US012385645B2

(12) **United States Patent**
Baker et al.

(10) **Patent No.:** **US 12,385,645 B2**
(45) **Date of Patent:** ***Aug. 12, 2025**

(54) **GAS CONTROL SYSTEM**

(71) Applicant: **MARLIN GAS SERVICES, LLC**, Spring Hill, FL (US)

(72) Inventors: **Kenneth Lynn Baker**, Tarpon Springs, FL (US); **Paul Sydney Richards**, Lady Lake, FL (US)

(73) Assignee: **Marlin Gas Services, LLC**, Spring Hill, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **18/760,247**

(22) Filed: **Jul. 1, 2024**

(65) **Prior Publication Data**

US 2024/0353106 A1 Oct. 24, 2024

Related U.S. Application Data

(63) Continuation of application No. 18/128,970, filed on Mar. 30, 2023, now Pat. No. 12,025,319, which is a continuation of application No. 16/914,394, filed on Jun. 28, 2020, now Pat. No. 11,629,859.

(51) **Int. Cl.**
F24C 3/12	(2006.01)
F17C 13/04	(2006.01)
F23N 1/00	(2006.01)
F23N 5/24	(2006.01)
F24C 3/00	(2006.01)
F24C 3/14	(2021.01)
G05B 15/02	(2006.01)
G05D 7/06	(2006.01)

(52) **U.S. Cl.**
CPC *F24C 3/122* (2013.01); *F17C 13/04* (2013.01); *F23N 1/005* (2013.01); *F23N 5/245* (2013.01); *F24C 3/002* (2013.01); *F24C 3/124* (2013.01); *F24C 3/14* (2013.01); *G05B 15/02* (2013.01); *G05D 7/0635* (2013.01); *F17C 2205/0326* (2013.01); *F17C 2205/0332* (2013.01); *F17C 2223/035* (2013.01); *F23K 2400/201* (2020.05)

(58) **Field of Classification Search**
CPC F17C 13/025; F17C 5/06; F17C 13/04; F17C 2221/033; F17C 2223/0123; F17C 2250/043; F17C 2225/0123; F17C 2205/0326; F17C 2205/0332; F17C 2223/035; F24C 3/122; F24C 3/002; F24C 3/124; F24C 3/14; F23N 1/005; F23N 5/245; G05B 15/02; G05D 7/0635; F23K 2400/201
USPC 432/35; 141/4
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

11,629,859 B2 *	4/2023	Baker	F17C 7/00 432/35
12,025,319 B2 *	7/2024	Baker	F17C 13/04
2003/0192609 A1 *	10/2003	Enerson	F17C 5/06 137/899
2017/0268792 A1 *	9/2017	Costakis	F24F 11/85

* cited by examiner

Primary Examiner — Craig M Schneider
Assistant Examiner — Christopher M Afful

(57) **ABSTRACT**

An apparatus includes a high-pressure tank, a controller, a valve, controlled by the controller, and a heater.

16 Claims, 6 Drawing Sheets

100

102
102A
102B1, 102B2
102C1, 102C2
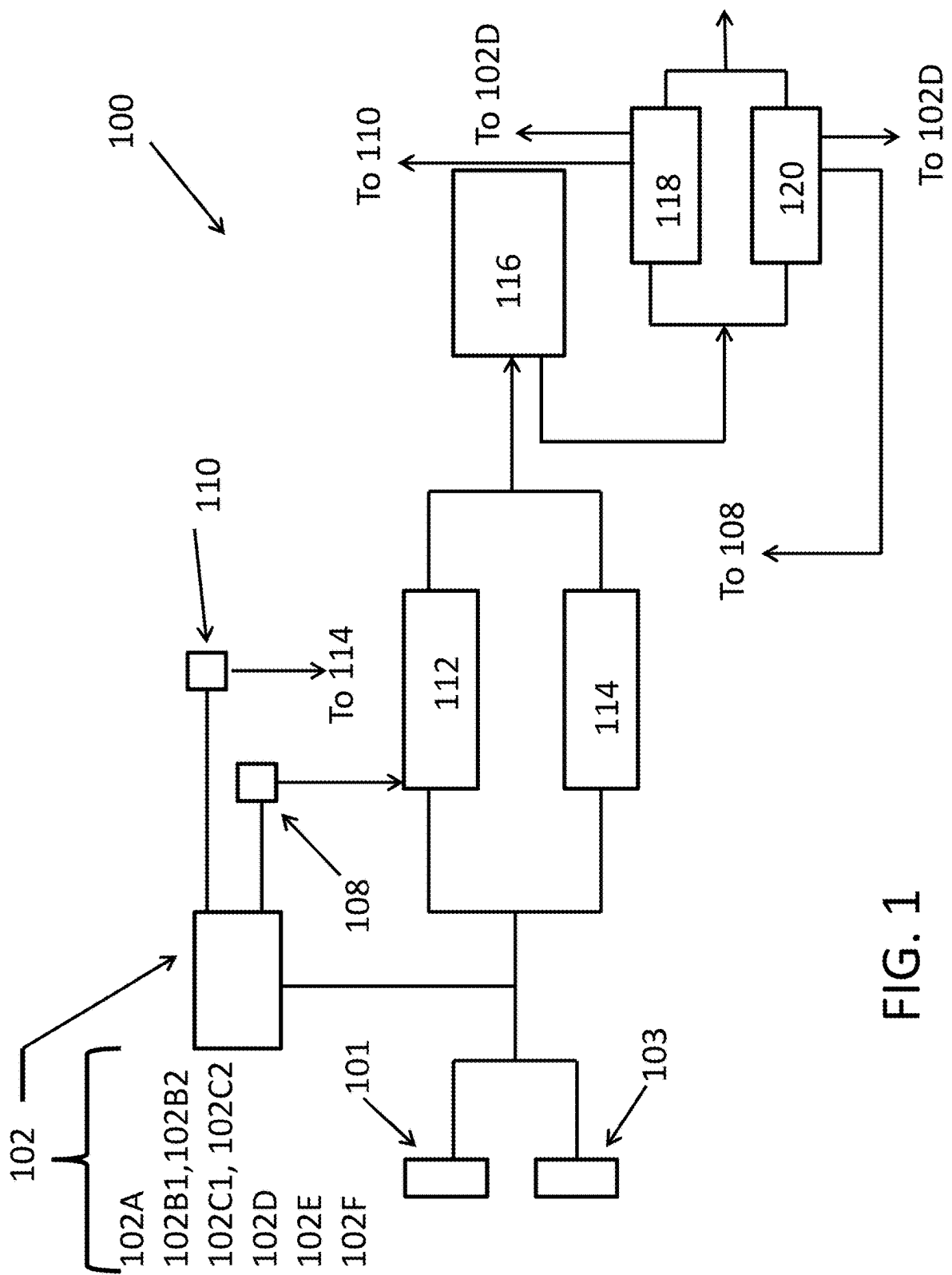102D
102E
102F

