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Callbeck

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(54) **APPARATUS FOR HEATING A GAS BURNER UNIT**

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F28D 20/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F28D 20/00*** (2013.01); *F28D 2020/0004* (2013.01); *F28D 2020/0065* (2013.01)

(58) **Field of Classification Search**
CPC F28D 20/00; F28D 2020/0004; F28D 2020/0065
See application file for complete search history.

(56) **References Cited**

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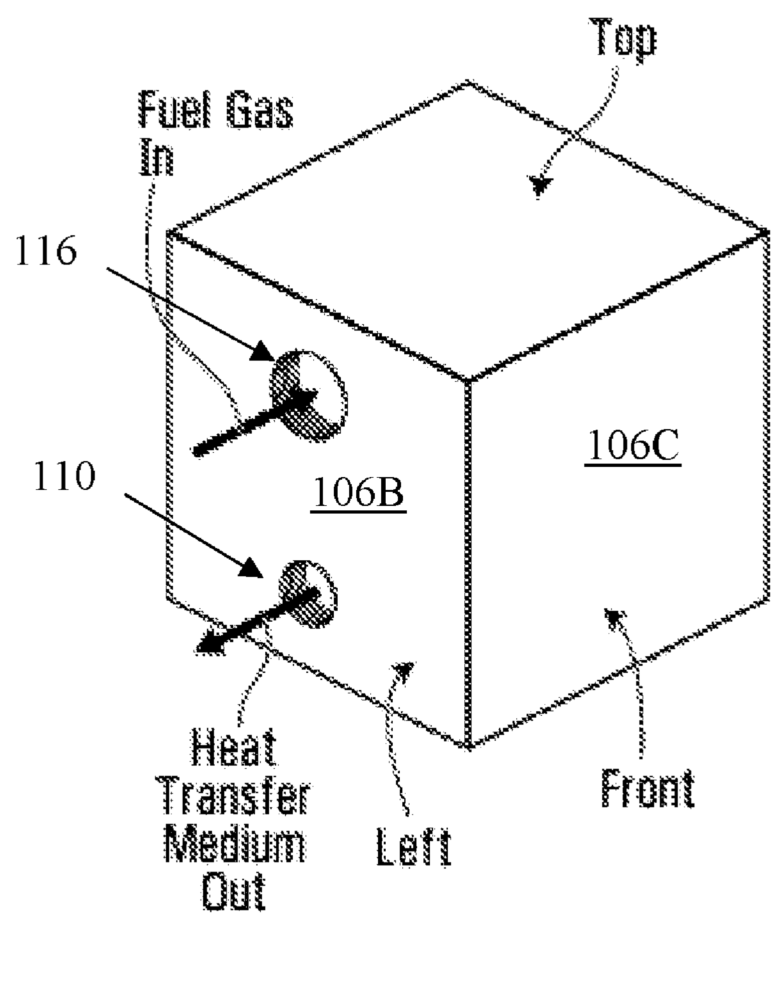
(57) **ABSTRACT**

The heater block of the present disclosure can transfer heat from a heat transfer fluid to a received fuel fluid, air passing in proximity to the heater block or combinations thereof. These heat transfers reduce, substantially prevent or prevent the freezing of water within the received fuel fluid and/or the air as it enters an intake member of a gas burning unit.

