(No Model.)

G. A. TURNBULL & W. WALTERS.

FURNACE.

No. 424,039. Patented Mar. 25, 1890.

Fig. 1.

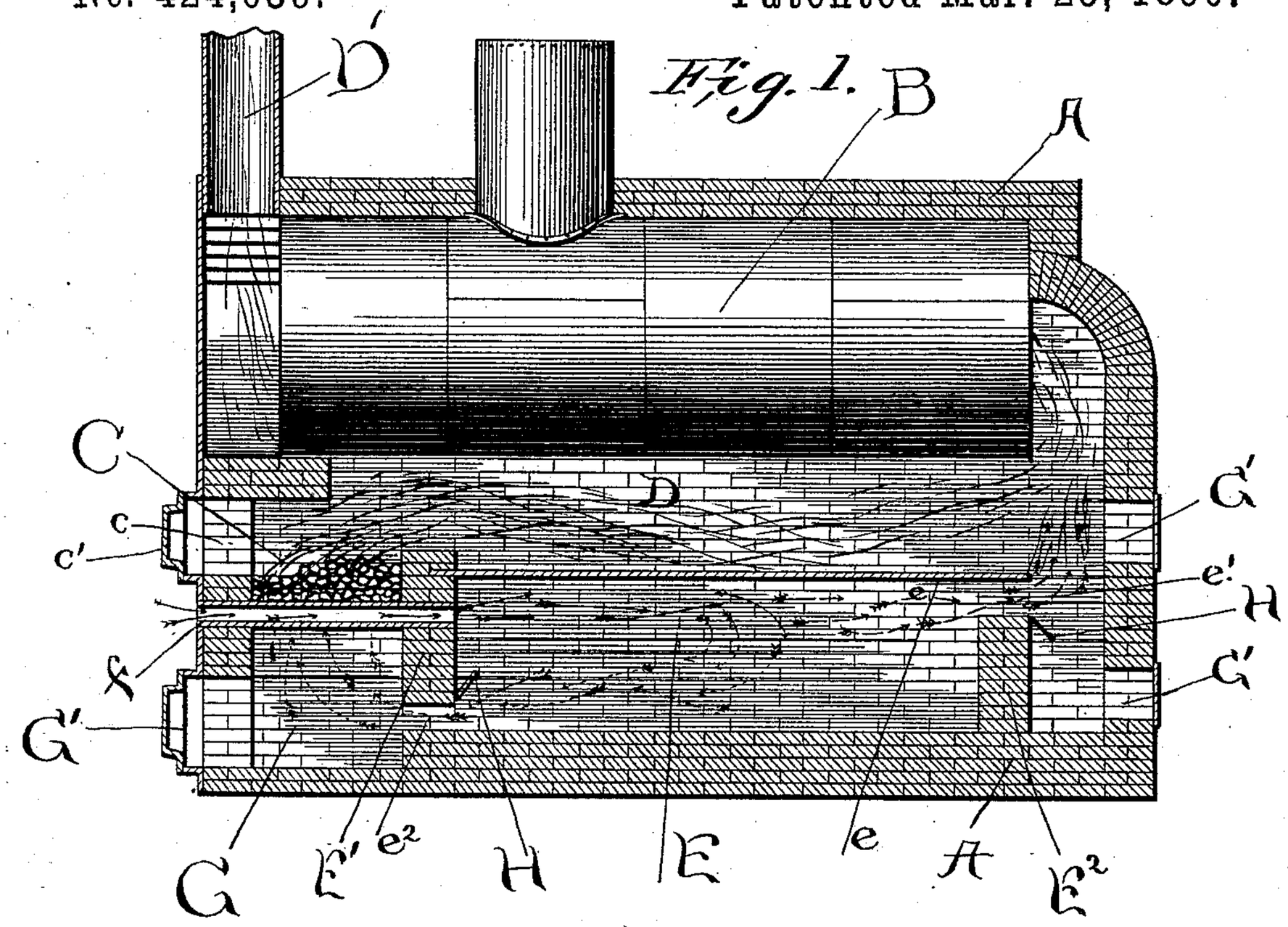
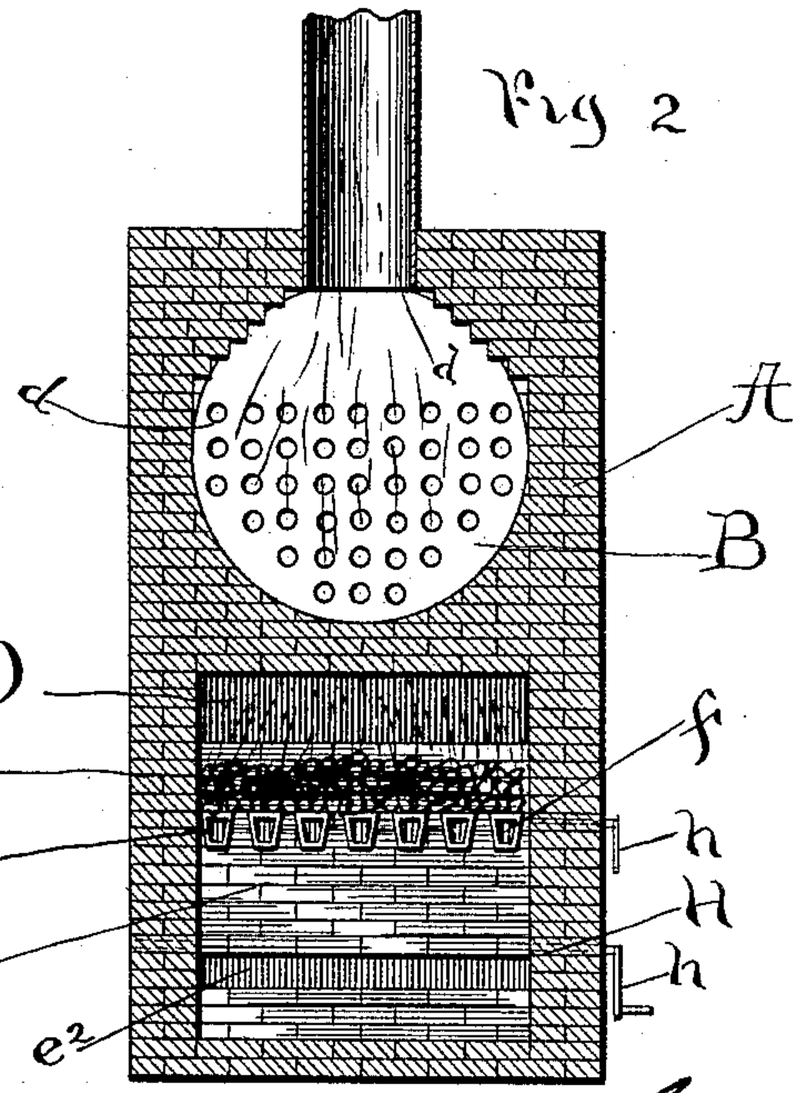


