

No. 701,861.

Patented June 10, 1902.

E. J. DUFF.
GAS FURNACE FOR STEAM BOILERS.

(Application filed July 17, 1901.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

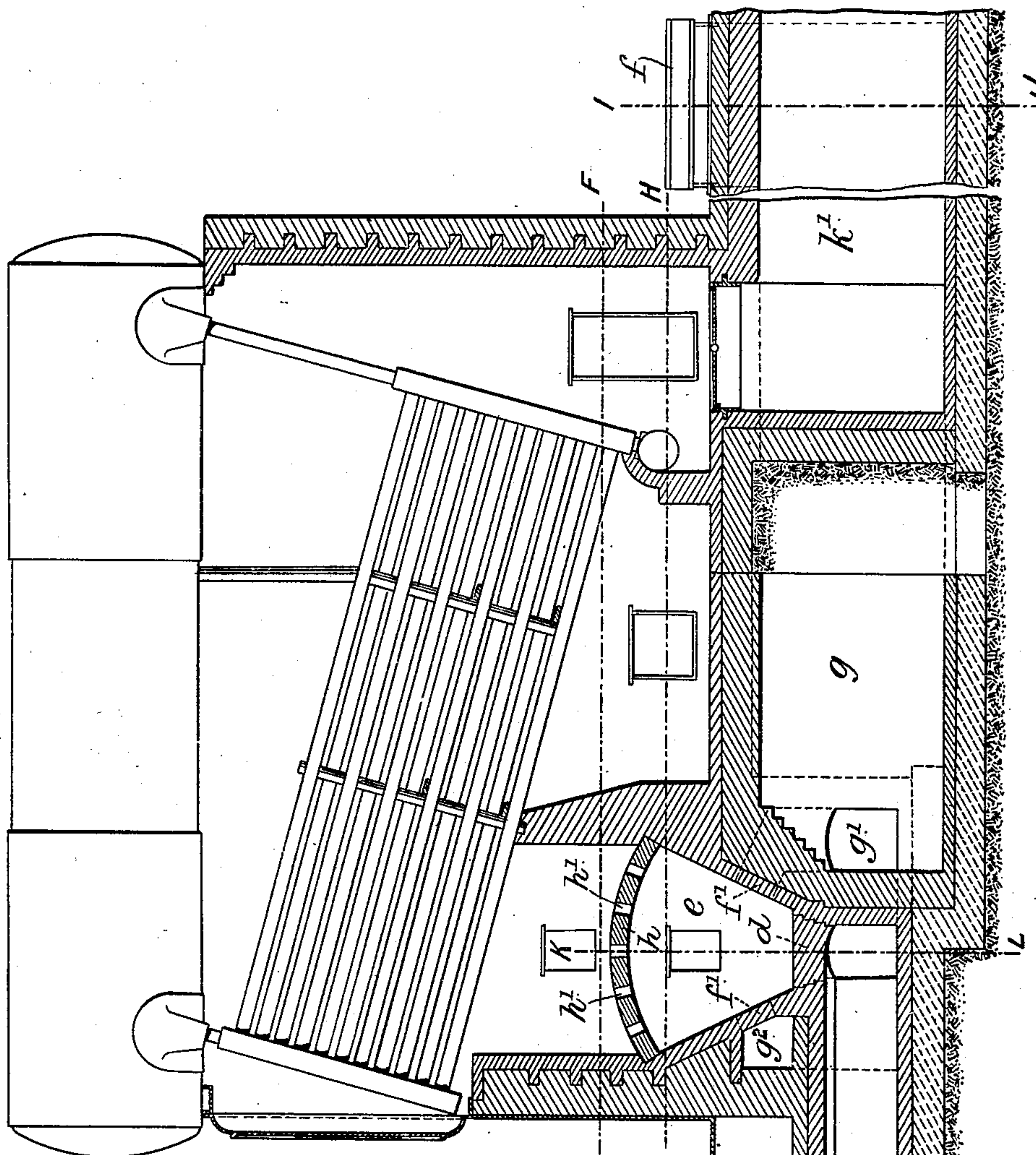
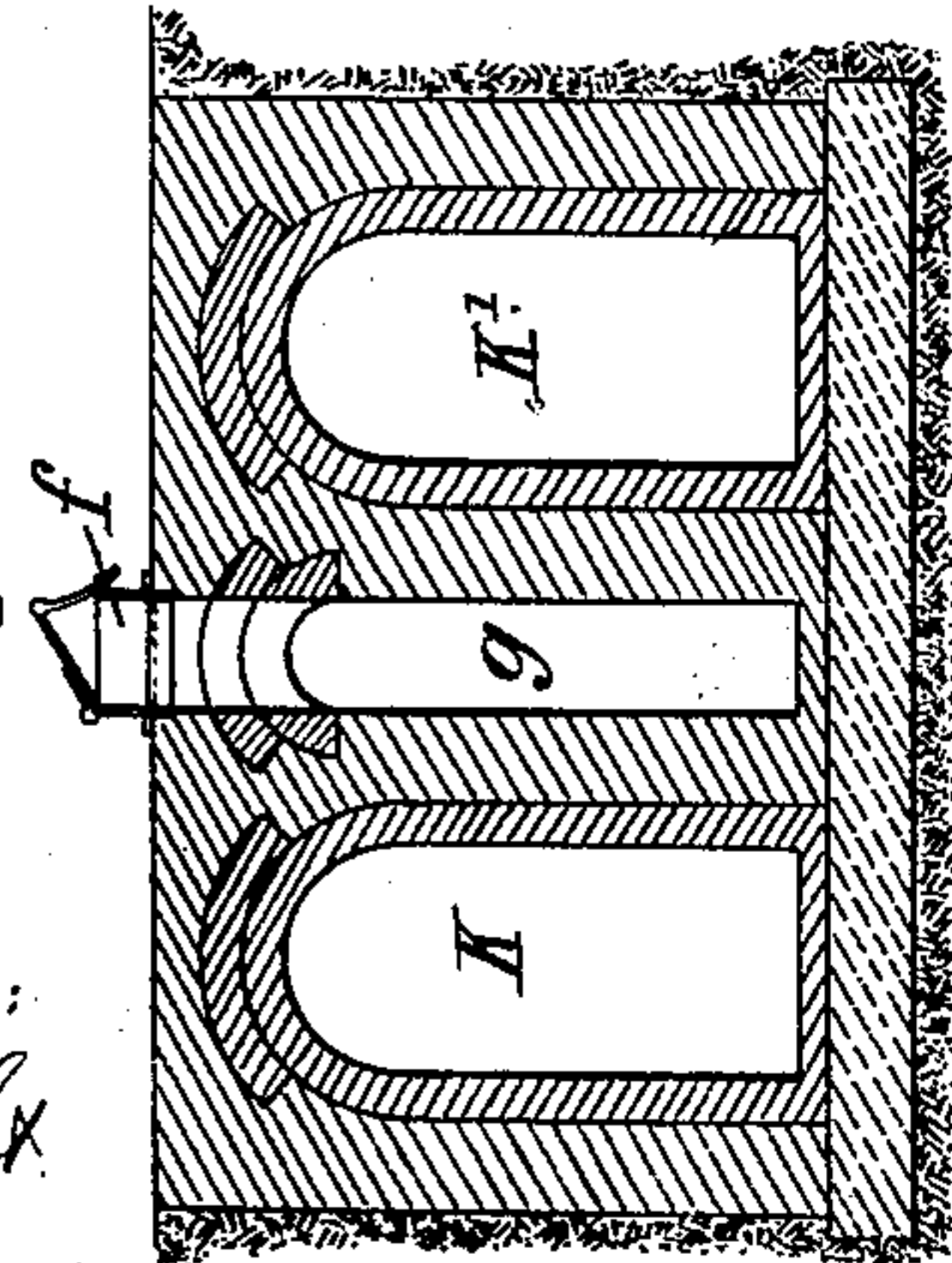