3 Claims, 5 Drawing Sheets



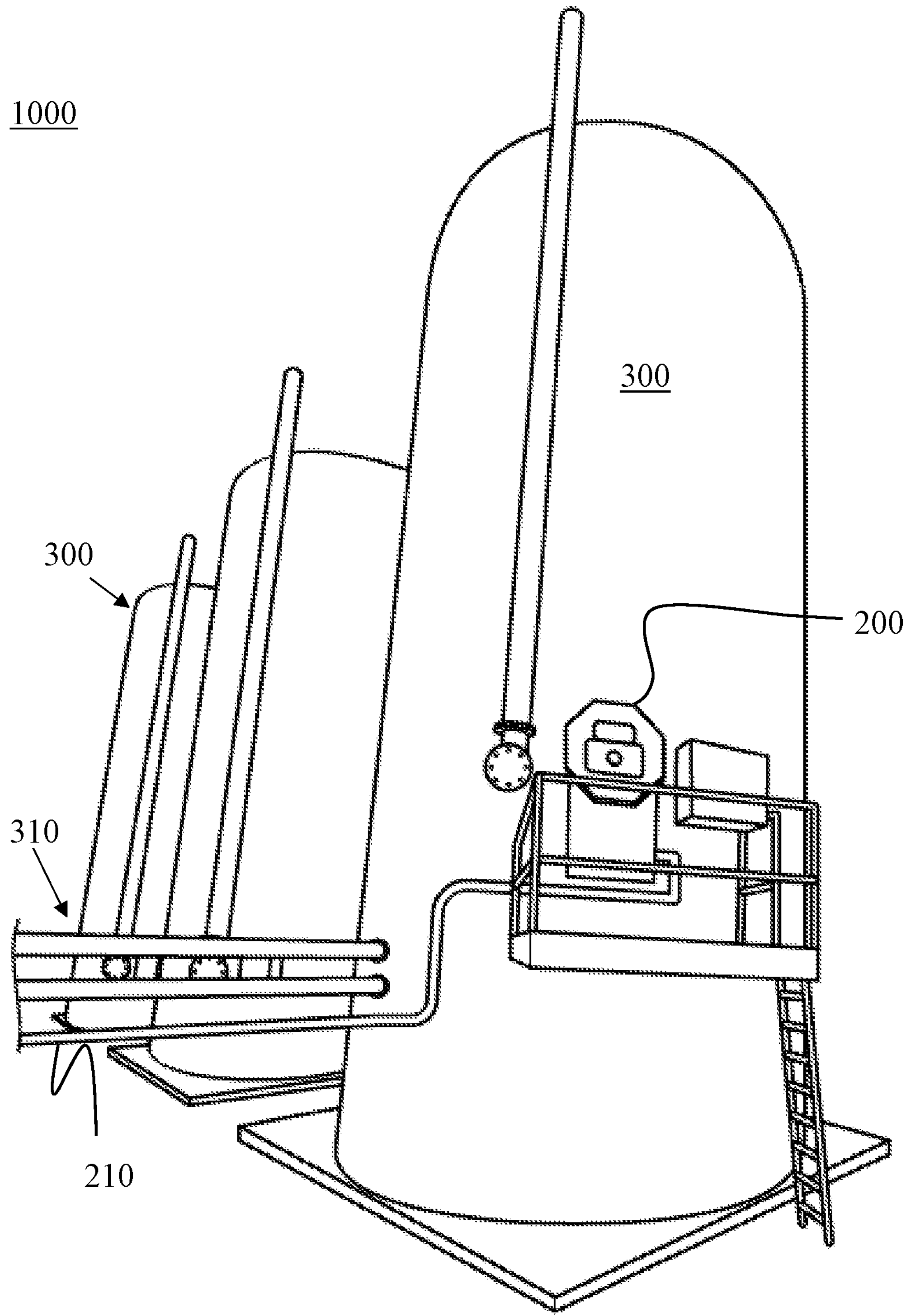
