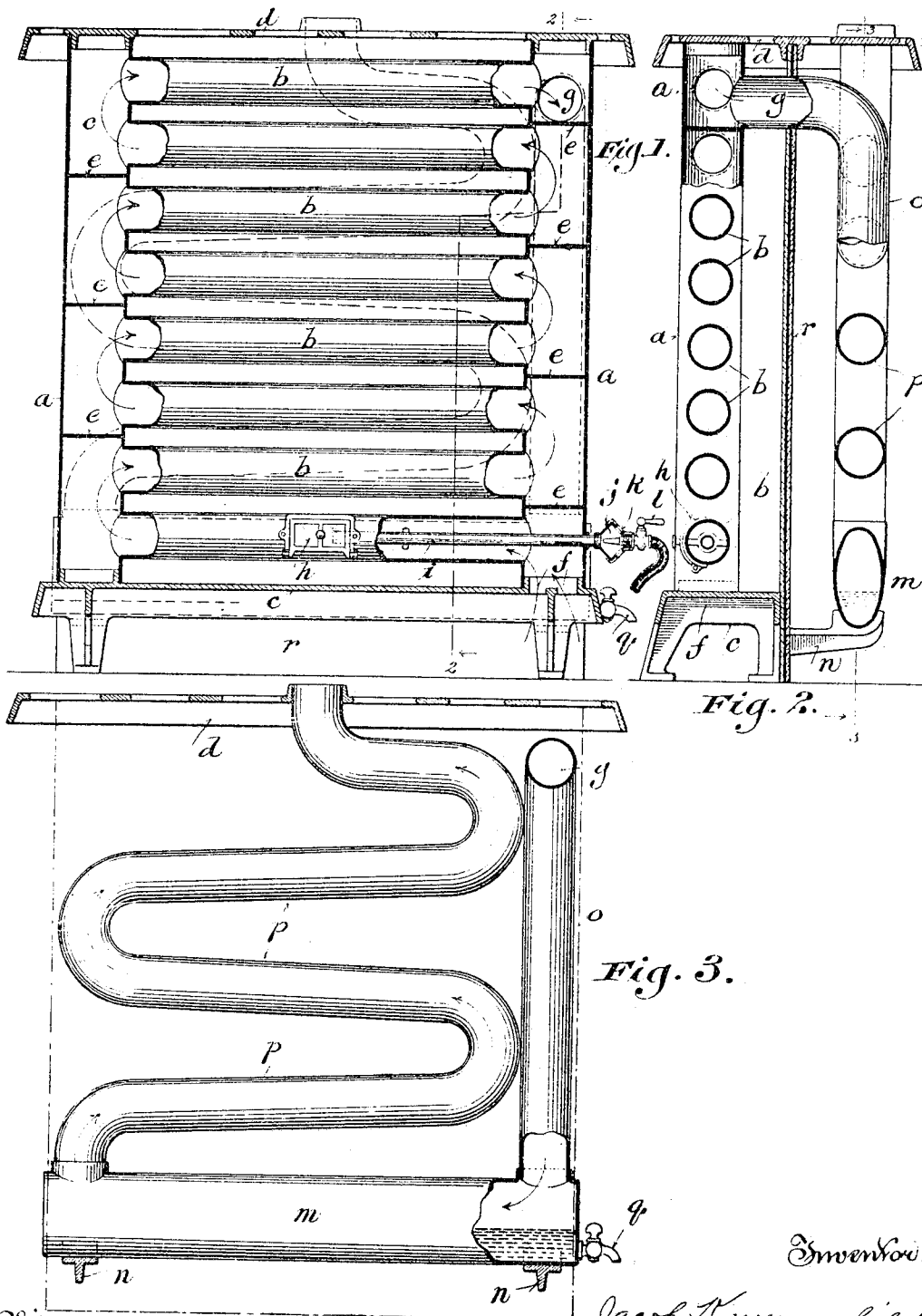


No. 798,801.

PATENTED SEPT. 5, 1905.

J. KNOERNSCHILD.
GAS HEATER.

APPLICATION FILED FEB. 15, 1904.



Witnesses
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UNITED STATES PATENT OFFICE.