110

To 114

108

112

114

101

103

116

118

120

To 110

To 102D

To 102D

To 110

To 108

FIG. 1

FIG. 2A

FIG. 2B

300

302 Receive Natural Gas for Control

304 Maintain Control Valve as Fully Open

306 Receive Pressure Information

308 Receive Additional Natural Gas for Control

310 Change Control Valve?

NO

YES

312 Reduce Gas Flow through Control Valve

FIG. 3

400

406

408

402

404

410

FIG. 4

500

MEMORY 530

INPUT COMPONENT 540

OUTPUT COMPONENT 550

BUS 510

PROCESSOR 520

COMMUNICATION INTERFACE 560
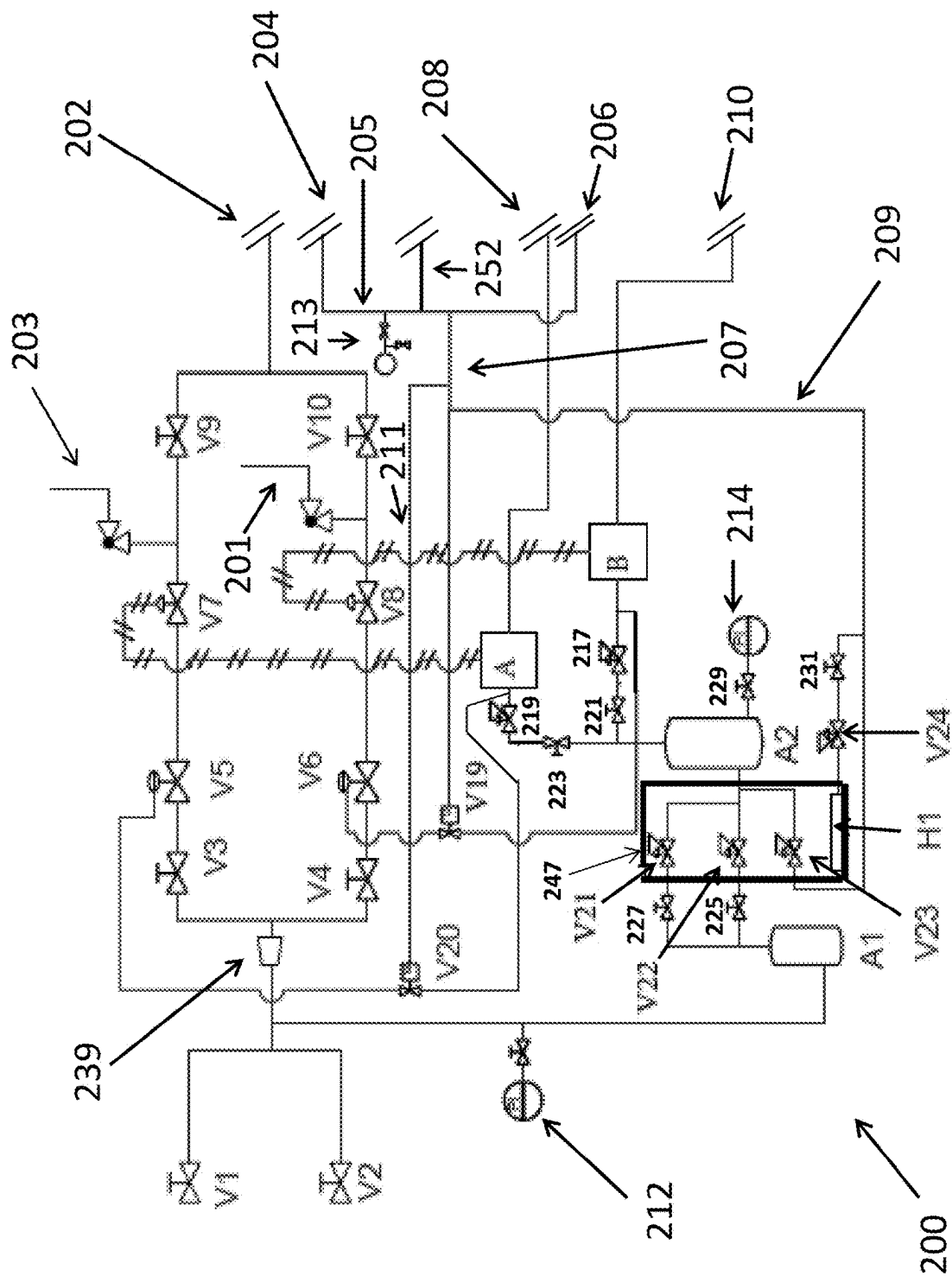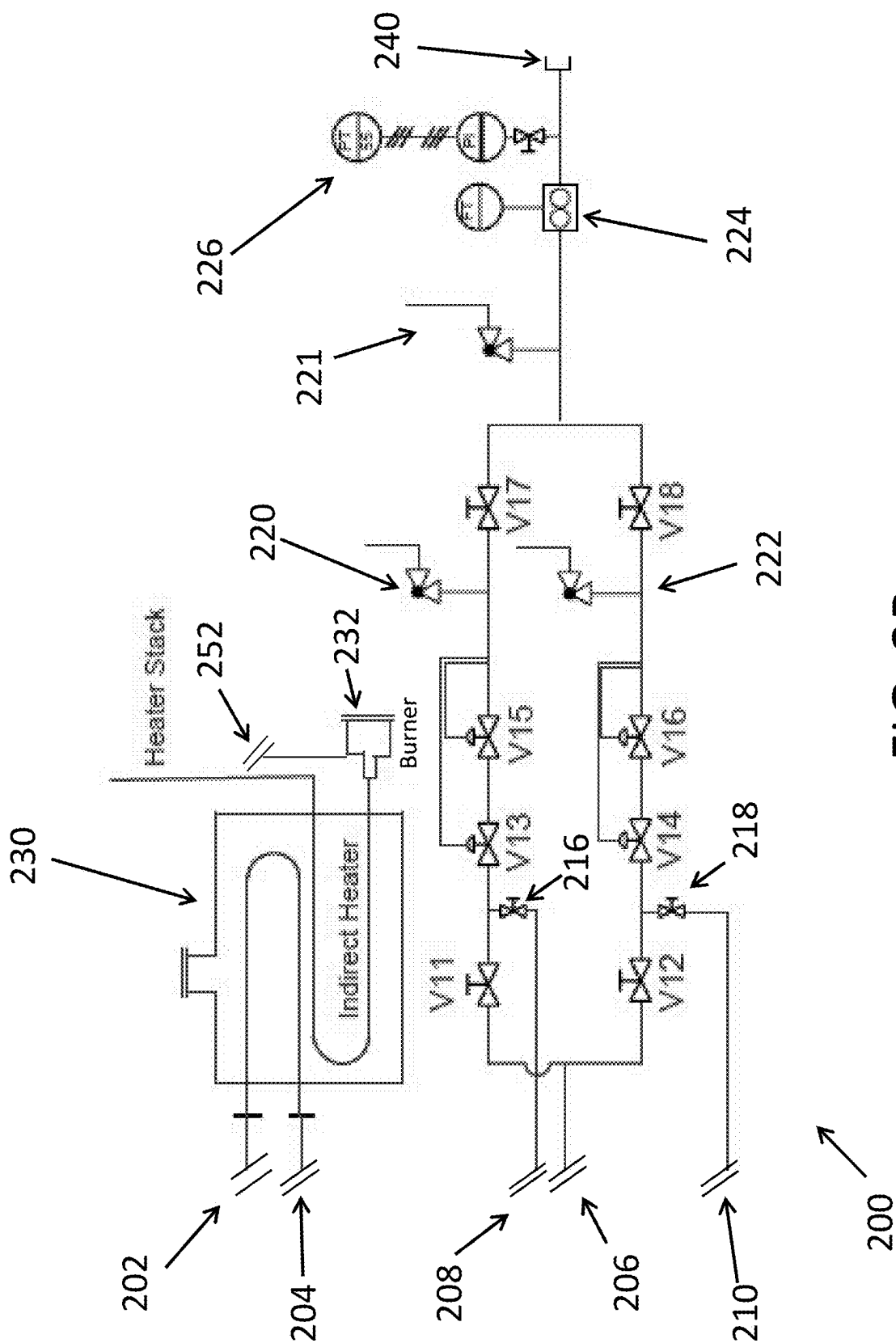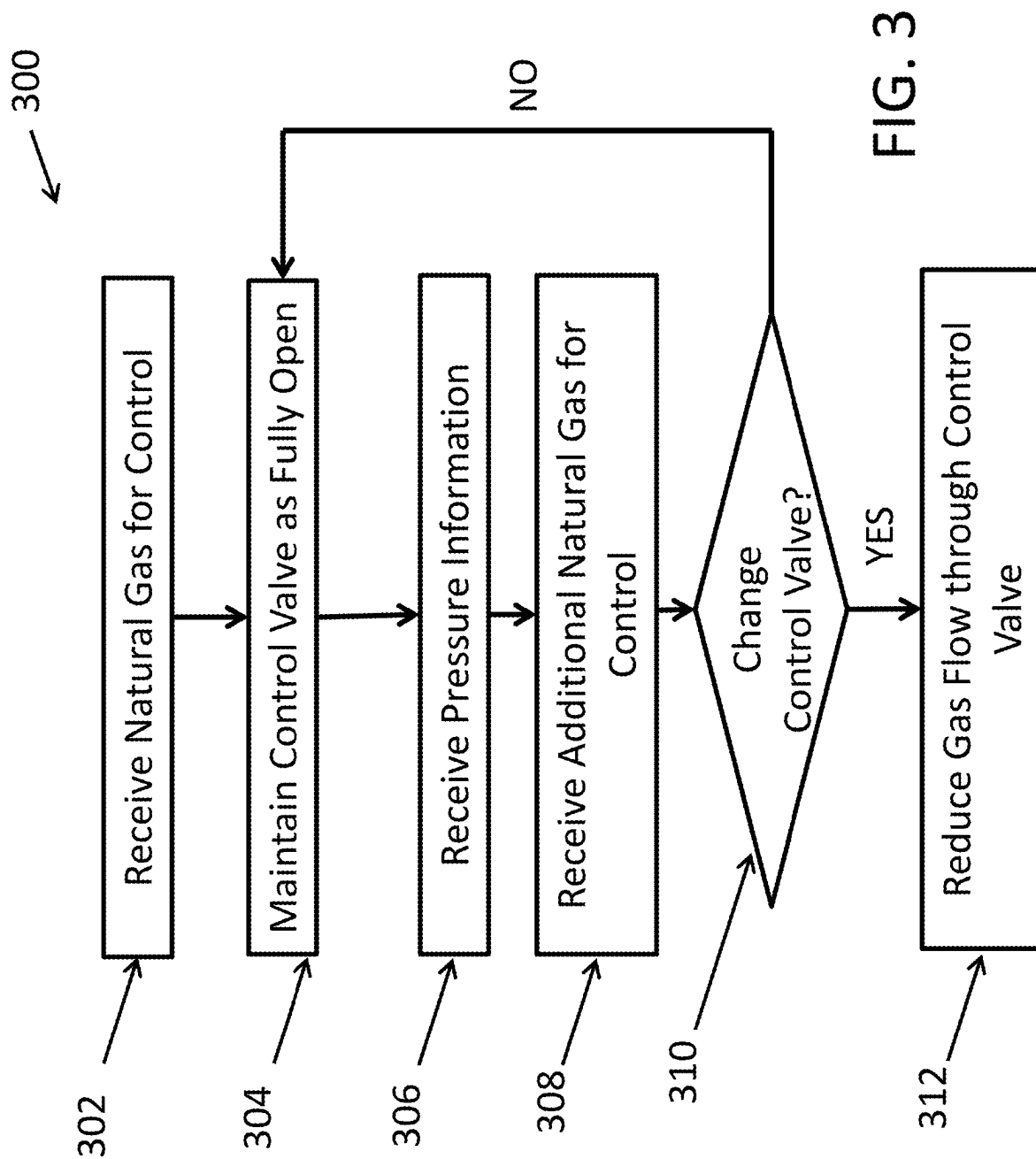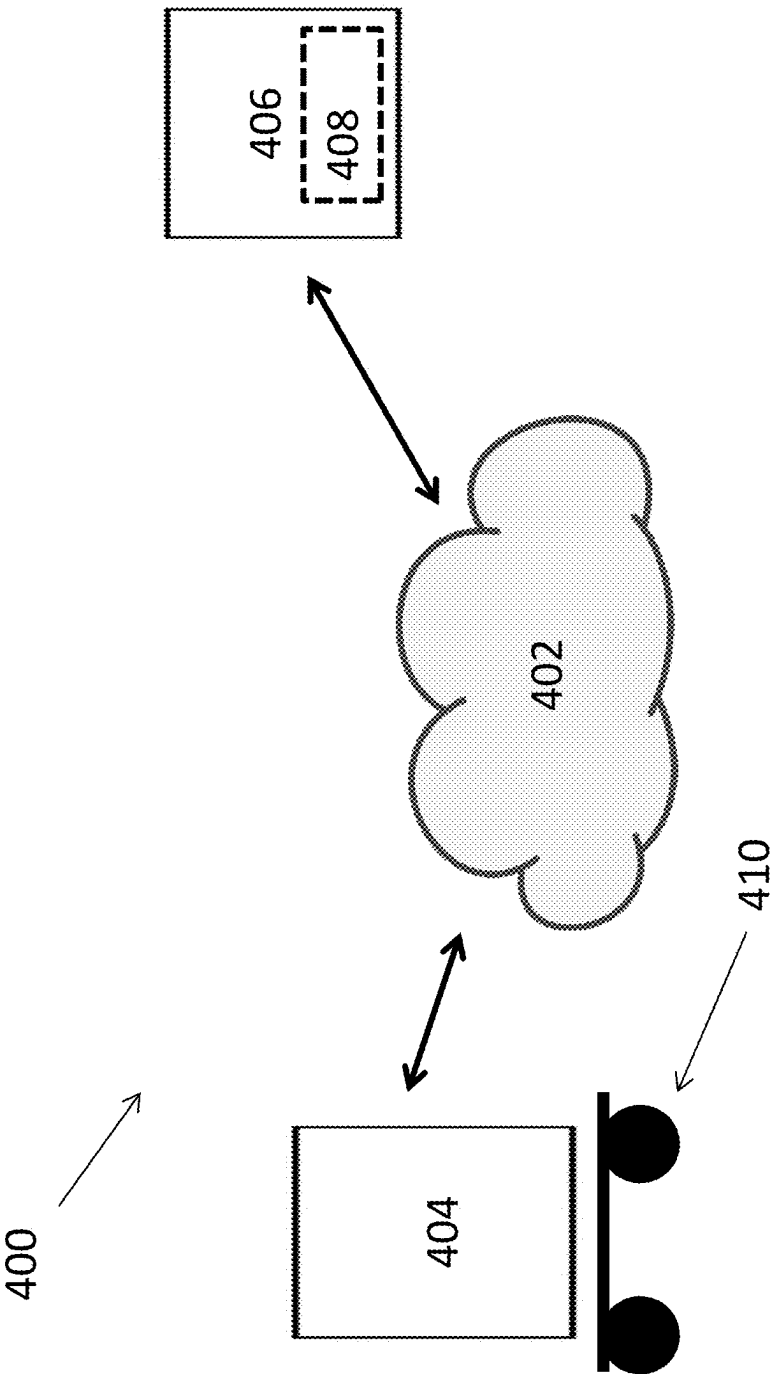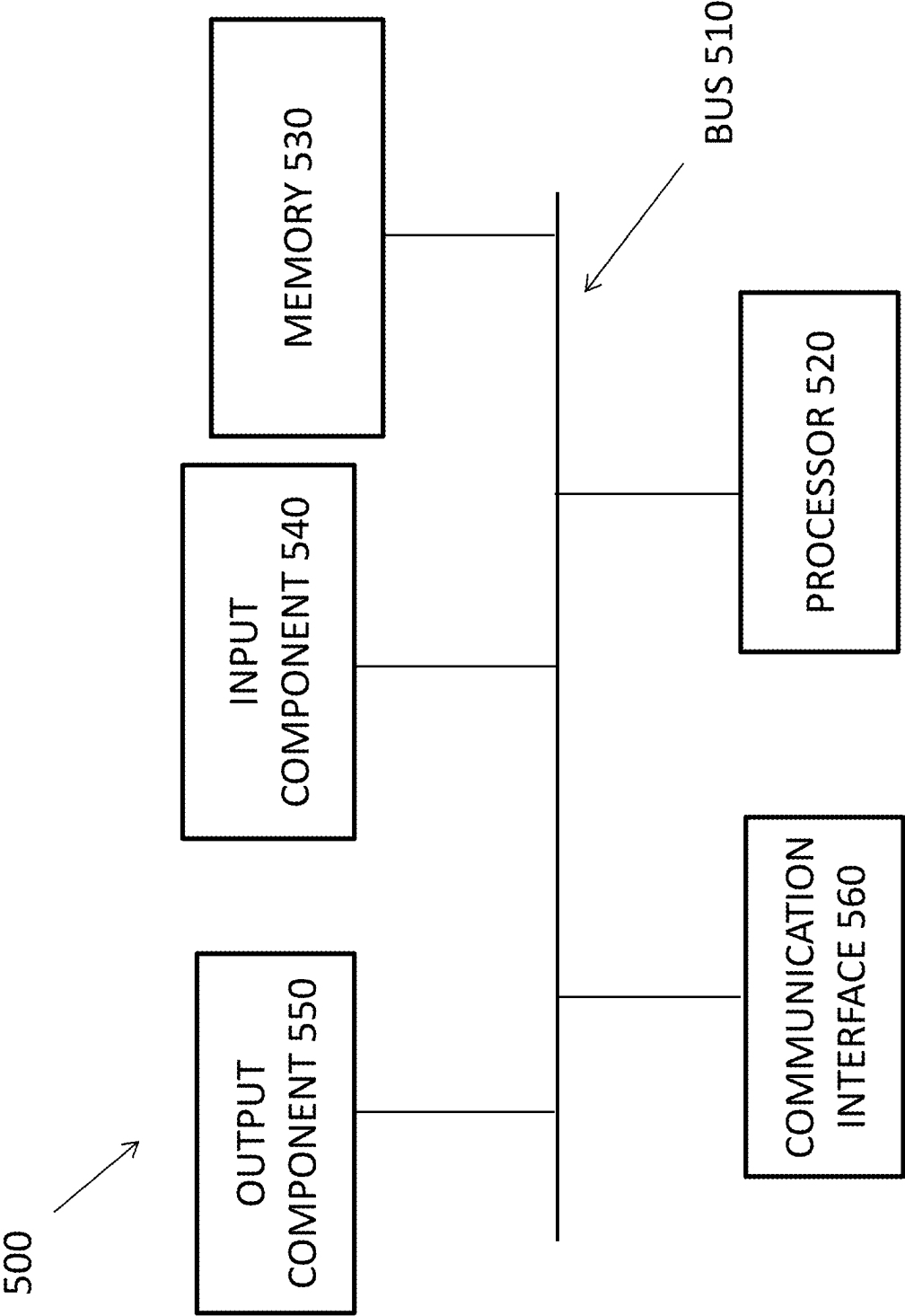
FIG. 5