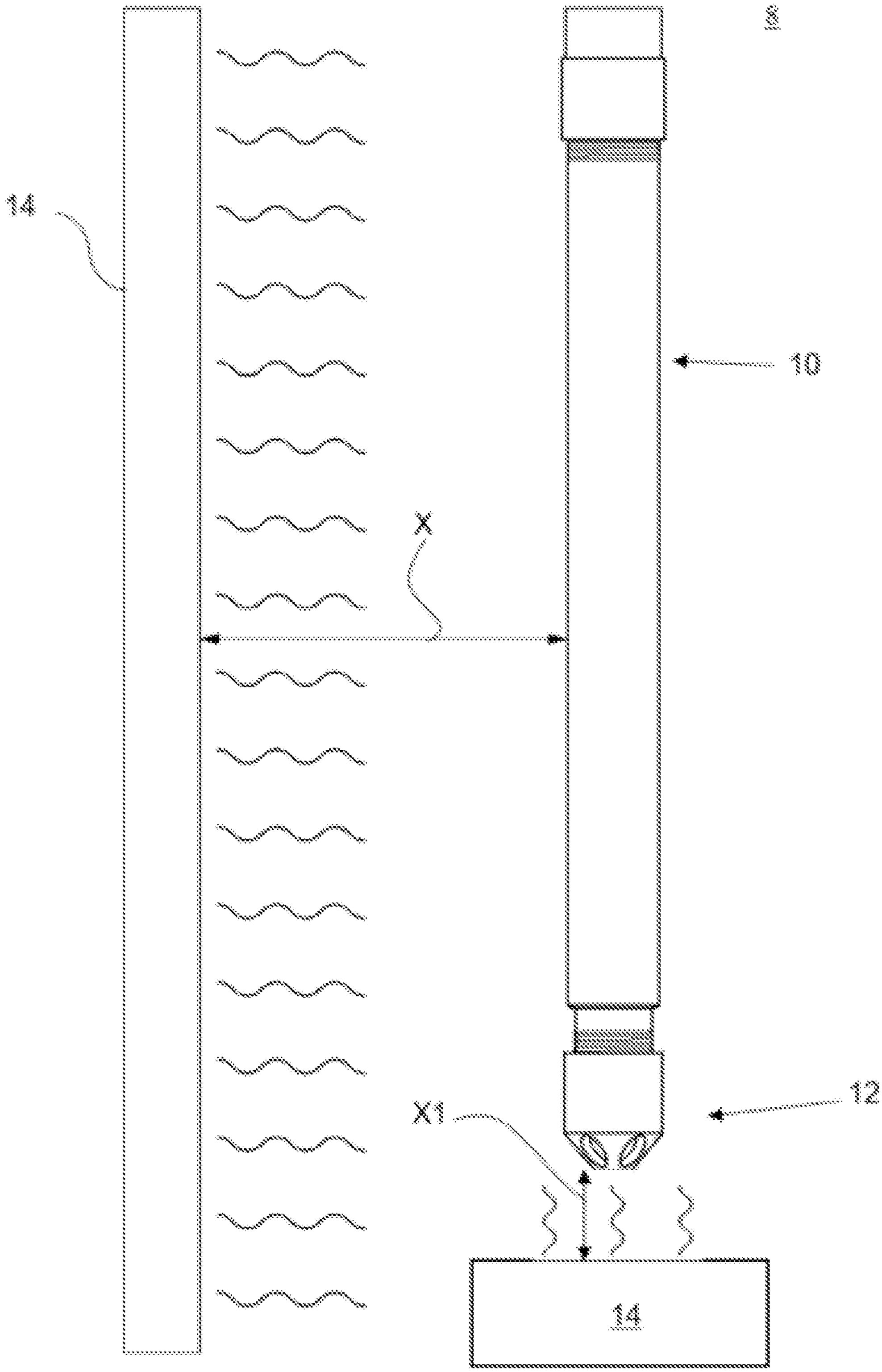
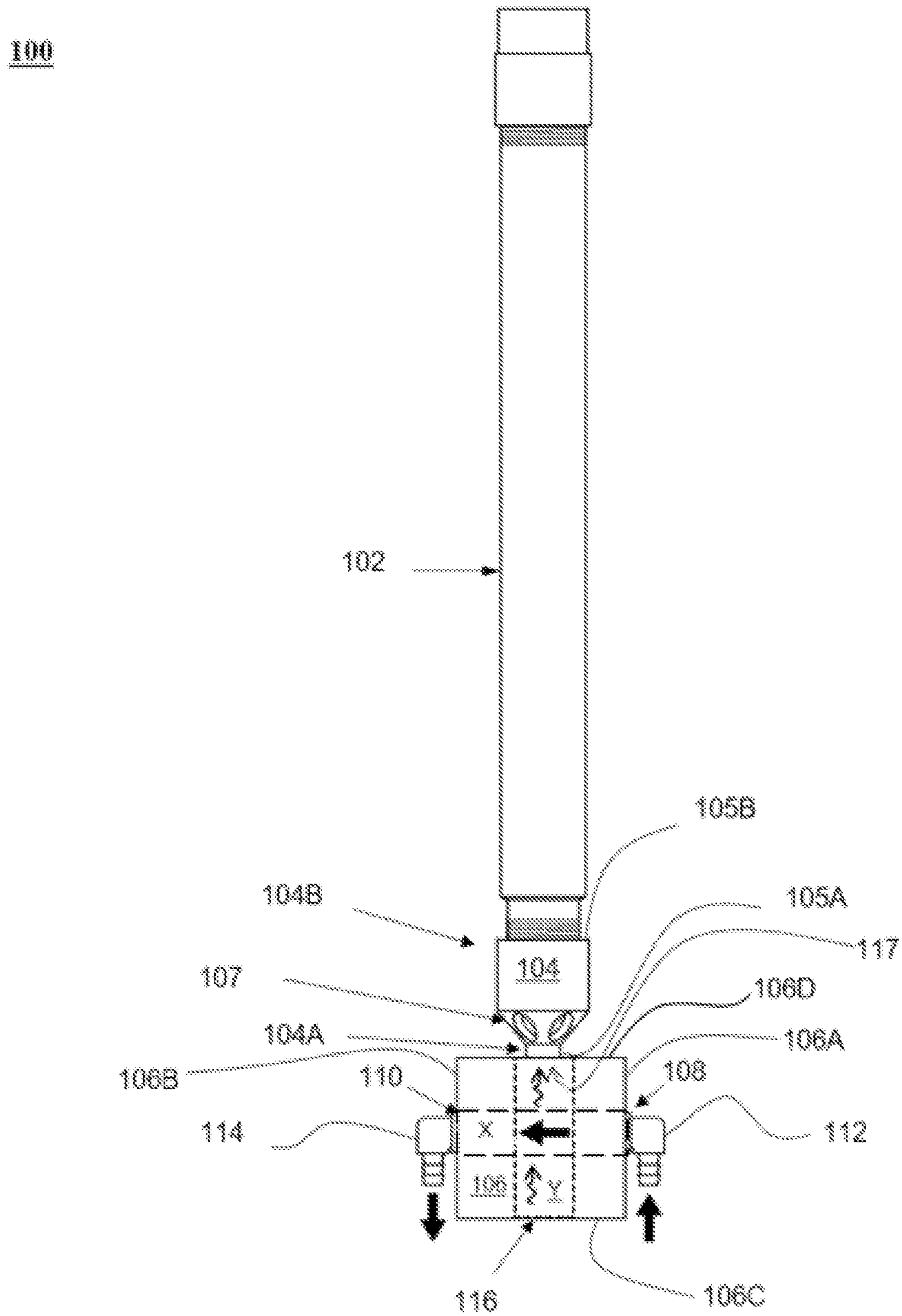