Fig. 3.



WITNESSES:
G. W. Wright
S. C. Connor

INVENTOR
EDWARD JAMES DUFF
BY *Horton and Horton*
HIS ATTORNEYS.

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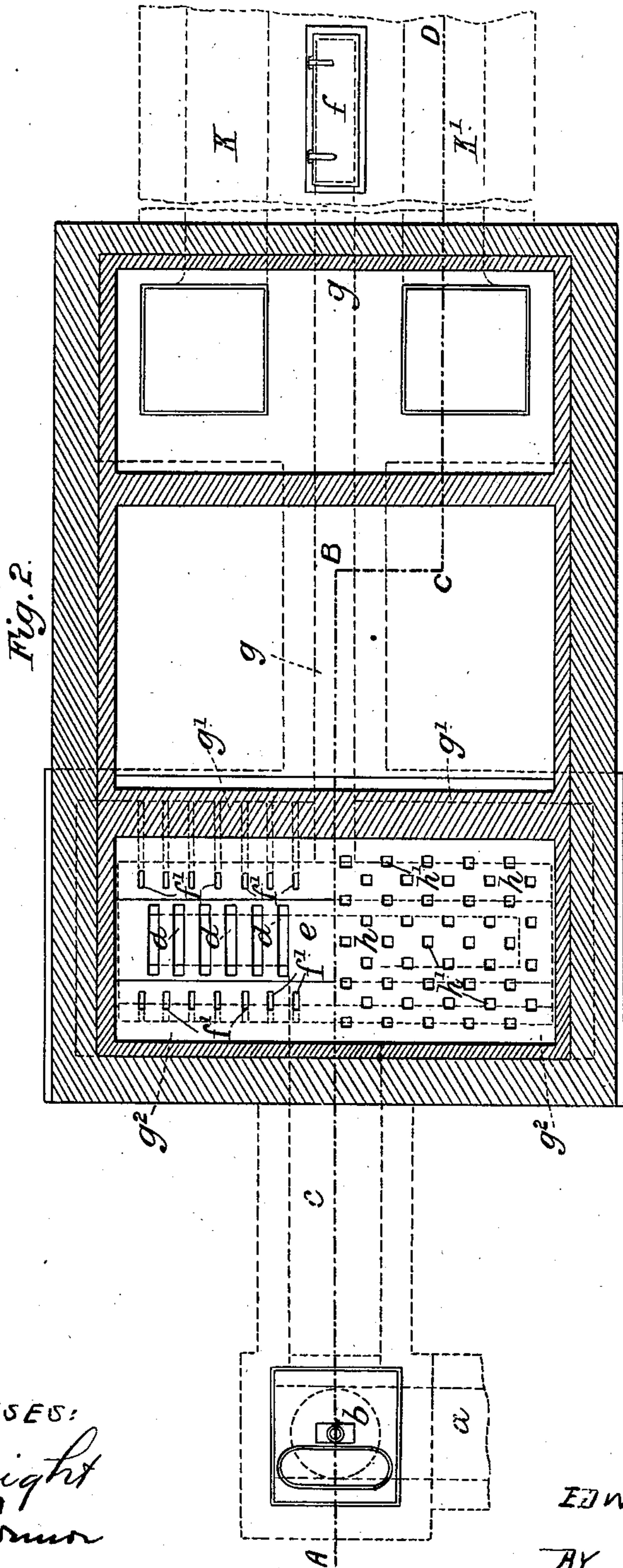
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F. W. Wright
S. C. Connor