GAS CONTROL SYSTEM

BACKGROUND

Natural gas end-users occasionally use high-pressure tankers to provide natural gas into their system. This will happen when there is a shortage of natural gas within the system to meet the demand or the end-user does not have a connection to an existing pipeline. Commercially, high-pressure natural gas tankers operate at pressures over 4,000 PSIG when initially filled and become depleted with lower pressure (e.g., less than 100 PSIG) when natural gas is supplied to the end-user. The actual supply pressure depends on the end user's requirements. Existing systems do not provide an efficient and safe control system with 100% redundancy while also ensuring lower costs.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagram of an example environment in which systems and/or methods described herein may be implemented;

FIGS. 2A and 2B are schematic diagrams of a process;

FIG. 3 is an example flowchart;

FIG. 4 is an example diagram; and

FIG. 5 is a diagram of an example computing device.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements. Systems, devices, and/or methods described herein may allow for a gas supply system that provides control mechanisms as well as 100% redundancy to one or more sub-systems within the gas supply system. In embodiments, the gas supply system uses one or more high-pressure tanks that discharge gas through a gas supply system that includes one or more groups of valves, control valves, safety valves, and/or monitor valves that have 100% redundancy with other groups of valves, control valves, safety valves, and/or monitor valves. In embodiments, the gas supply system discharges natural gas to an end-user system (e.g., a hospital, natural gas utility, a customer without a direct connection to the pipeline, etc.). In embodiments, the pressure in the one or more tanks may be rated at a maximum pounds per square inch gauge (PSIG) based on the construction and type of tank that is being used and the tank's certification capability for receiving and transporting a type of gas within the tanks (e.g., natural gas or another gas, such as nitrogen, hydrogen, biogas, etc.). In embodiments, the natural gas is being delivered at a particular pressure and/or flow rate through the piping system pressure for delivery of gas to an end-user (e.g., a natural gas utility, a commercial user of natural gas, etc.).