FIG. 1



PRIOR ART

FIG. 2



100
102
105B
104B
105A
117
104
107
106D
104A
106A
106B
110
108
114
X
112
106
Y
116
106C

FIG. 3

FIG. 4A

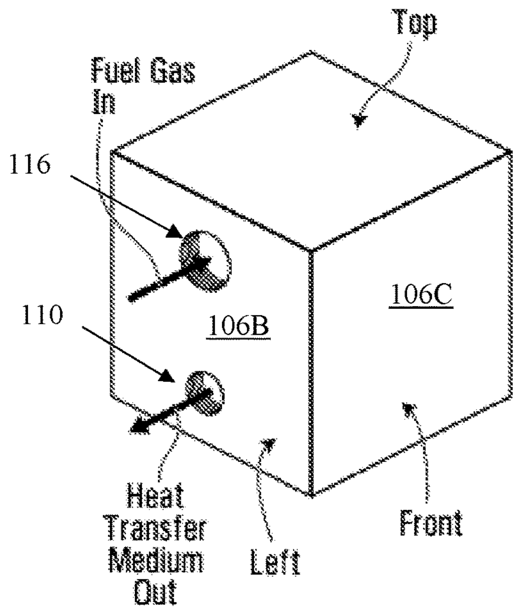


FIG. 4B

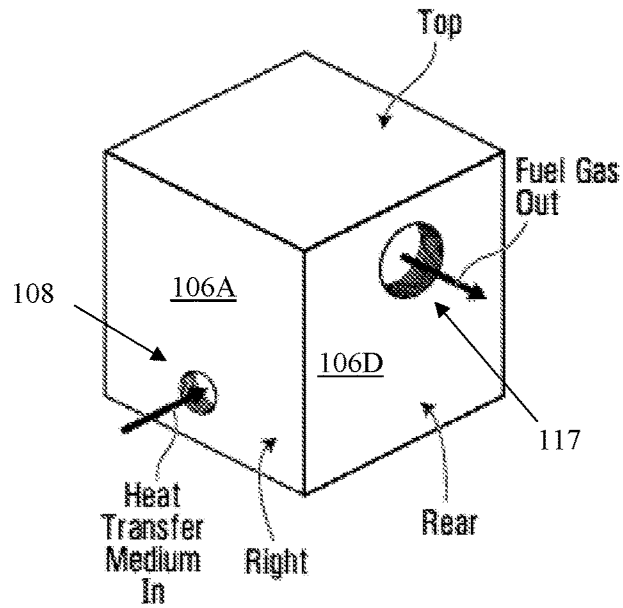


FIG. 4C

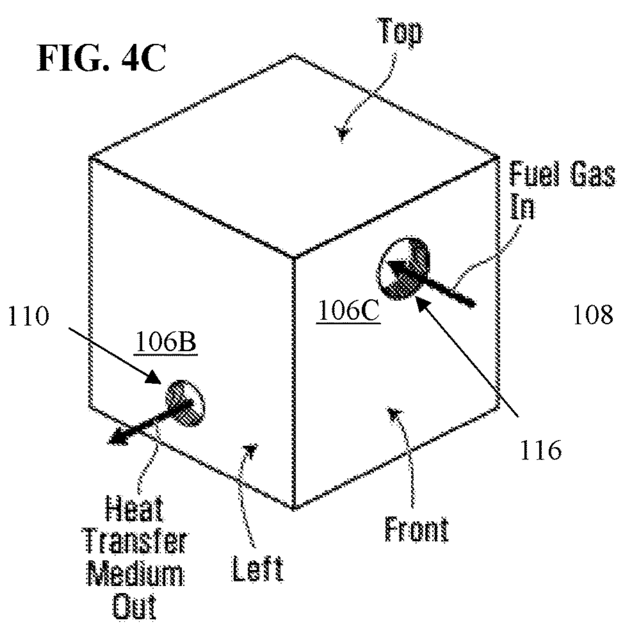
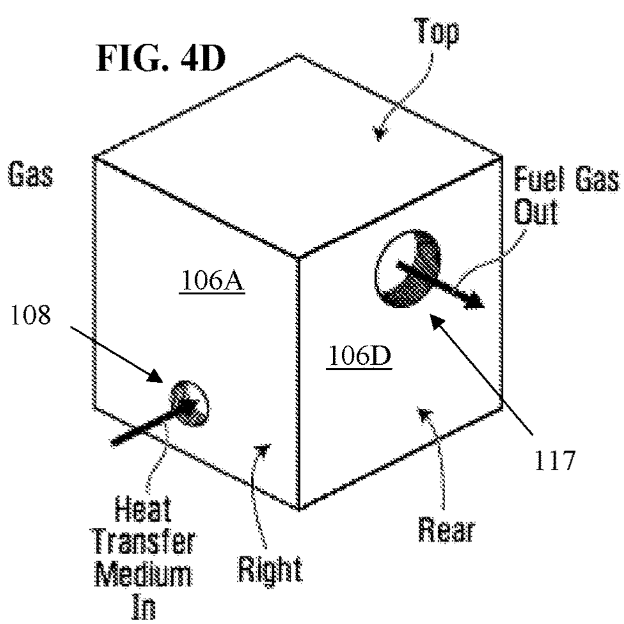


