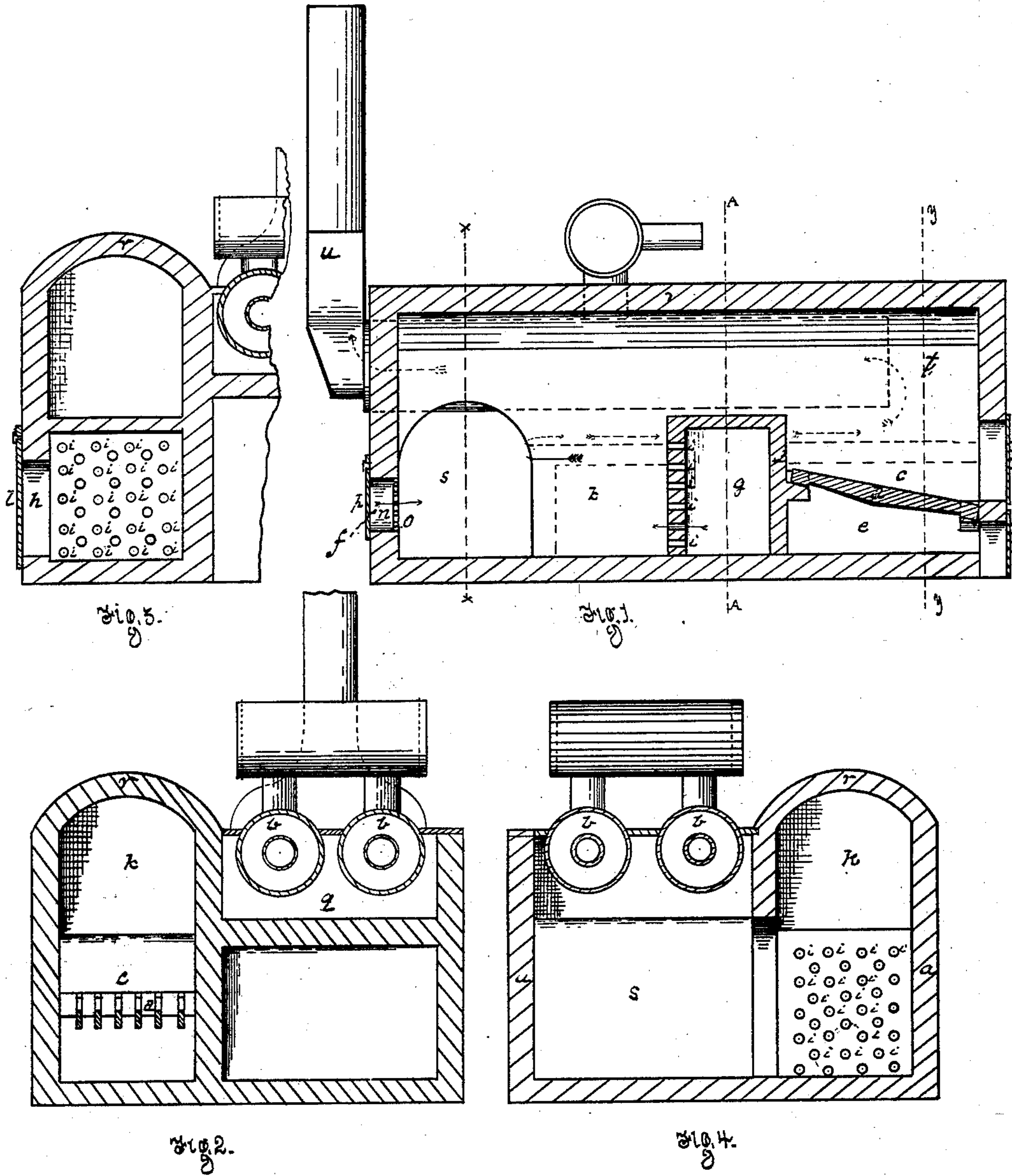


H. M. PIERCE.
Furnace.

No. 223,383.

Patented Jan. 6, 1880.



Witnesses.

James H. Porter
H. Bakewell

Inventor.

Henry M. Pierce

UNITED STATES PATENT OFFICE.

HENRY M. PIERCE, OF GRAND RAPIDS, MICHIGAN.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 223,383, dated January 6, 1880.

Application filed September 20, 1879.

To all whom it may concern:

Be it known that I, HENRY M. PIERCE, of Grand Rapids, in the county of Kent and State of Michigan, have invented a new and useful
5 Improvement in Furnaces for the Combustion of Fuel and Generation of Heat; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part
10 of this specification.

My improvement is adapted to use in various descriptions of furnaces in which fuel is consumed for the purpose of generating heat; and as an illustration of my invention I have
15 in the accompanying drawings exhibited its application to a furnace for steam-boilers. I do not, however, desire to be limited to such application of my invention.

The expansion of fuel by its change from a
20 solid to a gaseous or fluid condition, resulting from its combustion or exposure to heat, is enormous. It therefore becomes very important, in order to derive the full benefit of the fuel for the generation of heat, to provide room
25 for this expansion before or during the time of the oxidation of these fluid, gaseous, and carbonaceous products, so as to prevent their escape without being perfectly oxidized, and, further, to prevent their being cooled before
30 they are in a condition of expansion to receive the necessary quantity of oxygen to secure an efficient oxidation both of the gaseous and carbonaceous products. The object, then, of my present invention is, by the construction and
35 arrangement of the furnace, more fully to secure the accomplishment of these objects, and also to provide for the application and utilization of the heat to the purposes for which it is designed at the point in the furnace where
40 the heat is the greatest.