In embodiments, one or more pressure gauges may electronically (e.g., via wireless, satellite, Internet, Intranet systems) send electronic information about the gas pressure to one more computing devices that monitor the natural gas being distributed within the one or more piping sections. In embodiments, the one or more computing devices may determine, based on the electronic information about pressure, that a changeover is to occur between one or more redundant groups of valves, control valves, safety valves, and/or monitor valves. In embodiments, the one or more types of valves may be manually (e.g., mechanically) controlled and the changeover between different groups of valves, control valves, safety valves, and/or monitor valves is to occur manually. Additionally and/or alternatively, the one or more types of valves may be controlled electronically by one or more computing devices. In embodiments, the one or more computing devices may electronically communicate with one or more valves, control valves, and/or other types of valves to either open or close depending on which groups of valves are required. Furthermore, a computing device may determine which of one or more tanks (individually or in combination) should provide natural gas into the gas supply system.

Accordingly, a system may allow for (1) distribution of gas from one or more high-pressure tanks into a gas supply system that includes one or more piping sections and one or more valves, control valves, non-reversible valves, pressure gauges, temperature gauges, and/or flow rate gages; (2) controlling gas supply within the gas supply system; (3) determining which group of valves should provide distribution and control of gas; (4) lower costs; and (5) 100% redundancy between one set of valves and controller and another set of valves and another controller.

FIG. 1 is a schematic diagram of an example system 100 in which systems, devices, and/or methods described herein may be implemented. As shown in FIG. 1, system 100 includes tank 101, tank 103, system 102, controller 108, controller 110, system 112, system 114, heater 116, system 118, and system 120. In embodiments, tanks 101 and 103 may be high-pressure tanks that contain natural gas. In embodiments, tanks 101 and 103 may each hold natural gas at a pressure rating of 5,000 PSIG. In this example, systems 112, 114, 118, and 120 are sub-systems of system 100 with each sub-system including different types of valves (e.g., control valves, fail-close valves, etc.), pressure gauges, and/or flow rate gauges. In this example, one or more sub-systems of system 100 may communicate electronic information (via pressure gauges, flow rate gauges, etc.) about pressure and/or flowrate information to a computing device (e.g., device 406).

In a non-limiting example, tank 101 is providing natural-gas into system 100, which does not contain any natural gas. In this non-limiting example, tank 101 sends natural gas to both system 102 and system 112. System 112 may include a control valve that prevents natural gas from being sent beyond system 112 until a control indicator (e.g., control gas which provides control pressure information) is received from system 102. In embodiments, system 102 may consist of accumulators and valves that provide a conditioned gas stream (e.g., gas flowing at a particular pressure) which then provides motive power (e.g., actuate, control, etc.) for valves that are located in other systems. In embodiment, natural gas is delivered to high-pressure (HP) accumulator 102A, from tank 101. HP accumulator 102A pressure may vary depending upon the pressure within tank 101. Upon exiting HP accumulator 102A, the gas passes through valves 102B1 and 102B2, reducing the pressure of the natural-gas down to 200 pounds per square inch (PSIG). At the reduced pressure, the gas enters medium-pressure (MP) accumulator 102E which provides secondary storage at a stable pressure. As the gas leaves the MP accumulator 102E, it is further reduced in pressure by a valve located between system 102 and controller 108. This further reduced operating pressure provides the motive power for the valves in the other systems and is also used as reference pressure information for controller 108 to control a control valve. At this point, the control valve in system 112 is open and allows natural gas to flow through system 112

In this non-limiting example, based on the communications from controller **108**, a control valve in system **112** can be closed (or opened) to manage the downstream pressure within required limits. Accordingly, the control valve in system **112** can be used to reduce the natural gas pressure being delivered from tank **101**. If the natural gas pressure is reduced, there may be a drop in temperature of the natural gas. Thus, heater **116** increases the natural gas temperature within the delivery range required by the end-user. After passing through the heater **116**, the natural gas is sent to system **120**.

Additionally, before the natural gas is sent to system **120**, a small proportion of the natural gas is diverted to valve **102D**. In this non-limiting example, valve **102D** reduces the natural gas pressure and replaces the natural gas that enters system **102** from HP accumulator **102A**, valve **102B1**, and valve **102B2**. Thus, valve **102D** now sends the natural gas required to operate controller **108** (which controls a control valve in system **112**) by providing a reference pressure for controller **108** to operate, and also provide gas for the operation of a fail-close valve. Based on the temperature within system **102**, heater **102F** (which may be a catalytic heater) may operate using natural-gas diverted from a piping section after heater **116**.

In addition, natural gas is also sent from a piping section between heater **116** and system **120** to provide pressure information to controller **108**. Based on controller **108** comparing this downstream pressure information with the reference pressure information, controller **108** may make adjustments to the control valve in system **112** to control the amount of gas flow (based on an operator-adjusted set point). If a large surge of natural gas enters the system and the pressure rises rapidly, due to the control valve in system **112** being too slow to respond, then the pressure information will also be sent to another valve within system **102**. If the pressure is not within bounds of the operator-adjusted set point, this other valve within system **102** will stop the flow of gas to the fail-close valve and prevent any additional natural gas from entering the system.

In another non-limiting example, tank **103** is providing natural gas into system **100**, which does not contain any natural gas. In this non-limiting example, tank **103** sends natural gas to both system **102** and system **114**. System **114** may include a control valve that prevents natural-gas from being sent beyond system **114** until control gas is received from system **102**. In embodiments, system **102** may consist of accumulators and valves that provide a conditioned gas stream which then provides motive power for valves that are located in other systems. In embodiment, natural gas is delivered to high-pressure (HP) accumulator **102A**, from tank **103**. HP accumulator **102A** pressure may vary depending upon the pressure within tank **101**. Upon exiting HP accumulator **102A**, the gas pass through valves **102C1** and **102C2**, reducing the pressure of the natural-gas down to 200 pounds per square inch (PSIG). At the reduced pressure, the gas enters MP accumulator **102E** and provides secondary storage at a stable pressure. As the gas leaves MP accumulator **102E**, it is further reduced in pressure by a valve (not shown) located between system **102** and controller **110**. This further reduced operating pressure provides the motive power for the valves in the other systems and is also used as reference pressure information for controller **110** to control a control valve. At this point, the control valve in system **114** is open and allows natural gas to flow through system **114**.

In this non-limiting example, based on the communications from the controller **110**, a control valve in system **114** will close to manage the downstream pressure within the

required limits. Accordingly, a control valve in system **114** can be used to reduce the natural gas pressure being delivered from tank **103**. If the natural gas pressure is reduced, there may be a drop in temperature of the natural gas. Accordingly, heater **116** increases the natural gas temperature within the delivery range required by the end-user. After passing through the heater **116**, the natural gas is sent to system **118**.

Additionally, before the natural gas is sent to system **118**, a small proportion of the gas is diverted to valve **102D**. In this non-limiting example, valve **102D** reduces the natural gas pressure and replaces the natural gas that enters system **102** from HP accumulator **102A**, valve **102C1**, and valve **102C2**. Thus valve **102D** now sends the natural gas required to operate controller **110** (which controls a control valve in system **114**) and also provide gas for the operation of the fail-close valve. Based on the temperature within system **102**, heater **102F** (which may be a catalytic heater) may operate using natural-gas diverted from a piping section after heater **116**.

In addition, natural gas is also sent from a piping section between heater **116** and system **118** to provide pressure information to controller **110**. Based on controller **110** comparing this downstream pressure information with the reference pressure information, controller **110** may make adjustments to the control valve in system **114** to control the amount of gas flow (based on an operator-adjusted set point). If a large surge of natural gas enters the system and the pressure rises rapidly, due to the control valve in system **114** being too slow to respond, then the pressure information will also be sent to another valve within system **102**. If the pressure is not within bounds of the operator-adjusted set point, this other valve within system **102** will stop the flow of gas to the fail-close valve and prevent any additional natural gas from entering the system.

While the examples use high-pressure tank **101**, in the above examples, natural gas can be provided by high-pressure tank **103**, or both high-pressure tank **101** and **103**.