FIG. 4D



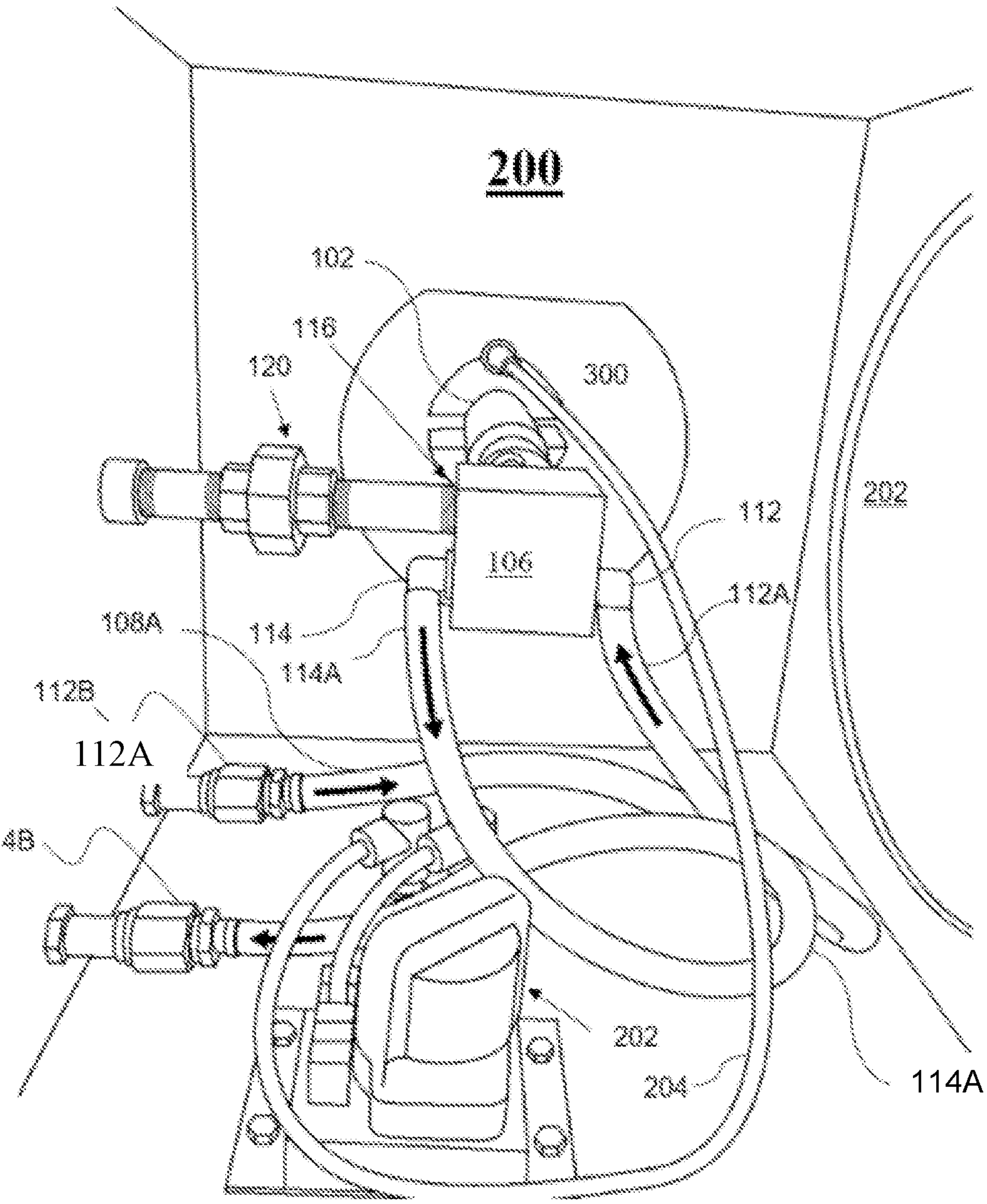

200
102
116
120
300
202
112
106
112A
108A
114
114A
112B
112A
114B
202
204
114A

FIG. 5

APPARATUS FOR HEATING A GAS BURNER UNIT

TECHNICAL FIELD

This disclosure generally relates to production of oil and/or gas. In particular, the disclosure relates to an apparatus for heating a gas burner unit.

