplied to the burning chamber during the predetermined safety time has a first lambda-value, wherein the method further comprises when a flame has been detected by the flame detector before the end of the predetermined safety time, the gas supply is kept open and the gas burning appliance continues to operate in a continuous operation mode, wherein the continuous operation mode comprises supplying combustible gas to the burning chamber having a second lambda-value, the first lambda-value being larger than the second lambda-value.

**[0046]** The lambda-value is defined as a ratio between a quantity of air and a quantity of fuel in the combustible gas. The first lambda-value may be at least 1.85. According to an embodiment, the first lambda-value may be larger than 2, in particular between 2-6, preferably larger than 3, in particular between 3-5, more preferably larger than 4, in particular between 4-5. According to an embodiment the second lambda-value is between 1-2, preferably between 1.05-1.5, more preferably between 1.05-1.3. According to an embodiment, the first lambda-value is at least 1.5 times as large as the second lambda-value, preferably at least 2 times as large, in particular at least

3 times as large.

**[0047]** The load in the starting up phase can be lower than the load in an operation phase of gas burning appliance. In the operation phase a flame is present. This embodiment even further reduces the risk as starting with a lower load means introducing less fuel into the burning chamber.

**[0048]** According to a further aspect there is provided a gas burning appliance comprising a burning chamber, a gas supply for supplying combustible gas to the burning chamber, a flame detector for detecting the presence of a flame in the burning chamber and an ignitor for igniting the combustible gas in the burning chamber, wherein the gas burning appliance comprises a controller configured to carry out the method according to the above. Further provided is the use of such a gas burning appliance in a boiler or water heater.

**[0049]** Additionally, an advantageous embodiment is a computer program product comprising instructions which cause the gas burning appliance according to the above to execute the steps of the method according to the above.

**[0050]** Furthermore, a data carrier is provided on which the computer program is stored and/or data carrier signal is provided which transmits the computer program.

**[0051]** In the figures, the subject-matter of the invention is schematically shown, wherein identical or similarly acting elements are usually provided with the same reference signs.

Figure 1 shows a gas burning appliance according to an embodiment,

Figure 2 shows an ignition sequence according to an embodiment,

Figure 3 shows an ignition sequence according to an alternative embodiment.

**[0052]** Fig. 1 schematically shows a gas burning appliance 1. The gas burning appliance comprises a burning chamber 2 with a burner 8. A gas supply 3 is provided to supply combustible gas to the burner 8. In the gas supply 3 a gas supply control valve 4 is provided. The gas flows in a pipe of the gas supply 3. Additionally, the gas supply 3 can comprise a non-shown mixer for mixing the fuel gas, in particular hydrogen, with air.

**[0053]** A flame detector 5 is provided for detecting the presence of a flame in the burning chamber 2. The flame detector 5 can be any suitable flame detector, such as an optical flame detector, a temperature sensor, a thermocouple, a catalytic sensor or an O2/lambda sensor.

**[0054]** Also, an ignitor 6 is provided for igniting the combustible gas in the burning chamber to create a flame. The ignitor 6 may be a spark electrode, arranged to generate sparks to ignite the combustible gas.

**[0055]** It will be understood that the gas burning appliance may comprise additional elements which are omitted in Fig. 1. For instance, the gas burning appliance may further comprise a heat exchanger to allow water to be heated by the heat generated in the burning chamber 2.

**[0056]** Furthermore, a controller 10 is provided. The controller 10 may be a dedicated piece of hardware or a computer which can be programmed.

**[0057]** The controller 10 may control the igniter 6 to be active during a predetermined ignition time. The controller 10 may also be arranged to switch the igniter 6 on and off when needed. The controller may be arranged to receive input from the flame detector 5 indicating the presence or absence of a flame.

**[0058]** The controller 10 may control the gas supply 3 to supply combustible gas to the burning chamber 2. The controller 10 may be arranged to control the flow rate of the combustible gas flowing into the burning chamber 2. The flow rate may be expressed as $m^3/s$ or kg/s.

