

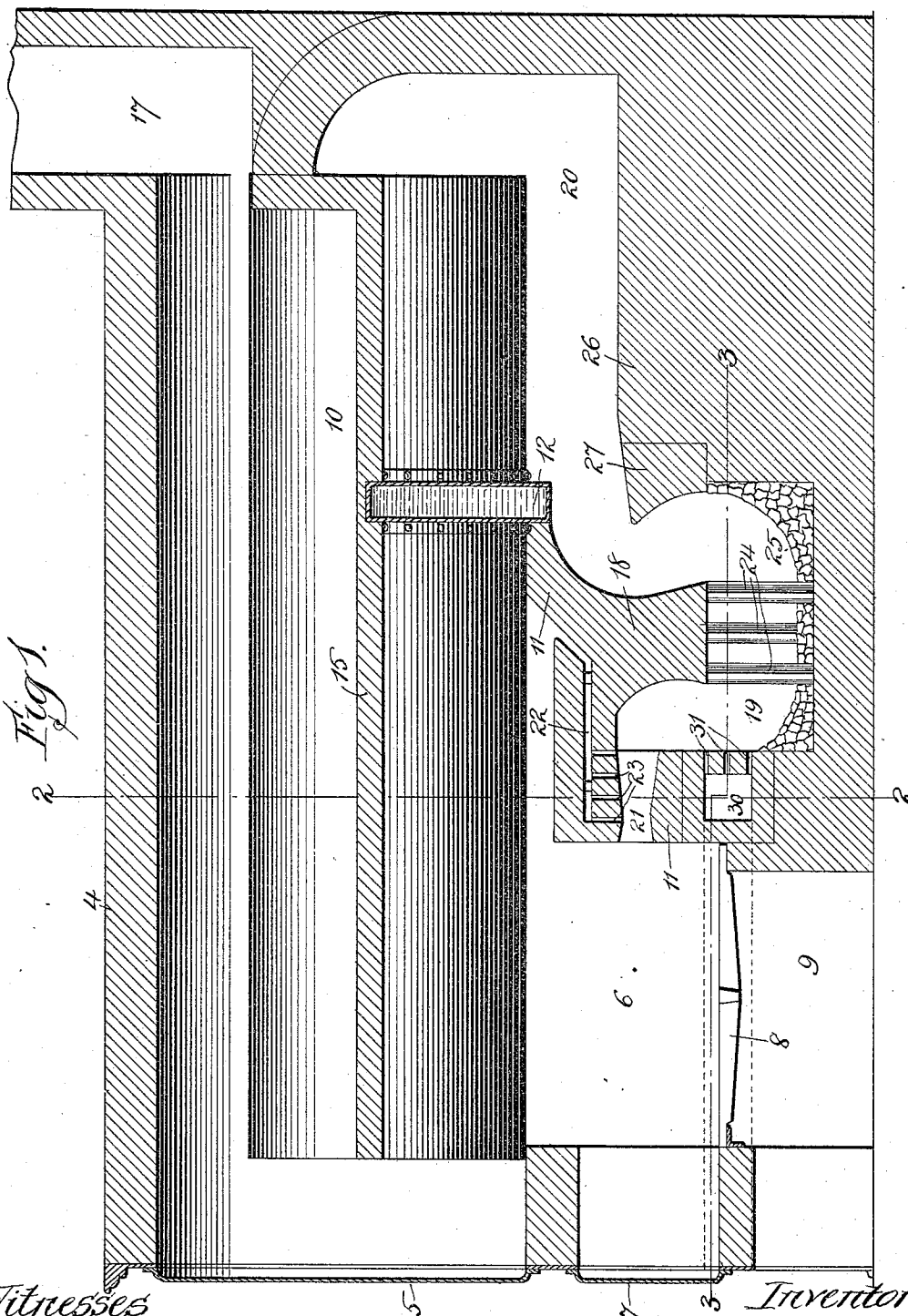
(No Model.)