BACKGROUND

Oil and gas producers often use a gas-burning unit (GBU) to burn off gas, such as produced gas, that originates from a subterranean reservoir. The burned off gas can be used as a source of heat for warming tanks that house produced fluids and solids and to heat other features present on a wellsite. Because the reservoir can also contain water, the produced gas itself may contain water and/or water may become entrained in the produced gas. In cold climates, the water that comes to the surface with the produced gas can freeze within the GBU, causing the GBU to malfunction and require maintenance or replacement.

Typically, the problem of having water freeze within the GBU is addressed by placing a heat radiator unit close to an orifice of an intake member of the GBU. As shown in FIG. **2**, a GBU **8** has a main burner barrel **10** with an intake member **12**. The main burner barrel **10** can receive a gas, such as produced gas, and perform a controlled combustion of the received gas will occur within the barrel **10**. The intake member **12** receives air from outside the GBU **8** for mixing with a fuel gas, often times the produced gas, for maintaining control over the combustion of the received gas. A radiator heater **14**, such as a pre-air radiator heater, is shown a predetermined distance X from a side of the barrel **10** and the intake member **12**. Additionally or alternatively, the radiator heater **14** can be positioned proximal the end of the barrel **10** where the intake member **12** is located, shown as a predetermined distance of X**1**. Typically, the radiator heater **14** is positioned a predetermined distance of about 6-15 inches (1 inch equals about 2.54 cm) from the outer surface of the barrel **10** and/or the intake member **12**. With this known approach, the air that enters the GBU **8** by the intake member **12** is warmed in an effort to prevent freezing of the produced-gas water content. However, if the ambient temperature drops substantially below the freezing point of water the heat radiator **14** may not provide sufficient heat that can travel the predetermined distance to heat the GBU **8**. As such water present in the intake member **12** or elsewhere in the GBU **8** can freeze.

Additionally, the GBU **8** may also include a glycol heating system (not shown) and often times a heat radiator **14** can impart flow restrictions in the glycol flow lines, which in turn can strain fittings and connectors of the glycol heating system.

SUMMARY

The embodiments of the present disclosure relate to a heater block for transferring heat from a heat transfer fluid to an intake of a gas burner unit. The heater block comprises a body and the body defines: an input port for receiving a heat transfer fluid and an output port for egress of the heat transfer fluid. The body also defines a first internal fluid conduit that extends between the first port and the second port through the heater block. The body also defines a fuel inlet port for receiving a fuel fluid; a fuel outlet port for egress of the fuel fluid; and, a second internal fluid conduit that extends between the fuel inlet port and the fuel outlet port. Due to the design of the heater block, the first internal fluid conduit and the second internal fluid conduit are fluidly separated so that there is no mixing of the heat transfer fluid and the received fuel fluid.

Without being bound by any particular theory, the heater block of the present disclosure can transfer heat from the heat transfer fluid to the received fuel fluid, air passing in proximity to the heater block or combinations thereof. These heat transfers can reduce, substantially prevent or prevent the freezing of water within the received fuel fluid and/or the air as it enters an intake member of a gas burning unit.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the present disclosure will become more apparent in the following detailed description in which reference is made to the appended drawings.

FIG. **1** shows a well site with a produced fluid tank system.

FIG. **2** shows as schematic of a known radiator heater arrangement for warming intake air, fuel fluids or both of a produced gas burner.

FIG. **3** shows a top plan view of a heater system according to embodiments of the present disclosure, with internal fluid conduits shown in dashed lines and fluid flow directions shown with arrows.

FIG. **4** shows two sides of two embodiments of a heater block according to the embodiments of the present disclosure, wherein FIG. **4**A is an isometric view that shows a front side and a left side of a heater block; FIG. **4**B is an isometric view that shows a back side and a right side of the heater block of FIG. **4**A; FIG. **4**C is an isometric view that shows a front side and a left side of another embodiment of a heater block; and, FIG. **4**D is an isometric view that shows a back side and a right side of the heater block of FIG. **4**C.

FIG. **5** shows portions of a system according to embodiments of the present disclosure.

DETAILED DESCRIPTION

FIG. **1** shows a wellsite **1000** with one or more produced fluid tanks **300**. Each tank **300** can receive produced fluids from a wellhead (not shown) via one or more produced-fluid conduits **310**. According to the embodiments of the present disclosure, the wellsite **1000** can include a housing **200** for housing one or more components of a gas-burning unit (GBU), where the housing **200** is positioned on or proximal a sidewall of a tank **300**. As discussed further below, a burner barrel of the GBU can extend into a portion of a sidewall of the tank **300** and contain a controlled combustion process therein for heating the contents of the tank **300**.