**[0059]** The controller 10 is arranged to perform an ignition sequence comprising:

- activating the igniter 6 for a predetermined ignition time,
- opening the gas supply 3 for a predetermined safety time to supply combustible gas to the burning chamber 2,
- detecting the presence of a flame by means of the flame detector 5,
- closing the combustible gas supply 3 if no flame has been detected at the end of the predetermined safety time.

**[0060]** Opening and closing of the combustible gas supply 3 may be done by controlling the combustible gas supply valve 4.

**[0061]** The combustible gas comprises more than 20 mol% of hydrogen. The activation of the igniter commences at a predetermined pre-ignition time interval before opening the gas supply.

**[0062]** With reference to the left-hand side of Fig. 2, an ignition sequence is depicted. First, the igniter 6 is activated. After the predetermined pre-ignition time, indicated by the double arrow P, the gas supply 3 is opened. This is schematically depicted in the two top rows in Fig. 2. The gas supply 3 is opened for a predetermined safety time indicated by the double arrow S in Fig. 2. In this embodiment, the ignitor 6 is activated during a predetermined ignition time equal, such that activation of the ignitor ends before the end of the safety time. The predetermined ignition time consist of the predetermined pre-ignition time and a remaining part of the predetermined ignition time in which the gas valve is open.

**[0063]** During the safety time, the flame detector 5 detects the presence or absence of a flame. The third line in Fig. 2 shows the actual presence of a flame in the burning chamber 2, while the fourth line shows the detection of a flame by the flame detector 5.

**[0064]** As shown in Fig. 2, if no flame has been detected at the end of the predetermined safety time, the gas

supply 3 is closed. In that case, at the end of the predetermined safety time, the ignitor 6 may be de-activated. Optionally, the gas chamber may be purged to remove combustible gas from the gas chamber 2, before a new ignition sequence is initiated.

**[0065]** Purging means the forced introduction of air through the combustion chamber and flue passages in order to displace any remaining fuel/air mixture and/or products of combustion.

**[0066]** Purging may take place in between each ignition sequence. This is referred to as an inter-purge. Inter-purge is done between ignition sequences or attempts.

**[0067]** Purging may also be done before the first ignition sequence, for instance in case of flame loss during operation. This is referred to as a pre-purge. Pre-purge is a purge which takes place between a start signal and energization or activation of the igniter.

**[0068]** Ignition sequences may be initiated repeatedly, until the presence of a flame is detected by the flame detector 5 before the end of the predetermined safety time. The right-hand side of Fig. 2 shows a second ignition sequence. As shown, in this case a flame is present and detected and the gas supply 3 remains open. Still, the ignitor 6 is deactivated at the end of the predetermined ignition time.

**[0069]** The controller 10 may set the predetermined safety time and/or the predetermined pre-ignition time based on information obtained regarding the composition of the combustible gas, in particular the amount of hydrogen present in the combustible gas. This indication may be obtained in different ways. According to the embodiment depicted in Fig. 1 the indication is obtained by means of a gas composition detector 7. Any suitable gas composition detector 7 may be used, such as for instance a thermal conductivity sensor configured to measure the thermal conductivity of the combustible gas or a sensor measuring the speed of sound in the combustible gas. Based on the obtained measurements, the composition of the combustible gas can be deduced. The gas composition detector 7 is arranged to obtain an indication of the composition of the gas or at least the amount of hydrogen present in the gas flowing through the gas supply 3 and provide such to the controller 10. The controller 10 is arranged to set the safety time and/or the predetermined pre-ignition time based on the received information. Generally, a higher hydrogen content results in a shorter safety time interval and/or a longer pre-ignition time.

**[0070]** In the embodiment described with reference to Fig. 2, the ignition time ends before the safety time. This may be required in case the flame detector 5 cannot function reliably during the ignition time. Fig. 3 shows an alternative ignition sequence in which the ignition time ends at the same time as the safety time. In this embodiment the flame detector 5 can function when the ignitor 6 is active.