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GAS-HEATER.

No. 798,801.

Specification of Letters Patent.

Patented Sept. 5, 1905.

Application filed February 15, 1904. Serial No. 193,580.

To all whom it may concern:

Be it known that I, JACOB KNOERNSCHILD, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Gas-Heaters, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

This invention relates to heaters designed to burn gas and to warm the air of rooms.

The main objects of the invention are to secure greater heating capacity and economy of fuel, to prevent the contamination of the air of the room in which the heater is located, and generally to improve the construction and operation of heaters of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters designate the same parts in the several figures.

Figure 1 is a view, partly in front elevation and partly in vertical longitudinal section, of a heater embodying my invention. Fig. 2 is an end elevation and vertical cross-section on the line 2 2, Fig. 1, showing the condenser associated with the radiator; and Fig. 3 is a sectional view on the line 3 3, Fig. 2, showing the detail construction of the condenser.

The radiator consists generally of two hollow or tubular uprights or columns *a*, connected by cross tubes or flues *b*, arranged one above another, and is mounted upon a suitable base *c* and surmounted by an open-work top plate *d*, giving the heater an appearance approximating that of a steam-radiator.

The uprights or columns *a* are formed or provided with alternating cross walls or partitions *e*, which are so arranged as to cause the hot gases and products of combustion to pass back and forth in opposite directions through the adjacent tubes *b* and the compartments formed by said partitions in the columns *a* from the lower to the upper part of the radiator, as indicated by arrows on Fig. 1.

An air-inlet opening *f* is provided in the base at the lower end of one of the columns

a, and one of the columns is formed or provided at the top with an outlet opening or connection *g*. The inlet and outlet openings may be arranged, as shown, in connection with the same column, or with a slightly-modified arrangement of the cross-tubes and partitions they may be arranged in connection with different columns, so that air will enter the heater at the bottom of one column and the waste gases or products of combustion will escape at or near the top of the other column. The lower tube *b* is provided at or near the center with an opening and a mica door *h* for lighting the burner and observing its operation.

The burner, which is of the Bunsen type, consists of a long tube *i*, passing through one column *a* into the lower tube *b* and terminating at its inner end opposite or near the door *h*, a mixing-chamber *j*, having adjustable air-inlet openings at the outer end of the tube, and a gas-nozzle *k*, provided with a cock *l* and projecting axially through the mixing-chamber to a point in or near the outer end of the burner-tube.

The radiator may be constructed either of cast or sheet metal or in part of sheet metal and in part of cast metal. Preferably the uprights or columns and the top and bottom pieces will be cast and the cross-tubes will be made of sheet metal to more readily transmit to the outside air the heat of the flame and gases passing through them.

To avoid the loss of heat incident to the use of an ordinary chimney or smoke-flue connection and to prevent vitiating the air by discharging the products of combustion into the room in which the heater is located, a condenser is connected with the outlet *g* of the radiator. The condenser, which is preferably located behind and hidden by the radiator, consists of a horizontal reservoir-pipe *m*, supported by brackets *n n* on the base *c* and connected at one end by a vertical pipe *o* with the outlet *g* from the radiator and at the other end by an ascending sinuous escape-pipe *p* with a chimney, smoke-flue, ventilator shaft or pipe leading and opening to the outside atmosphere. The straight parts of the pipe *p* are pitched downward sufficiently to insure the drainage of the water of conden-

sation into the pipe *m*, which is provided with a cock *q* or other connection for drawing or conducting off either at intervals or continuously the water which collects therein.

5 A shield or partition *r*, constructed wholly or partially of some suitable non-conductor of heat, such as asbestos, is interposed between the radiator and condenser and prevents the former from heating the latter and
10 detrimentally affecting its operation.

The radiator possesses advantages as a heater independently of the condenser and may under certain conditions be used without it by connecting the outlet *g* directly with
15 a chimney or other escape-flue leading to the outside atmosphere; but ordinarily its operation will be found to be more economical and satisfactory in connection with the condenser.

