(No Model.)

2 Sheets—Sheet 1.

# G. RAVEN.

## SMOKE CONSUMING FURNACE.

No. 337,436. Patented Mar. 9, 1886.

*Fig. 1.*

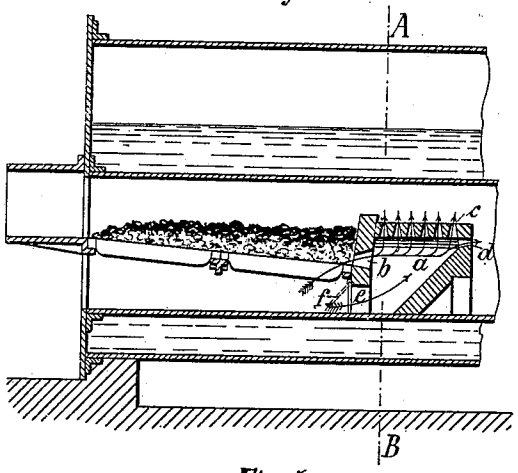



*Fig. 2.*

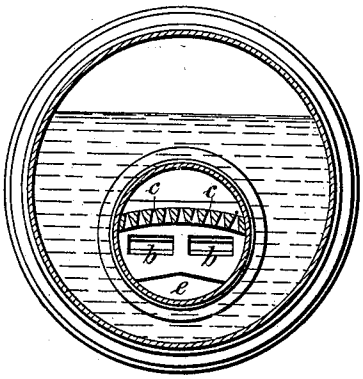



*Fig. 5.*

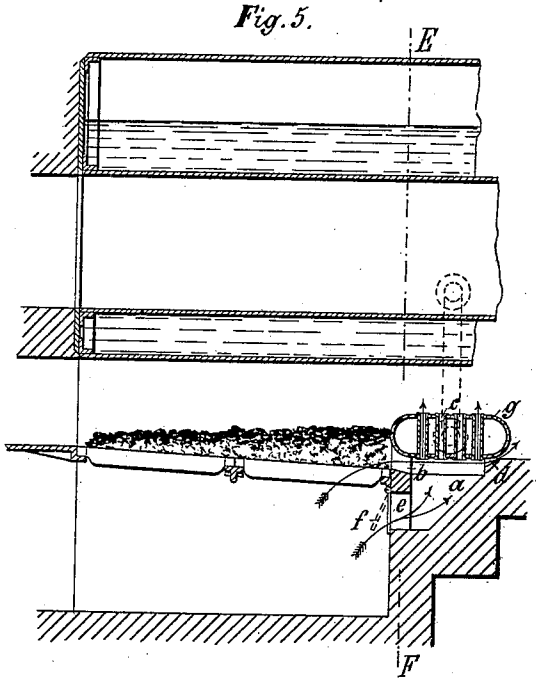



*Fig. 6.*

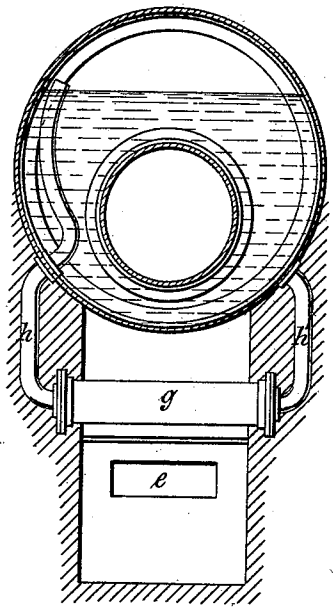
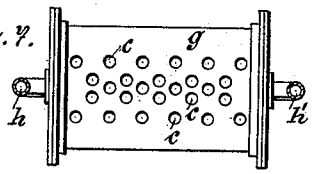



*Fig. 7.*




Attest:

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C. M. Woodbock

Inventor:

Gustav Raven

per Henry Orth

his atty

(No Model.) 2 Sheets—Sheet 2.

# G. RAVEN.

## SMOKE CONSUMING FURNACE.

No. 337,436. Patented Mar. 9, 1886.