**[0071]** Similar to Fig. 2, the left-hand side of Fig. 3 shows a failed ignition sequence, the right-hand side shows a successful ignition sequence.

**[0072]** For the case that a flame is detected before the ignition time starts, the controller 10 determines that an alarm state is present, in particular due to hydrogen leakage. The controller 10 acts on the combustible gas supply valve 4 to close so that no hydrogen is supplied to the burner 8.

**Reference Signs**

**[0073]**

1. Gas burning appliance
2. Burning chamber
3. Gas supply
4. Gas supply control valve
5. Flame detector
6. Ignitor
7. Gas composition detector
8. Burning deck
10. Controller

**Claims**

**1.** Method for starting up a gas burning appliance (1), the gas burning appliance (1) comprising a burning chamber (2), a gas supply (3) for supplying combustible gas to the burning chamber (2), a flame detector (5) for detecting the presence of a flame in the burning chamber (2) and an ignitor (6) for igniting the combustible gas in the burning chamber (2), wherein the method comprises an ignition sequence comprising:

- activating the igniter (6) for a predetermined ignition time,
- opening the gas supply (3) for a predetermined safety time to supply combustible gas to the burning chamber (2),
- detecting the presence of a flame by means of the flame detector (5),
- closing the gas supply (3) if no flame has been detected at the end of the predetermined safety time,

wherein the combustible gas comprises more than 20 mol% of hydrogen and

wherein activation of the igniter (6) commences at a predetermined pre-ignition time interval before opening the gas supply (3).

**2.** Method according to claim 1, wherein the predetermined pre-ignition time interval is at least

- 1,0 second
- 1,5 seconds, or
- 2,0 seconds, or
- 2,5 seconds, or

- 3,0 seconds.

3. Method according to any one of the preceding claims, wherein the predetermined pre-ignition time interval is shorter than a remaining part of the predetermined ignition time.

4. Method according to any one of the preceding claims, wherein the pre-ignition time interval plus the remaining part of the predetermined ignition time is greater than or equal to the safety time.

5. Method according to any of the claims 1-3, wherein the predetermined safety time is less than 3,0 seconds.

6. Method according to any one of the preceding claims, wherein the combustible gas comprises more than 40 mol% of hydrogen or more than 80 mol% of hydrogen or more than 90 mol% of hydrogen or more than 98 mol% of hydrogen.

7. Method according to any one of the preceding claims, wherein the ignition sequence comprises:

- obtaining an indication of the amount of hydrogen present in the combustible gas,
- setting the pre-ignition time interval and/or the safety time based on the obtained amount of hydrogen present in the combustible gas.

8. Method according to any one of the preceding claims, wherein the pre-ignition time interval and/or the safety time depends on the composition of the combustible gas.

9. Method according to any one of the preceding claims, wherein the method further comprises switching to an alarm state if a flame is detected during the predetermined pre-ignition time interval.

10. Method according to any one of the preceding claims, wherein the combustible gas supplied to the burning chamber (2) during the predetermined safety time has a first lambda-value, wherein the method further comprises when a flame has been detected by the flame detector (5) before the end of the predetermined safety time, the gas supply (3) is kept open and the gas burning appliance (1) continues to operate in a continuous operation mode, wherein the continuous operation mode comprises supplying combustible gas to the burning chamber (2) having a second lambda-value, the first lambda-value being larger than the second lambda-value.

11. Gas burning appliance (1) comprising a burning chamber (2), a gas supply (3) for supplying combustible gas to the burning chamber (2), a flame detector (5) for detecting the presence of a flame in the burning chamber (2) and an ignitor (6) for igniting the combustible gas in the burning chamber (2), wherein the gas burning appliance comprises a controller (10) configured to carry out the method of one of the claims 1 - 10.

12. Use of a gas burning appliance (1) according to claim 11 in a boiler or a water heater.

13. Computer program product comprising instructions which cause the gas burning appliance (1) of claim 10 to execute the steps of the method of any one of the claims 1 - 10.

14. Data carrier on which the computer program of claim 13 is stored or data carrier signal transmitting the computer program according to claim 13.