In order to enable others skilled in the art to make practical use of my invention, I will proceed to describe it in its application to a furnace for horizontal-flue steam-boilers.

45 In the drawings, Figure 1 is a longitudinal sectional elevation through the furnace. Fig. 2 is a transverse sectional elevation of the furnace and boiler at the line *y y*, Fig. 1. Fig. 3 is a transverse sectional elevation through the
50 air-chamber of the furnace at the line *A A* of Fig. 1. Fig. 4 is a transverse sectional eleva-

tion through the expansion-chamber of the furnace at the line *x x* of Fig. 1.

In the drawings, *c*, Figs. 1 and 2, is the fire-box of the furnace, into which the fuel to be
55 burned is supplied. *d* are the grate-bars, and *e* the ash-pit below the grate, the fire-box and ash-pit being furnished with doors, as usual. The bridge-wall of the fire-box forms one side of the air-chamber *g*, situated immediately
60 back of the fire-box and ash-pit, having an air-passage, *h*, opening to the outside in the side wall of the furnace, and a series of fine openings or air-vents, *i i*, &c., communicating from the air-chamber to the expansion-
65 chamber *k*. The air-chamber is inclosed on all sides, excepting for the air-passages just named. The air-passage *h* is furnished with a covering, *l*, pivoted to the wall at top, so as to serve as a valve to admit more or less air
70 as it is more or less widely opened. Back of the fire-box and air-chamber is an inclosed space, *k*, which may be of the same width as the fire-chamber and air-box, and some two or three times as long as its width, formed by
75 backward extension of the side walls, *a a*, of the furnace. The end wall of this chamber (which I term the "expansion-chamber") has an opening, *f*, for the admission of air into the expansion-chamber, in which is set a grating,
80 *o*, pierced with a series of fine apertures, so that the air in entering may be divided into fine jets. This air-opening is covered by a pivoted door, *p*, which serves as a valve to regulate the amount of air admitted in that
85 direction into the expansion-chamber *k*.

The furnace or fire-box *c*, the passage over the air-chamber *g*, and the expansion-chamber *k* are covered over by a single arch of fire-brick, *r*, extending from the front wall of the
90 fire-box to the rear wall of the expansion-chamber, forming a reverberatory covering.

The boilers *b b* are placed horizontally along-side of the furnace at such an elevation as to permit of the extension of the expansion-cham-
95 ber *k* under the rear end of the boilers, as shown in Figs. 1 and 4. This extension of the expansion-chamber is marked *s*.

Beneath the boilers *b b* is a space extending from the extension *s* of the expansion-chamber
100 to the front wall of the furnace, which space is floored with fire-brick, and forms the flue *q*

or passage-way for the flame and heat. The boilers are set so as to form the upper side of this flue, and also to extend into the extensions of the expansion-chamber, so that the flame and heat of the furnace first come in contact with the boilers in the extension-chamber *s*. The boilers do not extend to the front wall of the furnace, thus leaving a space, *t*, at the end of the flue, (see Fig. 1,) from which the flame and heat enter the flues of the boilers and pass through them into the chimney or stack *u*.

The advantage of this construction and arrangement is that the smoke and gases from the burning fuel in the fire-box, after passing over the bridge-wall formed by the air-chamber *g*, have sufficient room to expand in the expansion-chamber *k*, where they have time to become thoroughly intermingled with the air which enters through the air-vents *i* from the air-chamber and through the air-openings *o* at the rear end, and are oxidized thereby. The air which enters through the air-chamber *g* becomes heated from its proximity to the fire-box and ash-pit, and thus prevents the chilling of the carbonaceous products of the fuel. Just at the point where the highly-heated products of combustion of the fuel are about to come in contact with the boiler they are met with a fresh supply of atmospheric air in fine jets through the openings *o* in the grating *n*, the quantity of air introduced at that point being so adjusted by the valve-door *p* as to secure the complete oxidation of the gaseous and carbonaceous products of the fuel. The result is that a very intense heat is generated, which is greatest at the rear end of the expansion-chamber *k* and in its extension *s* under the boilers.

If it is desired to have two sets of boilers in connection with one furnace, the second set may be similarly placed on the other side of the furnace, in which case the air may be admitted into the air-chamber *g* through the ash-pit *e* or through a passage under the ash-pit.

As before stated, I do not design to limit my

invention to its application to steam-boilers, as by obvious modifications it may be advantageously applied to the various purposes for which furnace-heat is required. The expansion-chamber at the point where the heat is to be applied may be made of such shape as to adapt it to the purpose for which it may be desired.

In addition to the advantages already stated my improved furnace effects a very large saving of fuel, emits no perceptible smoke from the chimney when bituminous coal is used as fuel, nor even when crude petroleum is burned in the furnace, as it may readily be by merely changing the construction of the fire-box to adapt it to the burning of fluid hydrocarbons in any of the well-known ways of so doing.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. As an improvement in furnaces, the combination, with a fire-box and an air-chamber arranged within the bridge-wall, of an expansion-chamber interposed between the fire-box or initial combustion-chamber and the initial heating-point, and an extension-flue leading from the expansion-chamber to the boilers or other point of utilization of the heat, substantially as and for the purpose specified.

2. The combination, in a furnace for boilers or like purposes, of a fire-box, an air-chamber in rear thereof and delivering air into an expansion-chamber, and an expansion-chamber interposed between the fire-box or initial point of combustion and the boiler or initial heating-point, the expansion-chamber provided with a secondary air-supply inlet at its rear or near the initial heating-point, substantially as and for the purpose set forth.

In testimony whereof I, the said HENRY M. PIERCE, have hereunto set my hand.

HENRY M. PIERCE.

Witnesses:

JAMES H. PORTE,
F. W. RITTER, Jr.