*Fig. 3.*

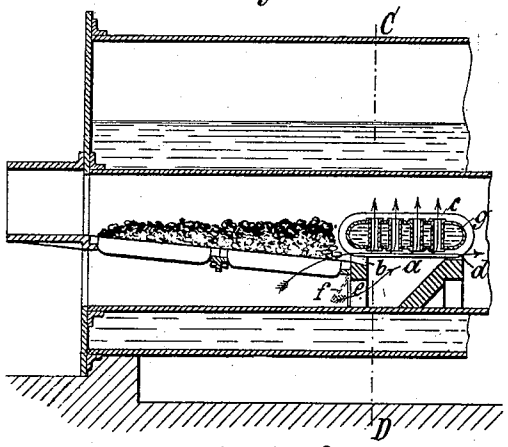



*Fig. 4.*

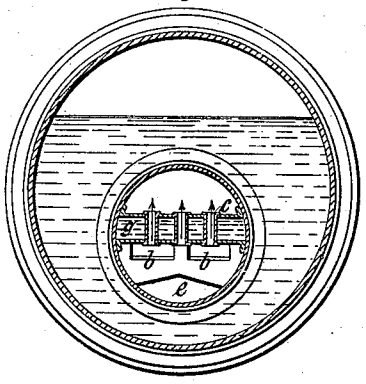



*Fig. 8.*

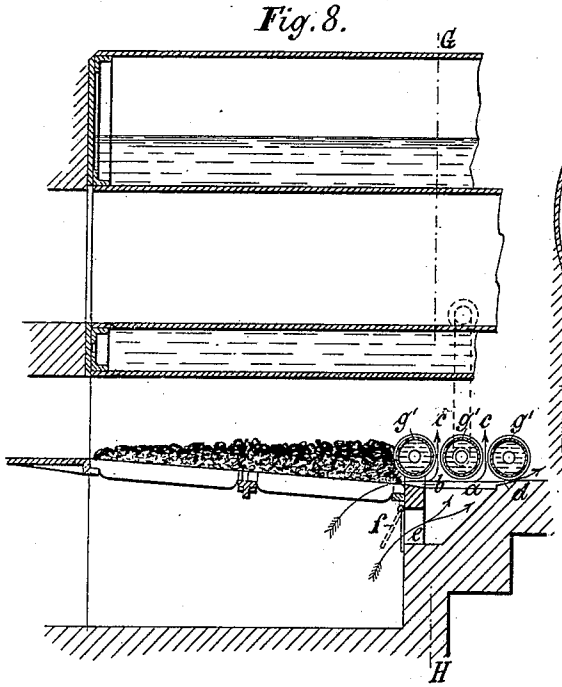



*Fig. 9.*

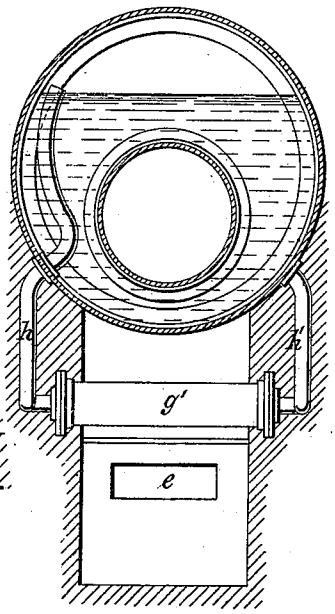
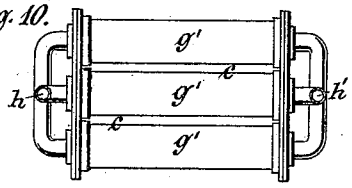



*Fig. 10.*

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Inventor:
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per Henry Orth
his atty.

# UNITED STATES PATENT OFFICE.

GUSTAV RAVEN, OF DRESDEN, SAXONY, GERMANY.

## SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 337,436, dated March 9, 1886.

Application filed October 6, 1885. Serial No. 179,171. (No model.) Patented in Belgium July 9, 1885, No. 69,544; in France July 9, 1885, No. 170,050; in England July 20, 1885, No. 8,740, and in Austria-Hungary October 25, 1885, No. 26,478 and No. 55,267.

*To all whom it may concern:*

Be it known that I, GUSTAV RAVEN, engineer, a subject of the King of Prussia, residing at Dresden, Sedanstrasse 26, Saxony, German Empire, have invented certain new and useful Improvements in Smoke-Consuming Furnaces or Fire-Places; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in smoke-consuming furnaces for steam-boilers and heating apparatuses generally; and it consists, essentially, in the construction of the fire-bridge to form a chamber, and in means for admitting a portion of the gases and products of combustion, and in means for conducting the said air and gases above and in rear of the fire-bridge, to be commingled with the smoke or partially-consumed products of combustion, to insure their complete combustion, substantially as hereinafter more fully described, and as set forth in the claims.

In the accompanying drawings, Figure 1 is a longitudinal vertical section of so much of a steam-boiler as is necessary to illustrate my invention. Fig. 2 is a transverse section thereof, taken on line A B of Fig. 1. Figs. 3, 5, and 8 and Figs. 4, 6, and 9, respectively, are views similar to Figs. 1 and 2, illustrating slight modifications of my invention, Figs. 4, 6, and 9 being sections taken on lines C D, E F, and C H of Figs. 3, 5, and 8, respectively. Figs. 7 and 10 are detail views of Figs. 5, 6 and 8, 9, respectively.