2 Sheets—Sheet 1.

U. P. SMITH.
FURNACE.

No. 532,218.

Patented Jan. 8, 1895.



Witnesses
Wm. J. Fleming
D. M. Pheasant

Inventor
Uzziel P. Smith
Bond, Adams, Pickard & Jackson
Attorneys

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Fig. 3.

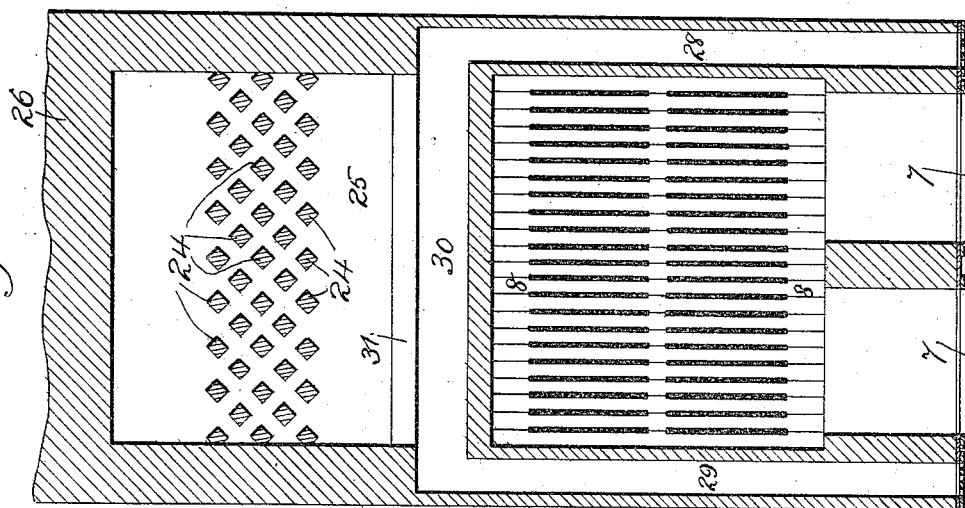
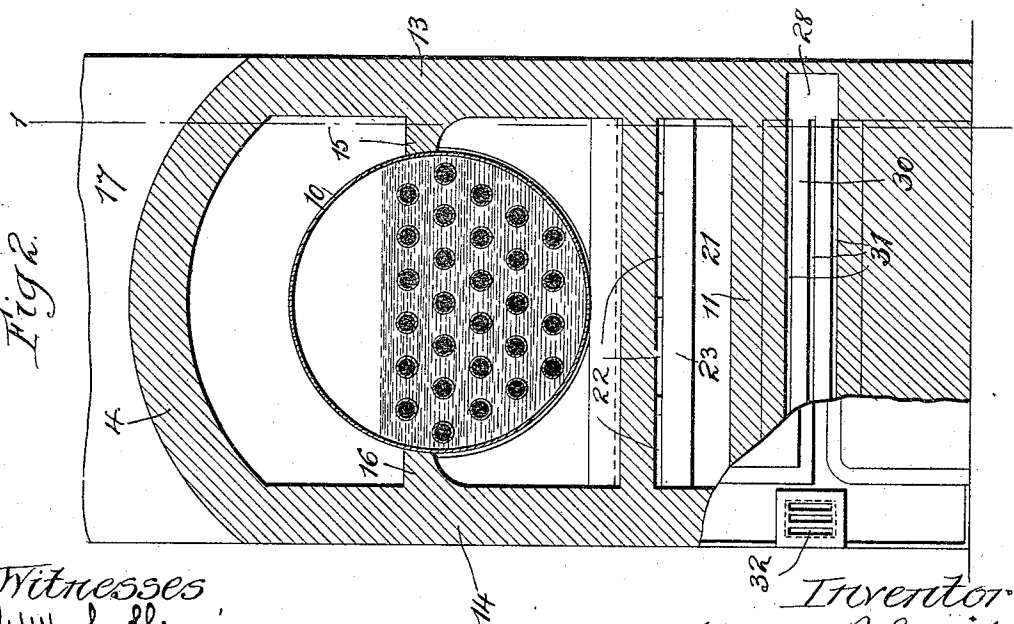


Fig. 2.