FIGS. **2A** and **2B** are example diagrams of a system **200** for distribution of high-pressure gas as well as control systems for the high-pressure gas. FIG. **2A** shows a first portion of system **200** and FIG. **2B** shows a second portion of system **200**. As shown in FIGS. **2A** and **2B** diagonal lines ("\\") are used on piping sections **202**, **204**, **206**, **208**, **210**, and **252** as they are shown across both FIGS. **2A** and **2B**. FIGS. **2A** and **2B**, in combination, show valves v1, v2, v3, v4, v5, v6, v7, v8, v9, v10, v11, v12, v13, v14, v15, v16, v17, v18, v19, v20, v21, v22, v23, and v24. In addition, FIG. **2A** shows pipe expansion **239**, heater H1 (e.g., a catalytic heater), high-pressure (HP) accumulator tank A1, medium-pressure (MP) accumulator tank A2, pressure safety valve **201**, pressure safety valve **203**, pressure gauges **212**, **213**, and **214**, controller A, controller B, and piping sections **202**, **204**, **206**, **207**, **208**, **209**, **210**, **211**, and **252**. FIG. **2A** also shows valves **217**, **219**, **221**, **223**, **225**, **227**, **229**, and **231**. Furthermore, FIG. **2B** shows piping sections **202**, **204**, **206**, **208**, **210**, and **252**. FIG. **2B** also shows indirect heater **230**, burner **232**, valve **216**, valve **218**, pressure safety valve **220**, and pressure safety valve **222**, flow rate reader **224**, and pressure reader **226**. In embodiments, any of the valves described in FIGS. **2A** and **2B** may be opened and closed either (1) mechanically (e.g., manually), (2) pneumatically, (3) electrically, or (4) electronically based on electronic communications (e.g., wired and/or wireless from a computing device, such as device **406** described in FIG. **4**). In FIGS. **2A** and **2B**, controller A, valves v3, v5, v7, v9, v11, v13, v15, and v17 provide for 100% redundancy of control-

ler B, valves v4, v6, v8, v10, v12, v14, v16, and v18 (and vice versa). Thus, for example, if there is a problem with valve v11 (e.g., based on pressure readings in system 200), then a changeover will be conducted to use controller B, valves v4, v6, v8, v10, v12, v14, v16, and v18. Also, for example, if there is a problem with valve v8 (based on pressure readings in system 200, a failure of the valve, etc.), then a changeover will be conducted to use controller A, valves v3, v5, v7, v9, v11, v13, v15, and v17. Furthermore, piping sections are shown in FIGS. 2A and 2B that may not be numbered but may be described based on their location to other features, such as controllers, valves, pressure gauges, accumulators, pressure safety valves, etc. In embodiments, controller A may be a pneumatic, electric, hydraulic, electrohydraulic, or an electro-pneumatic controller. In embodiments, controller B may be a pneumatic, electric, hydraulic, electrohydraulic, or an electro-pneumatic controller. In embodiments, as shown in FIG. 2A, depending on the type of controller and the type of valve, the line between controller A and v7 may be a pneumatic line, hydraulic line, electric line, or any other line that can provide motive power (e.g., actuate, control, etc.) to v7. In embodiments, as shown in FIG. 2A, depending on the type of controller and the type of valve, the line between controller B and v8 may be a pneumatic line, hydraulic line, electric line, or any other line that can provide motive power (e.g., actuate, control, etc.) to v8. While A1 may be a HP accumulator, A1 in other examples may be any other type of pressure accumulator. While A2 may be MP accumulator, A2 in other examples may be any other type of pressure accumulator.

In a non-limiting example, natural gas is received through v1 from a high-pressure tank. In embodiments, v1 (and v2) can be opened manually or electronically via electronic communications (e.g., wired, wirelessly, etc.). However, natural gas can also be provided through v2 or a combination of two tanks from both v1 and v2. In this non-limiting example, there is no natural gas in the system until (1) natural gas is sent to v3 and/or v4, and (2) natural gas is sent through v1 and passes to high-pressure accumulator tank A1. In embodiments, the piping diameter after v1 and v2, and before pipe expansion 239, is smaller than the piping diameter of the piping after pipe expansion 239. For example, piping up to pipe expansion 239 (from v1 and v2) may be one inch in diameter while piping after pipe expansion 239 may be two inches in diameter. In embodiments, before any gas enters from any tank into any of the piping sections, v5 may be closed and v7 may be open. In embodiments, v5 may be a fail-close valve.

In embodiments, the pressure within tank A1 (a HP accumulator) may vary following the pressure within tanks 101 or 103. In embodiments, tank A1 holds a small volume of natural gas to dampen any pressure variations that may occur within the mainline (e.g. one or more piping sections). Upon exiting tank A1, the natural gas is then sent to v21 via valve 227 and/or v22 via valve 225. As the natural gas passes through v21 and/or v22 the pressure is reduced (e.g., from 1000 PSIG to 200 PSIG) and the natural gas is sent to tank A2 (a MP accumulator). In embodiments, v21, v22, v23, and H1, may be located in a cabinet 247. In embodiments, tank A2 contains a modest volume (e.g., less than 50 liters) of natural gas to further reduce any effects of pressure variations that may occur within the piping sections.

After leaving tank A2, the natural gas then passes through valves 223 and 219, the pressure is further reduced to an operating pressure (e.g., 20 PSIG). In addition, the natural gas is delivered via valve 229 to pressure gauge 214. In

embodiments, the pressure reading by pressure gauge 214 provides information (e.g., viewed locally or sent via electronic communications to another device) about whether the amount of natural gas in A2 is below a particular threshold level. At any time, in this or any other non-limiting example, if the pressure information read by pressure gauge 214 is below the particular threshold, this may indicate that there is not enough natural gas in a high-pressure tank and that the tank should be replaced. A portion of the natural gas exiting valve 219 at the final operating pressure is sent to v20, which is an inverse acting valve. Since v20 is receiving low-pressure information regarding the natural gas, v20 will be fully open. This will allow the natural gas to proceed and pass through v5. At this point, v5 (which is a fail-close valve) is opened based on the fully-open position of v20.

In addition, pressure information (e.g., pressure reference information) of the natural gas exiting tank A2 may be used by controller A (via valve 223 and then valve 219) to control valve v7 at a later time. However, at this particular time, in this non-limiting example, v7 is currently open and allows gas now passing through v5 to continue to flow.

In between v7 and v9, a pressure safety valve 203 is provided to prevent a pressure build-up from occurring between v7 and v9. Once the natural gas passes v9, the natural gas enters piping section 202. The natural gas flows through piping section 202 and then enter indirect heater 230 (e.g., a water bath heater) as shown in FIG. 2B. Within indirect heater 230, the natural gas is heated, indirectly, to maintain a temperature level. In embodiments, indirect heater 230 contains water which is heated by burner 232 (e.g., a natural gas burner) and uses the heated water via a heat exchange to heat the natural gas as that enters through piping section 202.

As shown in FIG. 2A, piping section 252, located after pressure gauge 213, may send natural gas to one or more accumulators and valves (not shown in FIG. 2A) which will reduce the natural gas pressure. The natural gas with reduced pressure is then transmitted via piping section 252 to burner 232 (as shown in FIG. 2B) which then maintains the flame within the fire tube (of heater 230) and continues to heat the water contained in heater 230.

Thus, the natural gas exits indirect heater 230 and enters piping section 204. The natural gas passes from piping section 204 into piping section 205 (as shown in FIG. 2A), piping section 206 (shown in FIG. 2A), and then enters valve v11 (as shown in FIG. 2B). The natural gas then passes through monitor valves v13 and v15. In embodiments, monitor v13 is an inactive monitor valve that is only used if there is a problem with active monitor valve v15. For example, inactive monitor valve v13 may actuate at a pressure level of 55 PSIG while active monitor valve v15 may operate at a pressure level of 50 PSIG. If there is a problem with v15, then v13 will take over. In embodiments, v13 operates at a higher pressure and will remain in the open position. If v15 fails, then the pressure level will be higher than the required pressure level and, thus, v13 will operate as there is now a higher pressure in that piping section. After monitor valve v15, a pressure safety valve 220 is provided. If there are no problems with pressure, the natural gas passes through v17 and passes by pressure safety valve 221. Flow rate reader 224 reads the flow amount and device 226 is a pressure gage and pressure transmitter which sends pressure information to a computing device (e.g., device 406) to determine whether a sufficient amount of natural gas is being delivered to gas system 240 (e.g., an end-user system or another system).

In this non-limiting example, when natural gas enters piping section **205**, the natural gas may also follow piping section **207** and then piping section **209**. The natural gas entering piping section **209** is sent to heater H1 (via valve **231**) and valve v**23**. The natural gas sent to v**23** is then sent to mid-pressure accumulator tank A**2**. This natural gas is then used to provide reference pressure information to controller A. Thus, controller A no longer requires natural gas (and the natural gas pressure information) via A**1**, V**21** and/or V**22** which are only used to provide the initial pressure needed for controller A to operate the first time. In this non-limiting example, the natural gas pressure exiting v**23** is at a higher pressure than the natural gas that is exiting v**21** and/or v**22** from high-pressure accumulator A**1**. Thus, the pressure from v**23** back-pressurizes and prevents gas from v**21** and/or v**22** from proceeding any further. Thus, the gas passes from v**23** and then enters mid-pressure accumulator A**2**.

In addition, the natural gas that enters piping section **207** also enters piping section **211**. The gas from piping section **211** goes to v**20** and provides gas pressure information to v**20**. If this pressure (provided in the gas pressure information) is above a prescribed level (e.g., an operator adjustable set point), v**20** will close and shut off the natural gas required to operate v**5** (as v**5** is a fail-close valve). Thus, v**5** will close and prevent the pressure within the pipeline increasing beyond this prescribed level and may also prevent any safety valves from opening and allowing natural gas to be emitted to the atmosphere.

In this non-limiting example, when gas enters v**11**, a portion of gas is sent through valve **216** and natural gas is sent through piping section **208** to controller A. In this non-limiting example, controller A receives downstream natural gas pressure information from the natural gas sent through piping section **208**. Based on comparing downstream natural gas pressure information with the reference pressure information (received via valve **219**), controller A controls v**7** to determine how much natural gas (as long as natural gas is flowing through v**5**) should flow through v**7**.