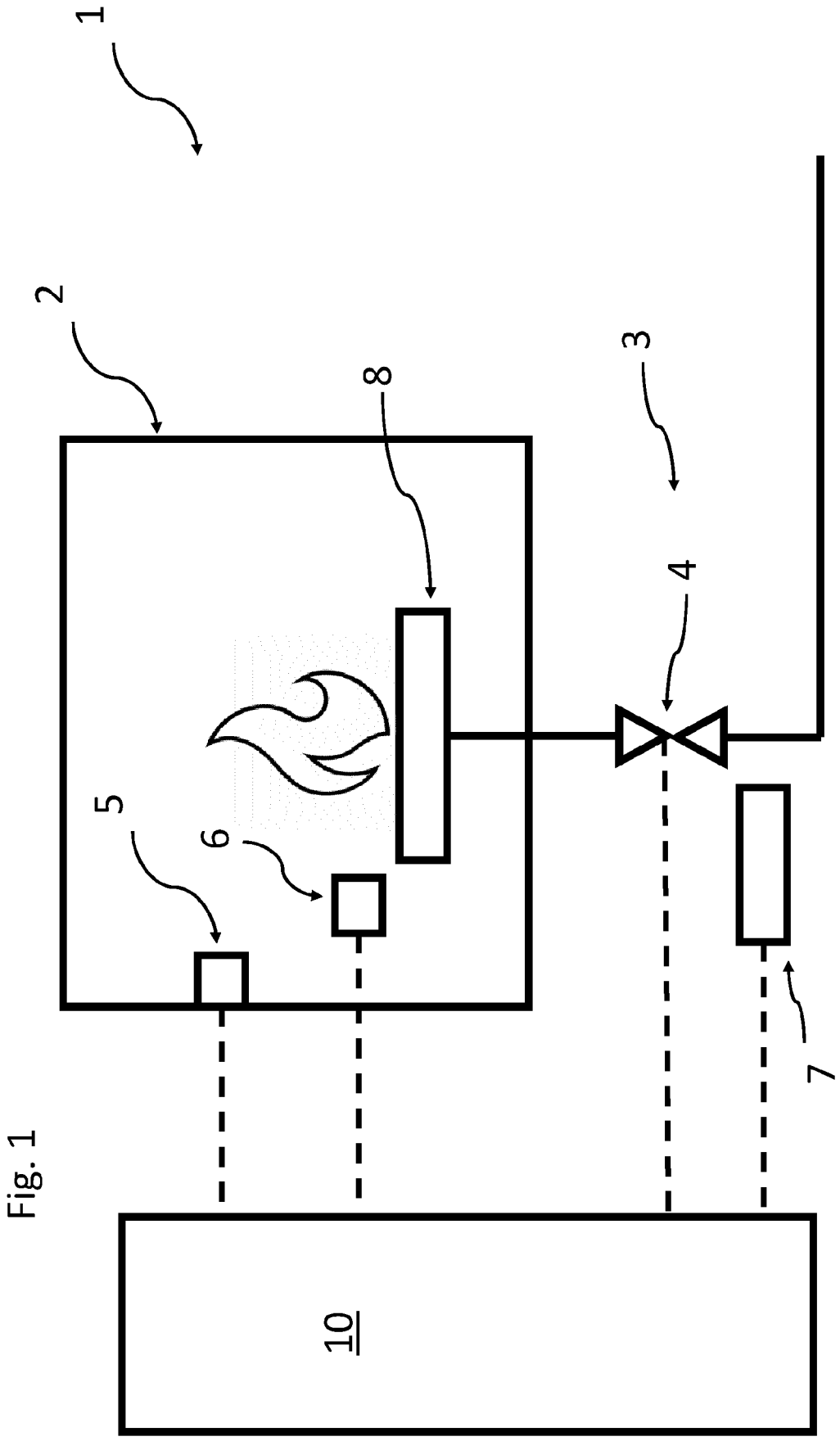



Fig. 1

Fig. 2

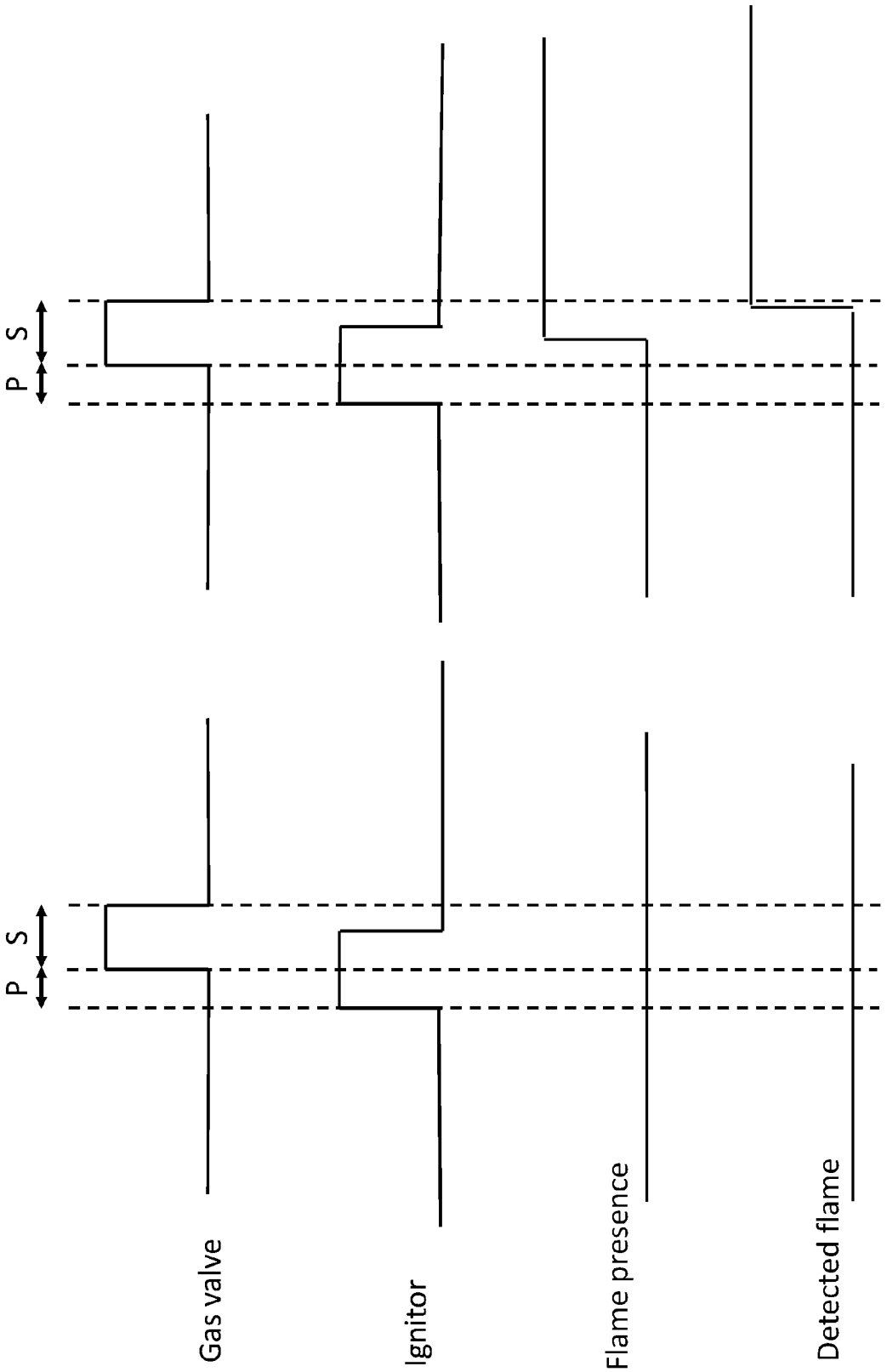
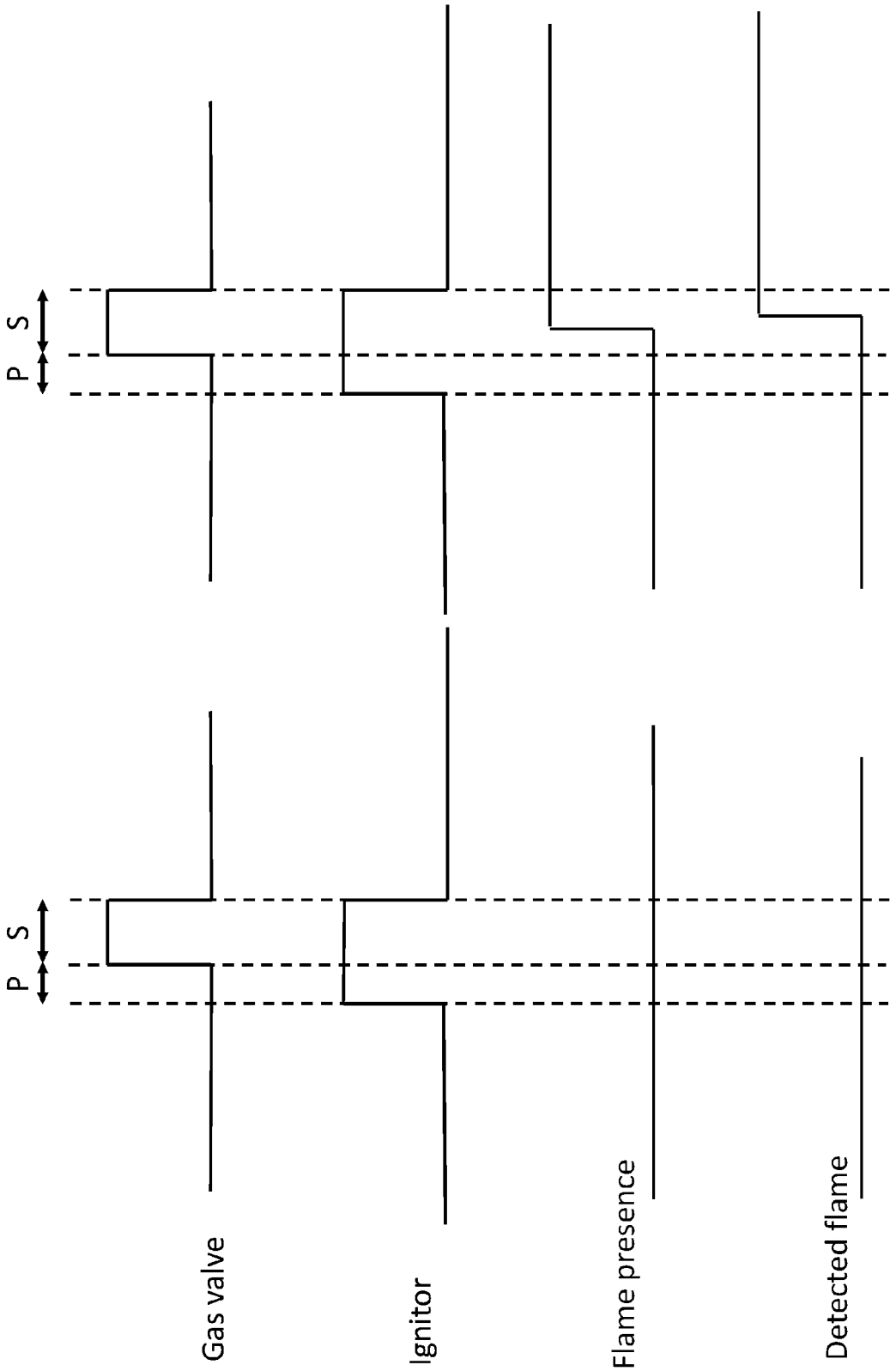


Fig. 3



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# EUROPEAN SEARCH REPORT

Application Number
EP 22 21 5283

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
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