INVENTOR
EDWARD JAMES DUFF
BY
Howson and Howson
HIS ATTORNEYS

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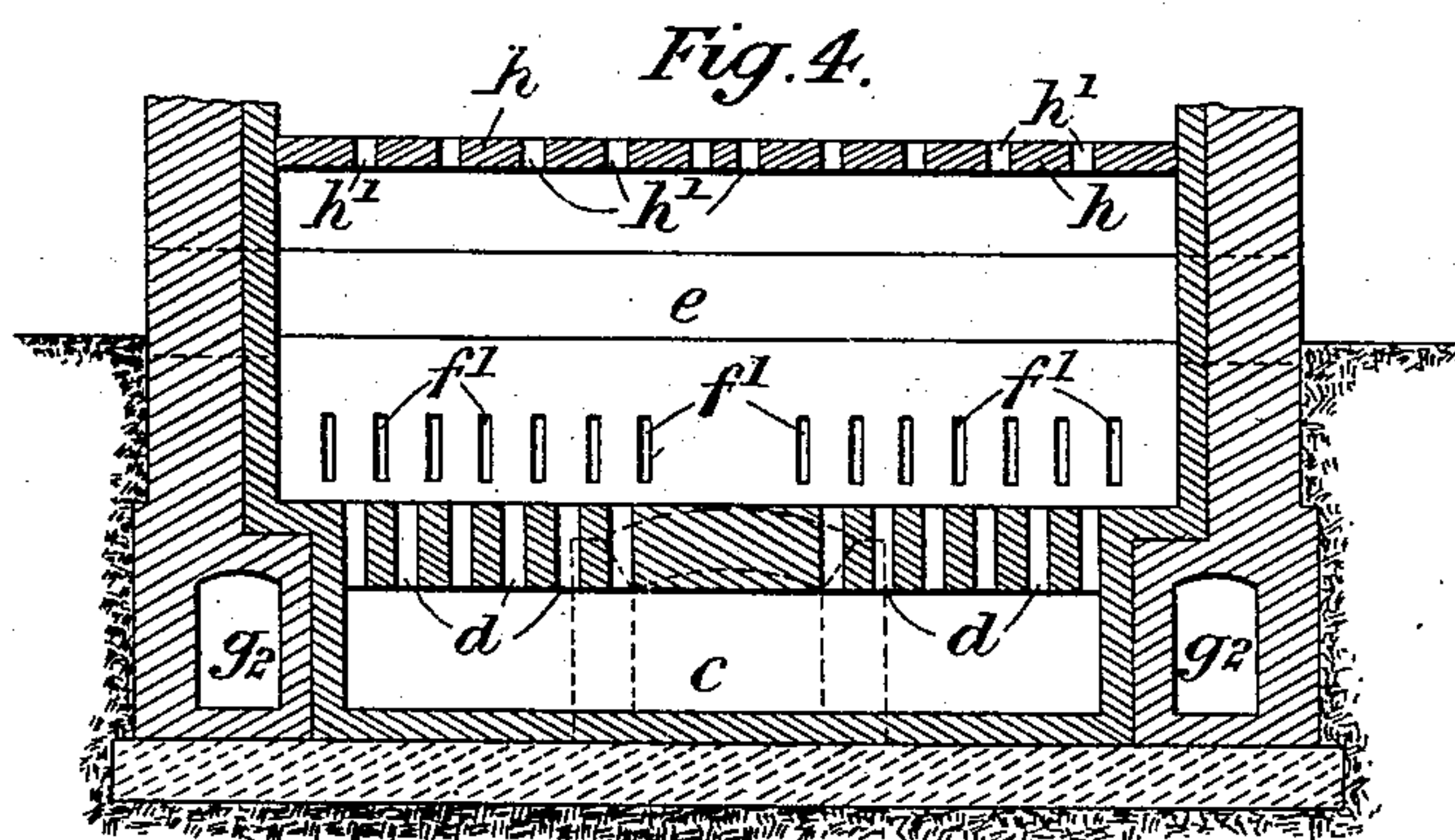
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BY

Howson and Howson
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

EDWARD JAMES DUFF, OF LIVERPOOL, ENGLAND, ASSIGNOR OF ONE-HALF
TO UNITED ALKALI COMPANY, LIMITED, OF LIVERPOOL, ENGLAND.

GAS-FURNACE FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 701,861, dated June 10, 1902.

Application filed July 17, 1901. Serial No. 68,663. (No model.)

To all whom it may concern:

Be it known that I, EDWARD JAMES DUFF, engineer, a subject of the King of Great Britain and Ireland, residing at 30 James street, Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Gas-Furnaces for Steam-Boilers or for other Heating Purposes; 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.

This invention relates to gas-furnaces, and is especially intended for application to the furnace of steam-boilers; but it can also be employed for furnaces used for other heating purposes.

The said invention has for its object to provide means whereby the gas is very efficiently consumed and the otherwise waste heat utilized.

According to this invention the air to be mixed with the gas for consumption is passed through a passage or passages arranged, as hereinafter described, in proximity to another passage or other passages through which the products of combustion from the furnace pass, the said air then passing into the hereinafter-described combustion-chamber through perforations arranged on either side of perforations through which the gas is admitted to the said combustion-chamber, so that the jets of gas issue between and are crossed by jets of heated air, insuring perfect intermingling or mixture of the air and gas, the combustion which takes place being perfected by the baffling actions of perforations through which the gases pass from the combustion-chamber to the boiler or other place where the heat is to be utilized.

The following is a description, with reference to the accompanying drawings, of the arrangement according to this invention as applied to a water-tube boiler, from which its general application to other heating purposes will also be understood.