In another non-limiting example, natural gas is received through v**1** from a high-pressure tank. In embodiments, v**1** (and v**2**) can be opened manually or electronically via electronic communications (e.g., wired, wirelessly, etc.). However, natural gas can also be provided through v**2** or a combination of two tanks from both v**1** and v**2**. In this non-limiting example, there is no natural gas in the system until (1) natural gas is sent to v**3** and/or v**4**, and (2) natural gas is sent through v**1** and passes to high-pressure accumulator tank A**1**. In embodiments, the piping diameter after v**1** and v**2**, and before pipe expansion **239**, is smaller than the piping diameter of the piping after piping expansion **239**. For example, piping up to pipe expansion **239** (from v**1** and v**2**) may be one inch in diameter while piping after pipe expansion **239** may be two inches in diameter.

In embodiments, the pressure within tank A**1** (a HP accumulator) may vary following the pressure within tanks **101** or **103**. In embodiments, tank A**1** holds a small volume to natural gas to dampen any pressure variations that may occur within the mainline (e.g., one or more piping sections). Upon exiting tank A**1**, the natural gas is then sent to v**21** via valve **227** and/or v**22** via valve **225**. As the natural gas passes through v**21** and/or v**22** the pressure is reduced (e.g., from 1000 PSIG to 200 PSIG) and the natural gas is sent to tank A**2** (a MP accumulator). In embodiments, tank A**2** contains a modest volume (e.g., less than 50 liters) of natural gas to further reduce any effects of pressure variations that may occur within the piping sections.

After leaving tank A**2**, the natural gas then passes through valves **221** and **217**, the pressure is further reduced to an operating pressure (e.g., 20 PSIG). In addition, the natural gas is delivered via valve **229** to pressure gauge **214**. A portion of the natural gas exiting valve **217** at the final operating pressure is sent to v**19**, which is an inverse acting valve. Since v**19** is receiving a low-pressure communication (e.g., gas pressure information) from the mainline (e.g., one or more piping sections), v**19** will be fully open. This will allow the natural gas to proceed and pass through v**6**. At this point, v**6** (which is a fail-close valve) is opened based on the fully-open position of v**19**.

In addition, pressure information (e.g., pressure reference information) of natural gas exiting tank A**2** may be used by controller B (via valve **221** and then valve **217**) to control valve v**8** at a later time. However, at this particular time, in this non-limiting example, v**8** is currently open and allows gas now passing through v**6** to continue to flow.

In between v**8** and v**10**, a pressure safety valve **201** is provided to prevent a pressure build-up from occurring between v**8** and v**10**. Once the natural gas passes v**10**, the natural gas enters piping section **202**. The natural gas then flows through piping section **202** and then enters indirect heater **230** (e.g., a water bath heater) as shown in FIG. **2B**. Within indirect heater **230**, the natural gas is heated, indirectly, to maintain a temperature level. In embodiments, indirect heater **230** contains water which is heated by burner **232** (e.g., a natural gas burner) and uses the heated water via a heat exchange to heat the natural gas as that enters through piping section **202**.

As shown in FIG. **2A**, piping section **252**, located after pressure gauge **213**, may send natural gas to one or more accumulators and valves (not shown in FIG. **2A**) which will reduce the natural gas pressure. The natural gas with reduced pressure is then transmitted via piping section **252** to burner **232** (as shown in FIG. **2B**) which then maintains the flame within the fire tube (of heater **230**) and continues to heat the water contained in heater **230**.

Thus, the natural gas exits indirect heater **230** and enters piping section **204**. The natural gas passes from piping section **204** into piping section **205** (as shown in FIG. **2A**), piping section **206** (shown in FIG. **2A**), and then enters valve v**12** (as shown in FIG. **2B**). The natural gas then passes through monitor valves v**14** and v**16**. In embodiments, monitor v**14** is an inactive monitor valve that is only used if there is a problem with active monitor valve v**16**. For example, inactive monitor valve v**14** may actuate at a pressure level of 55 PSIG while active monitor valve v**16** may operate at a pressure level of 50 PSIG. If there is a problem with v**16**, then v**14** will take over. In embodiments, v**14** operates at a higher pressure and will remain in the open position. If v**16** fails, then the pressure level will be higher than the required pressure level and, thus, v**14** will operate as there is now a higher pressure in that piping section. After monitor valve v**16**, a pressure safety valve **222** is provided. If there are no problems with pressure, the natural gas passes through v**18** and then passes by pressure safety valve **221**. Flow rate reader **224** reads the flow amount and device **226** is a pressure gage and pressure transmitter which sends pressure information to a computing device (e.g., device **406**) to determine the amount of natural gas being delivered to gas system **240**.

In this non-limiting example, when natural gas enters piping section **205**, the natural gas may also follow piping section **207** and then piping section **209**. The natural gas entering piping section **209** is sent to heater H1 (via valve **231**) and valve v**23**. The natural gas sent to v**23** is then sent

to mid-pressure accumulator tank A2. The natural gas sent to v23 is then sent to mid-pressure accumulator tank A2. This natural gas is then used to provide reference pressure information to controller B. Thus, controller B no longer requires natural gas (and natural gas pressure information) via A1, V21 and/or V22 which are only used to provide the initial pressure needed for controller B to operate the first time. In this non-limiting example, the natural gas pressure exiting v23 is at a higher pressure than the natural gas that is exiting v21 and/or v22 from high-pressure accumulator A1. Thus, the pressure from v23 back-pressurizes and prevents gas from v21 and/or v22 from proceeding any further. Thus, the gas passes from v23 and then enters mid-pressure accumulator A2.

In addition, the natural gas that enters piping section 207, and goes to v19, provides gas pressure information to v19. If this pressure value (provided in the gas pressure information) is above a prescribed level (e.g., an operator adjustable set point) v19 will close and shut off the natural gas required to operate v6 (as v6 is a fail-close valve). Thus, v6 will close and prevent the pressure within the pipeline increasing beyond this prescribed level and may also prevent any safety valves from opening and allowing natural gas to be emitted to the atmosphere.

In this non-limiting example, when gas enters v12, a portion of gas is sent through valve 218 and natural gas is sent through piping section 210 to controller B. In this non-limiting example, controller B receives downstream natural gas pressure information from the natural gas sent through piping section 210. Based on comparing downstream natural gas pressure information with the reference pressure information (received via valve 217), controller B controls v8 to determine how much natural gas (as long as natural gas is flowing through v6) should flow through v8.

In embodiments, for FIGS. 2A and 2B, device 406 (described in FIG. 4) may in communication with system 200 (e.g., system 404 described in FIG. 4). In embodiments, device 406 may receive electronic information about pressure readings in system 200 and generate messages to switch over from one set of valves to another set of valves in the event of problems occurring within the system. For example, if there is a problem with valve v4 (based on pressure readings in system 200, a failure of the valve, etc.), then device 406 may receive information about the problem (e.g., pressure reading information) and generate a message to conduct a changeover and use valves v3, v5, v7 and v9, and controller A. In embodiments, the messages may be sent to one or more valves in system 200 which are used to open or close the valves. Additionally, or alternatively, the messages may be sent to a user of system 200 who may change one or more valves in system 200 manually (e.g., mechanically). In embodiments, device 406 may be associated with a graphical user interface that includes a visual display. In embodiments, device 406 may be associated with a control panel system that includes alarms, warning lights, and/or other lighting indicators that are may be incorporated as part of the graphical user interface or are part of an analog system. Thus, a user may use the graphical user interface to view various types of information that are used to make decisions as to whether one or more valves should be opened or closed. In embodiments, based on changing requirements (e.g., pressure requirements) of natural gas supply of system 200 to an end-user, a set point for a controller (e.g., controller A, controller B, etc.) may be adjusted (e.g., electronically, manually, etc.) to accommodate any such updates. In embodiments, the set point value may be based on reference pressure information, a relationship between the reference

pressure information and the downstream pressure information, or another value. In embodiments, a controller may adjust a control valve (e.g., v7) based on comparing the set point to (i) a value based on a relationship (e.g., differential, proportional, etc.) between reference pressure information and downstream pressure information, (ii) a value based on downstream pressure information, (iii) a value based on reference pressure information, or (iv) another value (e.g., end-user pressure requirements). For the examples described above for systems 100 and 200, in embodiments, a set point value for v19 may be less than, equal to, or greater than a set point value for controller A. Also, in embodiments, a set point value for v20 may be less than, equal to, or greater than s set point value for controller B. In embodiments, any set point may be adjusted based on gas pressure requirements of an end-user system. For the non-limiting examples described in FIG. 2, gas refers to natural gas. However, in other examples, other types of gases may be used, such as biogas, oxygen, reclaimed natural gas, or any other type of gas.