Witnesses
Wm. J. Fleming
J. M. E. Green

Inventor
Uzzie P. Smith
by Bond, Adams, Pickard & Jackson
Attorneys.

UNITED STATES PATENT OFFICE.

UZZIEL P. SMITH, OF CHICAGO, ILLINOIS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 532,218, dated January 8, 1895.

Application filed December 7, 1893. Serial No. 493,052. (No model.)

To all whom it may concern:

Be it known that I, UZZIEL P. SMITH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section on line 1—1 of Fig. 2. Fig. 2 is a vertical cross section on line 2—2 of Fig. 1, part of the front of the furnace being shown in elevation; and Fig. 3 is a horizontal section on line 3—3 of Fig. 1.

My invention relates to furnaces, its object being to provide a furnace in which a perfect combustion of all the fuel used, including the gases and smoke generated therefrom, is obtained in such a manner as to utilize for the generation of steam all the combustible matter contained in the fuel used

It consists in providing a furnace with one or more air flues and a combustion chamber, in addition to the fire box, which chamber receives heated air from said flues, and is of such proportions and construction as to secure a thorough intermixture of hot air with the flame, unconsumed gases and smoke as they pass from the fire box through said chamber, which is intensely heated by the combustion thereby produced. The combustion chamber is provided with such orifices connecting with the fire box, the air supply, and the flue, at the rear end of such combustion chamber, as are required to properly regulate the proportions and flow of the mixed gases through said chamber in such manner as to prevent any clogging and insure a perfect combustion of all the gases and smoke under all circumstances, regardless of the quantity or condition of the fuel in the fire box. To insure this result the area of the orifice constituting the outlet of the combustion chamber is made larger than the combined area of all the inlets into the same, and the intermediate portions of the chamber are still further enlarged, its size being gradually increased from the flame inlets to a point at or near the point where the air is admitted, and again contracted at or near the outlet of the chamber, which outlet should be of ample relative size to permit of a free

passage of the volume of flame produced to the rear end of and through the flues of the boiler.

Referring to the drawings, forming a part of this specification,—4 indicates a furnace, of which 5 indicates the front.

6 indicates the fire box, to which access is had through a door 7.

8 indicates the grate bars, and 9 the ash pit. 10 indicates a tubular boiler arranged above the fire box 6.

11 indicates a bridge wall located at the back end of the fire box 6 and extending upward to a short distance below the boiler 10, at which point it extends backward a short distance, terminating at the leg 12 of the boiler, as shown in Fig. 1. The leg 12 may be of any approved construction, preferably being adapted to contain water, as shown.

As shown in Fig. 2, the side walls 13—14 of the furnace are provided with inwardly projecting portions 15—16, which project to the boiler, serving to separate the space above the boiler from that below it. The space above the boiler communicates with the forward end of the boiler and with the smoke stack 17, as shown in Fig. 1.

18 indicates a wall which depends from the rear portion of the bridge wall 11, as shown in Fig. 1, said wall 18 being located a short distance back of the forward portion of the bridge wall.

19 indicates a combustion chamber, located back of the bridge wall 11, and extending from the bridge wall around and under the wall 18 to the space 20 at the rear end of the furnace, which space communicates with the rear end of the boiler. As shown in Fig. 1, the intermediate portion of the combustion chamber is larger than its end portions, by which arrangement the rapidity of the flow of the gases into said chamber is checked after they pass through the inlet into said chamber, and thereby more time is given them for becoming thoroughly intermixed with the air introduced into said chamber, as hereinafter set forth.