Figure 1 is a vertical longitudinal section on the line A B C D, Fig. 2. Fig. 2 is a sectional plan, one half on the line E F and the other half on the line G H, Fig. 1. Fig. 3 is a transverse section on the line I J, Fig. 1;

and Fig. 4 is a transverse section on the line K L, Fig. 1.

The gas enters by the gas-flue *a* and valve *b* and passes by the flue *c* to and through the ports *d*, consisting of long narrow slits in the bottom of the combustion-chamber *e*. The said combustion-chamber is made, as shown, of a smaller capacity at bottom than at top, so that the mixture of gas and air expands as it passes upward to the ports *h'* in the roof of the combustion-chamber. As the gas enters the said combustion-chamber through the ports *d* heated air meets it, the said air being directed so that the streams thereof cross the streams of gas from either side, the said air entering by the valve *f* and passing along the narrow central flue *g* and branch flues *g' g''* around the base of the combustion-chamber *e*, into which chamber it passes by the ports *f'* in streams, which meet and cross the gas-streams as aforesaid, so as to thereby insure perfect mixture or intermingling of the air and gas, combustion taking place and the gases passing from upward in the combustion-chamber *e*, expanding as they so pass upward, and then passing through the perforations *h'* in the arched top *h*, which perforations by their baffling effect perfect and complete the intermingling and combustion of the gases, which then pass in contact with the heating-surfaces of the boiler and out by flues *k k'* to the chimney. The said flues *k k'* are arranged alongside the central narrow air-flue *g*, so as to effect preheating of the incoming air on its way to meet the gas in the combustion-chamber *e*. As shown in Figs. 1 and 3, the flue *g* is of elongated cross-section, with its narrow side in contact with and presenting a limited area to the heating chamber or space containing the boiler or like structure and its wider side in contact with and presenting a larger area to the discharge flue or flues, so that the maximum heat is extracted from the outgoing hot gases to heat the incoming fresh air when the least possible heat is extracted from the heating-chamber. These flues for the escaping products of combustion and the incoming air, respectively, may be increased in number and be arranged alternately, so as to effect a further division of the currents of escaping products of combustion and division of the incoming air-current; but in any case

they are arranged substantially as shown— viz., so that the air-passages which pass near to the space containing the boiler (or the equivalent) are narrow and have but a small area presented to the said space containing the boiler, so as not to deprive the boiler (or the equivalent) of heat; but the said air-passages have as much of their area as possible presented to the escape-flues k k' , so as to abstract as much as possible of the heat from the otherwise waste gases leaving the space containing the boiler—(or the equivalent.)

I claim as my invention—

1. In gas-furnaces, a combustion-chamber having a perforated arch at top and inlet-ports for gas at bottom and inlet-ports for air at each side so arranged that the streams of gas are met and crossed by incoming streams of air proceeding from opposite sides of the streams of gas, a heating-chamber into which the hot gases are discharged from said combustion-chamber, discharge flue or flues leading from said heating-chamber, and an air-flue of elongated cross-section for supplying fresh air to the air-inlet ports, said flue having its narrow side in contact with and presenting a limited area to the heating-chamber and its wider side in contact with and presenting a larger area to the discharge flue or flues, whereby the maximum heat may be derived from the hot gases leaving the heating-chamber through the discharge flue or

flues for preheating the air and the least heat extracted from the heating-chamber, substantially as described.

2. In gas-furnaces, a combustion-chamber small at bottom and having a perforated arch at top, and gas-inlet ports at bottom and inlet-ports for air at each side so arranged that the streams of gas are met and crossed by incoming streams of air proceeding from opposite sides of the streams of gas, a heating-chamber into which the hot gases are discharged from said combustion-chamber, discharge flue or flues leading from said heating-chamber, and an air-flue of elongated cross-section for supplying fresh air to the air-inlet ports, said flue having its narrow side in contact with and presenting a limited area to the heating-chamber and its wider side in contact with and presenting a larger area to the discharge flue or flues, whereby the maximum heat may be derived from the hot gases leaving the heating-chamber through the discharge flue or flues for preheating the air and the least heat extracted from the heating-chamber, substantially as described.

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

EDWARD JAMES DUFF.

Witnesses:

WILLIAM ANDERSON,
JAMES PATON, Jr.