FIG. 3 is an example flow chart diagram of an example process 300. In embodiments, example process 300 may be performed by a controller (e.g., controller 108, 110, controller A, and/or controller B, as described in FIGS. 1, 2A, and 2B), device 406 and/or electronic application 408 (which are described in FIG. 4). In embodiments, example 300 may be conducted to control one or more valves within a system, such as system 100 and/or system 200. As shown in FIG. 3, at step 302, a controller may receive natural gas. In embodiments, the controller may receive the natural gas from a MP accumulator and a set of valves (e.g., v21 and v22). In embodiments, the controller may be controller A, controller B, controller 108, and/or controller 110. By receiving the gas pressure information of the natural gas (which is at a particular pressure that is the minimum pressure level that the controller may operate at), the controller, at step 304, maintains a control valve as open. In embodiments, the control valve may be a fail-open valve. In alternate embodiments, the control valve may be another type of valve. At step 306, the controller receives downstream pressure information (of the natural gas that is downstream of the controller). In embodiments, the pressure information may be associated with natural gas that is downstream of the control valve. At step 308, the controller receives additional natural gas (which includes reference pressure information) for its controlling mechanism (e.g., controlling a control valve). In embodiments, the additional natural gas is received via MP accumulator and another valve (e.g., v23). In embodiments, the MP accumulator and the other valve reduces the pressure of natural gas downstream of the controller and this reduced pressure natural gas is the additional natural gas then sent to the controller. At step 310, the controller change the control valve and determine whether it should change the amount of natural gas passing through the control valve. In embodiments, the controller makes this determination based on the downstream pressure information received in step 306 and the pressure reference information received in step 308. If the downstream pressure is below a particular threshold pressure level, then no changes are made to the control valve (NO) and the control valve is kept fully open (step 304). If the downstream pressure is above the particular threshold pressure level, then changes are made to the control valve (YES) at step 312. Thus, the controller partially (or fully) closes the control valve to reduce the amount of natural gas being sent downstream.

FIG. 4 is a diagram of example environment 400 in which systems, devices, and/or methods described herein may be

implemented. FIG. 4 shows network **402**, system **404**, device **406**, and application **408**.

Network **402** may include a local area network (LAN), wide area network (WAN), a metropolitan network (MAN), a telephone network (e.g., the Public Switched Telephone Network (PSTN)), a Wireless Local Area Networking (WLAN), a WiFi, a hotspot, a Light Fidelity (LiFi), a Worldwide Interoperability for Microware Access (WiMax), an ad hoc network, an intranet, the Internet, a satellite network, a GPS network, a fiber optic-based network, and/or combination of these or other types of networks. Additionally, or network **402** may include a cellular network, a public land mobile network (PLMN), a second-generation (2G) network, a third-generation (3G) network, a fourth-generation (4G) network, a fifth-generation (5G) network, and/or another network. In embodiments, network **402** may allow for devices describe any of the described figures to electronically communicate (e.g., using emails, electronic signals, URL links, web links, electronic bits, fiber optic signals, wireless signals, wired signals, etc.) with each other to send and receive various types of electronic communications.

System **404** (e.g., system **100**, system **200** as described above) may include one or more devices that can communicate and/or receive electronic information to/from device **406**, and/or application **408**, via network **402**. In embodiments, system **404** may include valves, control valves, monitor valves, and/or heaters which may send/receive electronic information to/from device **406** (and/or application **408**) to turn on or off different valves in system **404**. In embodiments, system **404** may include sensors and/or gauges that communicate electronic information about pressure, temperature, and/or flow rates to device **406** and/or application **408** via network **402**. In embodiments, system **404** may be system **100** and system **200**. In embodiments, system **404** may be placed on moving device **410** (e.g., using a truck, tractor, type of boat, etc.) that can move or be moved from one location to another location. In alternate embodiments, moving device **410** may be a part of system **404**. In embodiments, other than electrical power to communications devices (e.g., pressure gauges that can electronically communicate information) that are part of system **404**, no other electrical power may be used to control any of the valves in system **404** (e.g., all valves may be pneumatically and/or mechanically controlled). In alternate embodiments, system **404** may be powered by electrical power, solar power, and/or other type of power. In embodiments, system **404** may be located at remote locations and be powered by its own power system which may be a generator system (e.g., operating on natural gas, diesel, etc.), and/or a solar-powered panel system which generates power that is used by one or more of the portions of system **404** in conjunction with other portions of system **404** that may require pneumatic power and/or no type of power (e.g., manually controlled valves).

Device **406** may include any computation or communications device that is capable of communicating with a network (e.g., network **402**) with other device and/or systems, such as system **404**. For example, device **406** may include a computing device, radiotelephone, a personal communications system (PCS) terminal (e.g., that may combine a cellular radiotelephone with data processing and data communications capabilities), a personal digital assistant (PDA) (e.g., that can include a radiotelephone, a pager, Internet/intranet access, etc.), a smartphone, a desktop com-

puter, a laptop computer, a tablet computer, a camera, a digital watch, a digital glass, or another type of computation or communications device.

Device **406** may receive and/or display content. The content may include objects, data, images, audio, video, text, files, and/or links to files accessible via one or more networks. Content may include a media stream, which may refer to a stream of content that includes video content (e.g., a video stream), audio content (e.g., an audio stream), and/or textual content (e.g., a textual stream). In embodiments, an electronic application may use an electronic graphical user interface to display content and/or information via user device **406**. Device **406** may have a touch screen and/or a keyboard that allows a user to electronically interact with an electronic application. In embodiments, a user may swipe, press, or touch device **406** in such a manner that one or more electronic actions will be initiated by device **406** via an electronic application.

Device **406** may include a variety of applications, such as, for example, a gas analyzer application, a flow rate application, a temperature application, a composition analyzer application, an e-mail application, a telephone application, a camera application, a video application, a multi-media application, a music player application, a visual voice mail application, a contacts application, a data organizer application, a calendar application, an instant messaging application, a texting application, a web browsing application, a blogging application, and/or other types of applications that are a combination of two or more of the above applications (e.g., electronic application **408**).

Electronic application **408** may be capable of interacting with device **406** and/or system **404** to automatically and electronically receive electronic information for one or more persons. In embodiments, electronic application **408** may obtain electronic information about pressure, temperature, and/or flow rates associated with natural gas. In embodiments, electronic application **408** may be associated with a graphical user interface that may display images, generate sounds, and/or display information associated with system **404**.

FIG. 5 is a diagram of example components of system **504** and device **506**. Device **500** may correspond to computing devices, such as device **406**, and/or a computing device feature that is part of systems **100** and **200**.

As shown in FIG. 5, device **500** may include a bus **510**, a processor **520**, a memory **530**, an input component **540**, an output component **550**, and a communications interface **560**. In other implementations, device **500** may contain fewer components, additional components, different components, or differently arranged components than depicted in FIG. 5. Additionally, or one or more components of device **500** may perform one or more tasks described as being performed by one or more other components of device **500**.

Bus **510** may include a path that permits communications among the components of device **500**. Processor **520** may include one or more processors, microprocessors, or processing logic (e.g., a field-programmable gate array (FPGA) or an application-specific integrated circuit (ASIC)) that interprets and executes instructions. Memory **530** may include any type of dynamic storage device that stores information and instructions, for execution by processor **520**, and/or any type of non-volatile storage device that stores information for use by processor **520**.

Input component **540** may include a mechanism that permits a user to input information to device **500**, such as a keyboard, a keypad, a button, a switch, etc. Output component **550** may include a mechanism that outputs information

to the user, such as a display, a speaker, one or more light-emitting diodes (LEDs), etc.

Communications interface **560** may include any transceiver-like mechanism that enables device **500** to communicate with other devices and/or systems. For example, communications interface **560** may include an Ethernet interface, an optical interface, a coaxial interface, a wireless interface, or the like.

In another implementation, communications interface **560** may include, for example, a transmitter that may convert baseband signals from processor **520** to radiofrequency (RF) signals and/or a receiver that may convert RF signals to baseband signals. Alternatively, communications interface **560** may include a transceiver to perform functions of both a transmitter and a receiver of wireless communications (e.g., radiofrequency, infrared, visual optics, etc.), wired communications (e.g., conductive wire, twisted pair cable, coaxial cable, transmission line, fiber optic cable, waveguide, etc.), or a combination of wireless and wired communications.

Communications interface **560** may connect to an antenna assembly (not shown in FIG. **5**) for transmission and/or reception of the RF signals. The antenna assembly may include one or more antennas to transmit and/or receive RF signals over the air. The antenna assembly may, for example, receive RF signals from communications interface **560** and transmit the RF signals over the air, and receive RF signals over the air and provide the RF signals to communications interface **560**. In one implementation, for example, communications interface **560** may communicate with a network (e.g., wireless network, Internet, Intranet, etc.).

As will be described in detail below, device **500** may perform certain operations. Device **500** may perform these operations in response to processor **520** executing software instructions (e.g., a computer program(s)) contained in a computer-readable medium, such as memory **530**, a secondary storage device (e.g., hard disk, CD-ROM, etc.), or other forms of RAM or ROM. A computer-readable medium may be defined as a non-transitory memory device. A memory device may include space within a single physical memory device or spread across multiple physical memory devices. The software instructions may be read into memory **530** from another computer-readable medium or another device. The software instructions contained in memory **530** may cause processor **520** to perform processes described herein. Alternatively, hardwired circuitry may be used in place of or in combination with software instructions to implement processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

In the preceding specification, gas may be interchangeably used with natural gas. While natural gas is used in the examples described in the preceding specification, any of the systems described in FIGS. **1**, **2A**, and **2B**, may use other types of gases, such as biogas, oxygen, reclaimed natural gas, or any other type of gas. Furthermore, in the preceding specification, a high-pressure tank may be a type of tank, vessel, storage device, or any other container that contains gas. In the preceding specification, as shown in FIGS. **1**, **2A**, and **2B**, each of the valves, pressure readers, flow rate readers, and/or temperature readers, may receive or send electronic information via wired or wireless communications to a computing device (e.g., device **406**).