The embodiments of the present disclosure relate to an apparatus and system for heating an intake member of a GBU **100**. The GBU **100** comprises a main burner barrel **102**, an intake member **104** and a heater block **106**. The GBU **100** can receive fuel gas and perform a controlled combustion of the received fuel gas to generate heat. The main burner barrel **102** can be of various designs and dimensions, depending on the type and amount of gas it will receive and burn through the controlled combustion process. The main burner barrel **102** can be positioned within a portion of a produced-fluid tank **300**, where such portion may be an inward extension of the sidewall, to transfer heat to a mixture of produced fluids housed within the tank **300**. The received fuel gas may be produced gas from a subterranean oil and/or gas reservoir. Due to the presence of water in the reservoir, the received gas also includes water.

The intake member **104** draws gas, such as air, from outside the GBU **100** into the barrel **102** and fuel gas from a fuel source, wherein the fuel source can be a source of produced gas such as a wellhead or another fluid conduit. As will be appreciated by those skilled in the art, the air may also contain water that can freeze inside the intake member **104** when ambient temperatures are cold enough. The intake member **104** has a first end **104**A and a second end **104**B and it defines an internal fluid conduit therebetween (not shown). The first end **104**A has a first connector **105**A that is connectible to the heater block **106** according to the embodiments of the present disclosure. The second end **104**B has a second connector **105**B that is connectible to the barrel **102**. As will be appreciated by those skilled in the art, the first connector **105**A and the second connector **105**B can be any type of industry approved and safety rated connector for connecting fluid conduits that convey flammable fluids. For example, the first connector **105**A and the second connector **105**B may be threaded connectors or connectors that are welded together. The first connector **105**A and the second connector **105**B may have the same outer diameters, or different outer diameters. Proximal the first end **104**A, the intake member **104** defines one or more intake apertures **107** for drawing air into the internal conduit. In some embodiments of the present disclosure, the intake member **104** can be made of a thermally conductive material, such as a metal or metal alloy including but not limited to: copper, aluminum, brass, steel, bronze, stainless steel and steel. In some embodiments of the present disclosure, the intake member **104** is made of a material with a greater potential to conduct thermal energy as compared to the materials that the barrel **102** is made of.

The heater block **106** transfers heat to a received fuel fluid, the intake member **104**, air entering the intake member **104** or both to reduce, substantially prevent or prevent freezing of any of the water content of the received gas, any air entering the intake member **104** or combinations thereof. The heater block **106** is made of a thermally conductive material. For example, the heater block **106** may be made of a metal or an alloy. In some embodiments of the present disclosure, the heater block **106** is made of a material with a greater potential to conduct thermal energy as compared to the materials that the barrel **102** is made of. In some embodiments of the present disclosure, the heater block **106** can be made of a thermally conductive material, such as a metal or metal alloy including but not limited to: copper, aluminum, brass, steel, bronze, stainless steel and steel.

The heater block **106** defines a first internal conduit X and a second internal conduit Y, each for conveying a fluid through different flow paths within the heater block **106**. In some embodiments of the present disclosure, the first internal conduit X (shown in FIG. **3** by the larger the dashed lines with the flow direction indicated by the larger solid arrows) can convey a heat transfer fluid through the heater block **106** between a first side **106**A and a second opposite side **106**B. In some embodiments of the present disclosure, the second internal conduit Y (shown in FIG. **3** by the smaller dashed lines with the flow direction indicated by the squiggled arrows) can convey a fluid fuel through the heater block **106** between a third side **106**C and a fourth side **106**D that is opposite to the third side **106**C and the fourth side **106**D is connectible to the intake member **104**. In some embodiments of the present disclosure, the second internal conduit Y can convey a fluid fuel through the heater block **106** from the first side **106**A or the second side **106**B to the fourth side **106**D that is opposite to the third side **106**C (as shown in FIG. **4**A and FIG. **4**B). The first internal conduit X and the second internal conduit Y are fluidly separated, meaning there is no fluid communication therebetween so that within the heater block **106** any fluid within the first internal conduit X does not mix with any fluid in the second internal conduit Y and vice versa. In some embodiments of the present disclosure, the first internal conduit X is substantially straight, without any curves or bends. In some embodiments of the present disclosure, the second internal conduit Y is substantially straight (as shown in FIG. **3** and FIG. **4**B and FIG. **4**D), or it may have define a turn, for example, when the second internal conduit Y extends from the first or second side **106**A, **106**B to the fourth side **106**D (as shown in FIG. **4**A and FIG. **4**B).

In some embodiments of the present disclosure, the heater block **106** defines an input port **108** (shown defined on the first side **106**A) and an output port **110** (shown defined on the second side **106**B) and the first internal conduit X extends therebetween. The input port **108** is connectible to a fitting **112** and the port **110** is connectible to a fitting **114**. The internal conduit X extends between the input port **108** and the output port **110** for providing fluid communication therebetween and between fitting **112** and fitting **114**. The heater block **106** can receive a heat transfer fluid via the input port **108** and egress the heat transfer fluid via the output port **110** while passing through the first internal conduit X of the heater block **106**. In some embodiments of the present disclosure, the fittings **112**, **114** are made of a thermally conductive material.