21 indicates a passage which affords communication between the fire box 6 and the forward portion of the chamber 19, opening into the upper end of said chamber. The inlet passage 21 is considerably narrower than

the inlet end of the chamber 19, and extends the entire length of the bridge wall, or, if desired, instead of a single continuous opening or passage, a number of separate passages may be provided.

22 indicates a narrow passage, which extends from the upper rear portion of the bridge wall to a series of discharge openings 23 which communicate with the passage, as shown in Fig. 1. This narrow passage or chamber is what may be termed a retort. Its object is two-fold; first, to create a circulation of heat over the shell of the boiler back to the water leg; and second, to afford a highly heated narrow passage of considerable length through which the escaped gases and smoke will be obliged to pass before they enter the combustion chamber, so that such gases and smoke will to a great extent be again re-combined, and the smoke converted into gas before it reaches the combustion chamber. The outlets 23 of this retort are placed on the upper side of, and in such portion of the flame outlet 21 of the fire box as to insure the ignition of the gases as they enter the combustion chamber, and their mixture with flame prior to the introduction of a fresh supply of pure heated air.

The wall 18 is supported upon a series of pillars 24, which are preferably square in cross section, and stand in the chamber 19 beneath the wall 18, as shown in Fig. 1. The pillars 24 are arranged in oblique rows with their edges forward, as shown in Fig. 3, thereby forming oblique passages between them.

The chamber 19 is paved with slag or fire brick 25, arranged to form a curved surface, as shown in Fig. 1, the use of such paving being to preserve the fire brick of which the furnace is constructed. If desired, the paving may be dispensed with.

26 indicates the back wall of the furnace, which forms part of the rear wall of the chamber 19, as shown. It is provided with fire brick 27 at the outlet of the chamber 19, the upper edges of which project toward the opposite wall 18, forming a more or less narrow outlet from said chamber. As above stated, the area of such outlet is somewhat greater than the combined areas of all the inlets opening into the combustion chamber, so as to provide a free passage for the ignited gases and flame from said chamber. By using the fire brick 27 to form the outlet of the combustion chamber the matter of repairing that part of the furnace is simplified, as such brick may readily be removed and replaced when necessary.

28—29 indicate air conduits, which extend from the front of the furnace at each side of the grate bars to a passage 30 located at the rear of the grate bars, as shown in Fig. 3. The passage 30 communicates with the combustion chamber 19 by a series of openings 31, which are placed at such a point as to permit of the mixture of the air with the gases, smoke and flame as they enter the combustion

chamber. I prefer to locate the openings 31 slightly below the level of the wall 18, so that the air is introduced into the combustion chamber at or near the point of its greatest area, as I find this produces the best results; but the location of the air inlets may be varied to suit different conditions, provided they are so placed as to permit of the thorough mixture of the air with the gases, smoke and flame as they enter the combustion chamber. The conduits 28—29 are provided with registers 32, as shown in Fig. 2. If desired the location of the conduits may be changed, provided they are so placed as to be suitably heated, and are arranged to conduct the air into the combustion chamber at the proper point. One or more of such conduits may be used.

In operation, the flame from the coal in the fire box, together with a portion of the gases and smoke generated, passes through the inlets 21 to the combustion chamber. The balance of the unconsumed gases and smoke rises above these inlets against the bottom and sides of the boiler, and by the suction produced by the draft in the combustion chamber is made to circulate along the bottom and sides of the boiler to the water leg, thence down through the narrow chamber or retort 22, where it will be heated to a high temperature, into the combustion chamber as above described. Thus it will be seen that all the products of the combustion which takes place in the fire box are compelled to pass through the combustion chamber, and in such passage they are supplied and mixed with a sufficient quantity of pure heated air to render their combustion complete before they reach the outlet from said chamber. The result is a voluminous incandescent flame, which encircles the entire rear end of the boiler, and passes through the boiler flues without a trace of smoke after the combustion chamber has once become thoroughly heated. In passing through the combustion chamber the flow of the gases is retarded owing to the increased size of the chamber, and time is given for their intimate intermixture with the hot air supplied through the air conduits. This intermixture is aided by the pillars 24, which cause the currents of gases and air to divide repeatedly as they pass through the oblique passages formed by such pillars, and thereby compel their thorough intermixture.