While various actions are described as selecting, displaying, transferring, sending, receiving, generating, notifying, and storing, it will be understood that these example actions are occurring within an electronic computing and/or elec-

tronic networking environment and may require one or more computing devices, as described in FIG. **2**, to complete such actions. Also it will be understood that any of the various actions can result in any type of electronic information to be displayed in real-time and/or simultaneously on multiple user devices (e.g., similar to user device **212**). For FIG. **3**, the order of the blocks may be modified in other implementations. Further, non-dependent blocks may be performed in parallel.

In the preceding specification, a high-pressure accumulator (e.g., A1 in FIG. **2A**) and a mid-pressure accumulator may be an American Society of Mechanical Engineers (ASME) certified expansion tank (e.g., bladder tank, diaphragm tank, etc.). In the preceding specification, a controller (e.g., controller **108**, controller **110**, controller A, controller B) may be a controller that can compare sensed process pressure (or differential pressure) with an operator-adjusted set point, and send a pneumatic signal to an adjacent control element (e.g., control valve v7) that maintains the process pressure at or near the set point value. In embodiments, a controller may be proportional only, proportional plus reset, differential gap, or any other type of configuration. In the preceding specification, a control valve (e.g., v7 and v8) may be a type of globe valve may be controlled pneumatically, electrically, and/or electronically. In the preceding specification, valves (e.g., v3) may be a type of ball valve. In the preceding specification, safety valves may be a type of relief valve (e.g., threaded or flanged valve). In the preceding specification, a fail-close valve (e.g., v5) may be a stem guided and/or non-balanced valve. In embodiments, monitor valves (e.g., v14, v16, etc.) may be a type of rotary ball type valve or any other type of valve.

In the preceding specification, various preferred embodiments have been described with reference to the accompanying drawings. It will, however, be evident that various modifications and changes may be made thereto, and additional embodiments may be implemented, without departing from the broader scope of the invention as set forth in the claims that follow. The specification and drawings are accordingly to be regarded in an illustrative rather than restrictive sense.

What is claimed is:

1. An apparatus, comprising:
   a first valve (v1), wherein the apparatus is configured to receive a first amount of natural gas through the first valve (v1);
   a first piping section;
   a high-pressure accumulator (A1), wherein the first piping section is between the first valve (v1) and the high-pressure accumulator (A1);
   a second valve (**225**);
   a catalytic heater (H1);
   a medium-pressure accumulator (A2), wherein the catalytic heater (H1) is located between the high-pressure accumulator (A1) and the mid-pressure accumulator (A2);
   a first controller (A), wherein the first controller (A) is configured to be connected to the mid-pressure accumulator (A2) via a second piping section;
   a control valve (v7), wherein the first controller (A) is configured use the first amount of natural gas to control the control valve (v7);
   a third piping section;
   a fail-close valve (v5), wherein the third piping section is between the first controller (A) and the fail-close valve (v5);

a fourth piping section, wherein the fail-close valve (v5) and the control valve (v7) are located on the fourth piping section;

a fifth piping section (202);

an indirect heater (230), wherein the fifth piping section (202) is located between the control valve (v7) and the indirect heater (230);

a sixth piping section (204);

a seventh piping section (207), wherein the sixth piping section (204) is configured to be connected to the seventh piping section (207);

an eighth piping section (209), wherein the eighth piping section (209) is configured to be connected to the seventh piping section (207);

a third valve (v23), wherein the eighth piping section (209) is configured to be connected to the third valve (v23), wherein the mid-pressure accumulator (A2) is configured to send a second amount of natural gas, from the mid-pressure accumulator (A2), through a ninth piping section, to the first controller (A).

2. The apparatus of claim 1, wherein the indirect heater (230) is located after the first controller (A).

3. The apparatus of claim 1, further comprising:

a computing device.

4. The apparatus of claim 1, further comprising:

a second controller (B).

5. The apparatus of claim 1, wherein the first controller (A) does not control the fail-close valve.

6. The apparatus of claim 1, further comprising:

a burner, wherein the burner is located before the indirect heater (230).

7. The apparatus of claim 1, further comprising:

a second controller (B);

another control valve (v8) and another fail-close valve (v6), wherein the other control valve (v8) and the other fail-close valve (v6) are located on an eleventh piping section; and

a twelfth piping section, wherein the twelfth piping section is between the second controller (B) and the fail-close valve (v5).

8. A device, comprising:

a memory;

a processor coupled to the memory to:

receive electronic information about pressure; and

generate electronic instructions to open or close one or more valves, wherein the one or more valves include a control valve and a fail-close valve;

a first valve (v1), wherein the apparatus is configured to receive a first amount of natural gas through the first valve (v1);

a first piping system;

a high-pressure accumulator (A1), wherein the first piping section is between the first valve (v1) and the high-pressure accumulator (A1);

a second valve (225);

a catalytic heater (H1);

a medium-pressure accumulator (A2), wherein the catalytic heater (H1) is located between the high-pressure accumulator (A1) and the mid-pressure accumulator (A2);

a first controller (A), wherein the first controller (A) is configured to be connected to the mid-pressure accumulator (A2) via a second piping section;

a control valve (v7), wherein the first controller (A) is configured use the first amount of natural gas to control the control valve (v7);

a third piping section;

a fail-close valve (v5), wherein the third piping section is between the first controller (A) and the fail-close valve (v5);

a fourth piping section, wherein the fail-close valve (v5) and the control valve (v7) are configured to be attached on the fourth piping section;

a fifth piping section (202);

a sixth piping section (204);

a seventh piping section (207), wherein the sixth piping section (204) is configured to be connected to the seventh piping section (207);

an eighth piping section (209), wherein the eighth piping section (209) is configured to be connected to the seventh piping section (207);

a third valve (v23), wherein the eighth piping section (209) is configured to be connected to the third valve (v23); and

a ninth piping section, wherein the ninth piping section is configured to be connected between the third valve (v23) and the mid-pressure accumulator (A2),

wherein the mid-pressure accumulator (A2) is configured to send a second amount of natural gas, from the mid-pressure accumulator (A2), through the ninth piping section, to the first controller (A).

9. The device of claim 8, wherein the first controller (A) pneumatically controls the control valve (v7).

10. The device of claim 8, wherein the first controller (A) does not control the fail-close valve (v5).

11. The device of claim 8, wherein the electronic instructions are displayed on a graphical user interface, and wherein the device controls the graphical user interface.

12. A method, comprising:

receiving, by a natural gas control system, a first amount of natural gas,

wherein the natural gas control system includes:

a first valve (v1), wherein the apparatus is configured to receive the first amount of natural gas through the first valve (v1);

a first piping system;

a high-pressure accumulator (A1), wherein the first piping section is between the first valve (v1) and the high-pressure accumulator (A1);

a second valve (225);

a catalytic heater (H1);

a medium-pressure accumulator (A2), wherein the catalytic heater (H1) is located between the high-pressure accumulator (A1) and the mid-pressure accumulator (A2);

a first controller (A), wherein the first controller (A) is connected to the mid-pressure accumulator (A2) via a second piping section;

a control valve (v7), wherein the first controller (A) is configured use the first amount of natural gas to control the control valve (v7);

a third piping section;

a fail-close valve (v5), wherein the third piping section is between the first controller (A) and the fail-close valve (v5);

a fourth piping section, wherein the fail-close valve (v5) and the control valve (v7) are located on the fourth piping section;

a fifth piping section (202);

an indirect heater (230), wherein the fifth piping section (202) enters the indirect heater (230);

a sixth piping section (204);

a seventh piping section (207), wherein the sixth piping section (204) is connected to the seventh piping section (207);

an eighth piping section (209), wherein the eighth piping section (209);

a third valve (v23), wherein the eighth piping section (209) is connected to the third valve (v23); and

a ninth piping section, wherein the ninth piping section is connected between the third valve (v23) and the mid-pressure accumulator (A2),

sending, by the natural gas control system, the first amount of natural gas to the high-pressure accumulator (A1);

heating, by the natural gas control system, the first amount of natural gas after the first amount of natural gas is sent through the high-pressure accumulator (A1);

sending, by the natural gas control system, the first amount of natural gas to the mid-pressure accumulator (A2);

sending, by the natural gas control system, the first amount of natural gas to the first controller (A) and to the fail-close valve (v5) after the natural gas is sent to the mid-pressure accumulator (A2);

sending, by the natural gas control system, the first amount of natural gas out through the indirect heater (230);

sending, by the natural gas control system, a second amount of natural gas to the third valve (v23);

heating, by the natural gas control system, the second amount of natural gas after the second amount of natural gas exits the third valve (v23);

sending, by the natural gas control system, the second amount of natural gas to the mid-pressure accumulator (A2); and

sending, by the natural gas control system, the second amount of natural gas to the first controller (A).

13. The method of claim 12, wherein the first controller (A) pneumatically controls the first amount of natural gas.

14. The method of claim 12, wherein the first controller (A) is not connected to the first piping section.

15. The method of claim 12, further comprising:

sending, by the natural gas control system, an additional amount of natural gas to the first controller (A); and

using, by the natural gas control system, the additional amount of natural gas to determine how the first controller A controls the control valve (v7).

16. The method of claim 12, further comprising:

a second controller (B), wherein the second controller (B) is connected to the mid-pressure accumulator (A2) via an eleventh piping section; and

another control valve (v8) and another fail-close valve (v6), wherein the other control valve (v8) and the other fail-close valve (v6) are located on a twelfth piping section.

* * * * *