The object of this invention is to produce the complete combustion of the gases and products of combustion evolved from the fuel employed in heating steam-boilers, heaters, ranges, or stoves. This I attain by constructing the fire-bridge in rear of the grate hollow, so as to form a chamber, and by providing means whereby a portion of the gases and products of combustion, together with fresh air, are introduced into said chamber. The air introduced into the fire-bridge chamber mixes with the gases and products of combustion, and is highly heated by contact with the highly-heated gases and by the combustion of the unconsumed products of said gases resulting from such mixture. This highly-heated mixture of gases, which contains an excess of hydrogen, is caused to mingle with the unconsumed products of combustion evolved from the fuel, thereby producing their complete combustion.

In the drawings, B indicates a steam-boiler, C the grate, A the ash-pit, and F the fire-bridge. The latter is constructed to form a chamber, *a*, with an arched roof, as shown in Figs. 1 and 2, in which are formed a series of openings or passages, *c*. The chamber *a* communicates with the ash-pit, or, if desired, with the outer air, by means of an opening or passage, *e*, provided with a damper, *f*, for regulating the admission of air to said chamber directly from without or through the ash-pit, as shown. The chamber *a* is also in communication with the space above the grate by passages *b*, which are preferably made tapering outwardly, to prevent their being choked when stirring the fire. Through these passages *b* the highly-heated and nearly-consumed products of combustion are admitted to the chamber *a*, and escape through the passages *c* in the roof thereof, and through passages *d*, formed in the rear wall of the hollow fire-bridge, thus producing a draft therein, whereby air is drawn in through the passages or openings *e*. The entering air mixes with the products of combustion coming from the grate, and is heated by contact with said gases and by the consumption of the unconsumed parts thereof, the highly-heated mixture containing an excess of hydrogen, escaping through passages *c d*, mixes with the products of combustion passing over the fire-bridge, and produces the complete combustion of the non-consumed parts thereof.

Instead of forming the passages *b* in the front wall of the fire-bridge chamber, a vertical or slightly-inclined grate may be set into said wall.

Instead of producing an arched roof having passages *c* therein, as described in reference to Figs. 1 and 2, said roof may be made hollow and placed in communication with the boiler B, thereby utilizing the heat above and

below said roof for heating the boiler-water and generating steam. This I attain by forming the roof of the hollow fire-bridge of a flattened metallic casing or pipe in which are passages *c* for the gases from chamber *a*, said passages being formed by tubes in the same manner as the fire-tubes of a boiler, as plainly shown in Figs. 3 and 4.

The metallic hollow roof of the fire-bridge described may also be placed in communication with both the steam and water spaces of the boiler, as shown in Figs. 5 and 6, the pipe *h* communicating with the steam-space, and the pipe *h'* with the water-space, for obvious purposes. Finally, instead of forming passages in the hollow roof of the fire-bridge, the said roof may be formed of a number of hollow metallic cylinders or pipes communicating with one another, and by pipes *h* and *h'* with the steam and water spaces of the boiler, respectively, said cylinders being so arranged as to leave a space between them for the passage of the gases from chamber *a*, as plainly shown in Figs. 8, 9, and 10.

If desired, any well-known arrangement for preheating the air admitted to the chamber *a* may be employed for obvious purposes.

Having thus described the nature of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, the combination, with the grate and draft-flue, of a chambered fire-bridge in direct communication with the fuel on the grate and with the draft-flue and outer atmosphere, respectively, substantially as and for the purpose specified.

2. In a boiler-furnace, the combination, with the grate and draft-flue, of a chambered fire-bridge having a hollow roof in communication with the boiler-passages formed in said roof, and passages in its walls communicating with the space above the grate and with the outer atmosphere, substantially as and for the purpose specified.

3. In a boiler-furnace, the combination, with the grate and draft-flue, of a chambered fire-bridge having a hollow roof in communication with the steam and water spaces of the boiler-passages formed in said roof, and passages in its walls communicating with the space above the grate and with the outer air, substantially as and for the purposes specified.

4. In a boiler-furnace, the combination, with the boiler, the draft-flue, and the grate, of a chambered fire-bridge projecting into said draft-flue, and having passages in its roof and rear wall communicating with said flue, passages communicating with the fuel on the grate, and a valved passage communicating with the outer atmosphere, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

GUSTAV RAVEN.

Witnesses:
LÉON KLEMPERER,
PAUL DENCKMULLER.

Corrections in Letters Patent No. 337,436.

It is hereby certified that in Letters Patent No. 337,436, granted March 9, 1886, upon the application of Gustav Raven, of Dresden, Saxony, Germany, for an improvement in "Smoke Consuming Furnaces," errors appear in the printed specification requiring correction, as follows: In lines 40 and 49, page 2, the hyphens between the words "boiler" and "passages" should be stricken out and commas inserted instead; and that the Letters Patent should be read with these corrections therein to make it conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 16th day of March, A. D. 1886.

[SEAL.]

H. L. MULDROW,
*Acting Secretary of the Interior.*

Countersigned:

M. V. MONTGOMERY,
*Commissioner of Patents.*