The heater block **106** also defines a fuel inlet port **116** (shown defined on the third face **106**C) and a fuel outlet port **117** (shown defined on the fourth face **106**D).

FIG. **5** shows a non-limiting example of the heating block **106** as part of the GBU **100** installed within the housing **200** that is secured on an exterior wall of a produced fluid tank **300**. The housing **200** may have four sidewalls and a top and bottom wall. Optionally, one sidewall may include a flame arrestor **202**. Another sidewall may define one or more ports for receiving fittings to permit fluid communication of the fuel fluid (via conduit **120**, which may be one or more lengths of suitable conduit for conveying a flammable fuel fluid) and the heat transfer fluid (via fitting **112**B and conduit **112**A and conduit **114**A and fitting **114**B) from outside the housing **200** to inside the housing **200** and vice versa. The housing **200** may house an electrical spark and/or flame control system **202** that includes an ignition control line **204** that can contribute towards the controlled combustion process that can occur inside the barrel **102**. Another sidewall of the housing **200** may define an aperture through which the barrel **102** extends out of the housing **200** for heating the contents of the produced fluid tank **300**.

The heat transfer fluid may ingress into the housing **200** via conduit **210**, fitting **112**B and then be conveyed to fitting **112** via the conduit **112**A. The heat transfer fluid may then pass through the first internal conduit X of the heating block **106**, transfers from the heat transfer fluid to heat the heater block **106**. The heat transfer fluid may then egress from the first internal conduit X and travel between fitting **114** and **114**B, via the conduit **114**A, for egress from the housing **200**. The flow rates and volume of the heat transfer fluid within the conduits **112**A and **114**A and, therefore, within the first internal conduit X of the heating block **106** may be controlled by a pump and controller system, as known in the art, outside the housing **200** (not shown). In some embodiments of the present disclosure, the heat transfer fluid can be a liquid, a gas or a mixture thereof. In some embodiments of the present disclosure, the heat transfer fluid may be oil-based or water-based. In some embodiments of the present disclosure, the heat transfer fluid may be a substantially pure fluid or it may be a mixture of constituent fluids. In some embodiments of the present disclosure, the heat transfer fluid has a freezing point that is sufficiently low so that it can be used in climates with temperatures that can reach below 0° C. or below −5° C. or below −10° C. or below −15° C. or colder. In some embodiments of the present disclosure, the heat transfer fluid may be glycol or a mixture of glycol and water. For example, further conduits may be fluidly connected to the pump and controller system for providing heat conducting fluid to warm one or more of the production conduits **310**. In some embodiments of the present disclosure, the heat transfer fluid may be heated to a temperature of between about 50° C. and 110° C. so that when the heat transfer fluid enters the heating block **106** the thermally conductive material of the heating block **106** will facilitate a transfer of heat from the heat transfer fluid through the heating block **106** and at least a portion of that transferred heat will transfer into the received fuel fluid.

Without being bound by any particular theory, the heating block **106** may transfer heat from the heat transfer fluid to the received fuel fluid by conduction. The heating block **106** may transfer heat from the heat transfer fluid to the received fuel fluid by convection. The heating block **106** may transfer heat from the heat transfer fluid to air that is passing by the heating block **106** before it enters the intake member **104**. Additionally, the heating block **106** may transfer heat from the heat transfer fluid to the intake member **104** by conduction, convection or a combination thereof. Heating of the received fuel fluid that is conducted through the heating block **106**, heating of the air that is passing in proximity to the heating block **106**, heating of the intake member **104** or combinations thereof may reduce, substantially prevent or prevent freezing of water within the received fuel fluid and/or the air passing in proximity to the heating block **106**.

The invention claimed is:

1. A heater block for transferring heat from a heat transfer fluid to an intake member of a gas burner unit, the heater block comprising:

(a) a body that defines:

(i) an input port for receiving a heat transfer fluid;

(ii) an output port for egress of the heat transfer fluid,

(iii) a first internal fluid conduit that extends between the input port and the output port through the heater block;

(iv) a fuel inlet port for receiving a fuel fluid;

(v) a fuel outlet port for egress of the fuel fluid, wherein the fuel outlet port is connectible to the intake member of the gas burner unit by a connector that is configured to convey the fuel fluid, wherein the fuel fluid is flammable; and

(vi) a second internal fluid conduit that extends between the fuel inlet port and the fuel outlet port,

the first internal fluid conduit and the second internal fluid conduit are fluidly separated and wherein the body is made of a thermally conductive material for transferring heat from the heat transfer fluid to the intake member.

2. The heater block of claim **1**, wherein the input port and the output port are defined on opposing faces of the body.

3. The heater block of claim **1**, wherein the fuel inlet port and the fuel outlet port are defined on opposing faces of the body.

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