The combustion chamber may be varied in its general contour from that shown in the accompanying drawings, but I prefer to curve the chamber as shown, or in the opposite direction, and I do not confine myself to any particular contour in the construction of the chamber, as that may be varied according to the situation and space allowed for its construction without essentially affecting its efficiency in operation; provided, however, that such chamber contains an intermediate enlargement, and an outlet of sufficient size to permit of the free passage of the gases and

flame. The retort or narrow chamber 22 may also be somewhat changed in its general outline, size, or position, according to circumstances, and I do not confine myself to the particular form, size, or location shown in Fig. 1. Its object is to relieve the combustion chamber by partially performing the work which otherwise the combustion chamber would be obliged to do, and thereby increase the combustion of the furnace as well as its efficiency.

Under certain circumstances I have found that the smoke stack may be advantageously placed at the forward end of the boiler instead of at its rear end, and I do not wish to limit myself to the arrangement shown; neither do I wish to limit myself to constructing my improved furnace specifically as shown and described, as this construction may be varied in many details without departing from the spirit of my invention.

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

1. In a furnace, the combination with a fire-box and a flue, of a bridge wall 11 having a passage 21 and one or more passages 22 communicating with the fire-box and with the passage 21 for conducting unconsumed gases and carbon from said fire-box to said passage 21, a combustion chamber communicating with said fire-box by means of said passage 21, a wall 18 projecting into said fire-box, and means for introducing fresh air into said chamber, substantially as described.

2. In a furnace, the combination with a fire-box and a flue, of a bridge wall 11 having a passage 21, and a passage 22 arranged over the passage 21 and communicating with the fire-box at its rear end and with the said passage 21 at its front end by passages 23, a combustion chamber communicating with said fire-box by means of said passage 21, a wall 18 projecting into said fire-box, and means for introducing fresh air into said chamber, substantially as described.

3. In a furnace, the combination with a fire-box and a flue, of a bridge wall 11 having a passage 21, and a passage 22 arranged over the passage 21 and communicating with the

fire-box at its rear end and with the said passage 21 at its front end by passages 23, a combustion chamber communicating with said fire-box by means of said passage 21, a wall 18 projecting into said fire-box, and an air flue 30 in said bridge wall communicating with the combustion chamber at a point below the wall 18 by openings 31, substantially as described.

4. A furnace having a fire box, a flue, a combustion chamber between the fire box and the flue, one or more inlets from the fire box for the admission of flame, one or more inlets situated above the inlet for the flame and communicating therewith, an outlet larger than the combined area of such inlets, the intermediate portion of said combustion chamber being larger than its outlet, and means for introducing fresh air into the main body of such chamber, substantially as described.

5. A furnace having a fire box, a flue, a combustion chamber between the fire box and flue, said combustion chamber being connected with the fire-box by one or more openings for the admission of flame, and also by openings for the admission of gases and smoke, which openings connect with the fire box by means of a narrow passage, said combustion chamber having an area larger than the area of all the inlets into it, an outlet from said combustion chamber to the flue, the area of said outlet being larger than the combined areas of all the inlets into said chamber, and means for introducing fresh air into said chamber, substantially as described.

6. In a furnace, the combination with a fire box, and a flue, of a combustion chamber, a passage affording communication between said fire box and said chamber, a depending wall 18 in said chamber, means for supplying fresh air to said chamber, and pillars 24 arranged to form oblique passages in said chamber, substantially as described.

UZZIEL P. SMITH.

Witnesses:

JOHN L. JACKSON,
A. H. ADAMS.