The operation of the heater may be briefly
20 explained as follows: The burner is lighted by opening the door *h* and is regulated by means of the cock *l* and the valve controlling the air-inlet openings in the mixer *j*, the flame being observed through said door. The
25 heat developed by the combustion of the gas produces an upward current, as indicated by arrows on Fig. 1, back and forth through the cross-tubes *b*, drawing air into the heater through the opening *f* in the base and discharging the products of combustion through
30 the outlet connection *g* at the top of the heater into the condenser. In their zigzag or sinuous course through the heater the hot gases and products of combustion transfer
35 their heat to the columns *a* and tubes *b*, which have a large total area and communicate their heat by convection and radiation to the surrounding air and adjacent objects. All the
40 available heat developed by the combustion of the gas is thus absorbed by the extended metal surfaces, with which the hot gases and products of combustion come in contact in their course through the heater, and is
45 communicated to the surrounding air and adjacent objects with the least possible loss. The waste products of combustion escaping from the heater in the form of steam mingled with carbonic-acid gas and nitrogen are directed downward through the pipe *o* into the
50 reservoir-pipe *m*, from which uncondensed vapor and waste gases pass into the escape-pipe *p*. The extended cooling-surface afforded by the pipes *o*, *m*, and *p* causes the steam to condense in its passage through them, there-
55 by tending to produce a vacuum therein and to maintain the upward draft through the radiator. The water formed by the condensation of steam collects in the reservoir-pipe *m*, from which it is drawn off from time to time
60 through the cock *q*, or may be continuously discharged through a suitable connection with a sewer or drain. The carbonic-acid gas, nitrogen, and any noxious gases entrained with steam from the radiator into the condenser,

parting with heat and moisture during their
65 sinuous passage through the condenser, are finally discharged from the upper end of the escape-pipe *p* into the chimney or other waste-flue. The condenser thus serves to maintain
70 the draft of the heater to avoid the loss of heat incident to the use of the ordinary chimney or smoke-flue connection and to prevent vitiating the air of the room in which the heater is located.

The columns *a* and cross-tubes *b* may be inclined more or less from the vertical and horizontal positions in which they are shown, and their number, shape, and size may be varied within certain limits without materially affecting the operation of the heater. In short, various modifications in the minor details of construction and in the arrangement of the component parts of the device may be made within the intended scope of my invention.

I claim—

1. In a gas-heater, the combination of tubular columns divided by partitions into alternating compartments, cross-tubes connecting said compartments in series and forming
90 therewith a sinuous passage from an inlet-opening in the lower part of the heater to an outlet-opening in the upper part thereof, and a tubular burner passing transversely through one of said columns into the lower cross-tube and provided outside of said column with an
95 air-supply opening and a gas-supply connection, substantially as described.

2. In a gas-heater, the combination of a radiator having an air inlet opening and an outlet opening and provided with a suitable
100 burner, and a condenser connected with said outlet-opening and having a gas-escape opening or connection at or near the top and a liquid-escape opening or connection at or near the bottom, substantially as described.

3. In a gas-heater, the combination of a radiator provided with a burner and having an air inlet and an outlet, a condenser connected with said outlet and having a gas-outlet at or near the top and a liquid-waste connection at
110 or near the bottom, and a non-conductor-of-heat shield interposed between said radiator and condenser, substantially as described.

4. In a gas-heater, the combination of a radiator provided with a burner, an air inlet
115 opening and an outlet opening, and a condenser consisting of a water reservoir or receptacle connected with said outlet-opening and provided with a liquid-discharge connection, and a sinuous gas-escape pipe leading upwardly from said reservoir, substantially as described.

5. In a gas-heater, the combination of a radiator comprising tubular columns divided by partitions into alternating compartments and
125 cross-tubes connecting said compartments in series and forming therewith a sinuous passage from an inlet-opening in the lower part

of the heater to an outlet-opening in the upper part thereof, and a condenser consisting of a water reservoir or receptacle connected with said outlet-opening and provided with a liquid-discharge connection and a sinuous gas-escape pipe leading upwardly from said reservoir, substantially as described.

In witness whereof I hereto affix my signature in presence of two witness.

JACOB KNOERNSCHILD.

Witnesses:

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CHARLES KNOERNSCHILD.