Fig 2



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UNITED STATES PATENT OFFICE.

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FURNACE.

SPECIFICATION forming part of Letters Patent No. 424,039, dated March 25, 1890.

Application filed June 12, 1889. Serial No. 314,065. (No model.)

To all whom it may concern:

Be it known that we, GEORGE A. TURNBULL and WILLIAM WALTERS, citizens 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.

Our invention relates to improvements in furnaces in which the atmosphere is introduced into a chamber or compartment in which it is heated before it passes to the fire; and the objects of our improvements are, first, to so construct and arrange the air-heating chamber and the flues or passages admitting air to the same or permitting its escape therefrom that the heating of the air therein will separate the nitrogenous gas from the oxygen and allow the nitrogenous gas to escape and pass off through the flues and out of the chimney and conduct the oxygen up through the fire, and, second, to provide means for admitting air to the air-heating chamber through flues in the grate-bars in such manner as to keep the bars comparatively cool, and thereby enable them to better resist the action of the fire upon them. These objects we have attained in the furnace constructed as illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of the furnace, the boiler portion being shown in side elevation. Fig. 2 is a transverse vertical section through the fire-box.

In the drawings, A designates the brick-work of the furnace, and B the boiler for generating steam for heating or power. The boiler is supported by the brick-work in the ordinary manner.

C is the fire-box, placed under the front end of the boiler and leaving an opening *c* for introducing the fuel closed by a door *c'*. From the fire-box there is a flue or passage D for the products of combustion to pass under the boiler and out through the boiler-flues *d* to the chimney or smoke-stack D', which are of ordinary construction.

E is the air-heating chamber, which is arranged beneath the flue D and separated therefrom by a metal plate *e*, which is supported at its side edges by being built in the side walls or supported thereon so as to form a covering for said air-heating chamber. The front side of the plate is built in or supported on a transverse partition E' of the brick-work at the rear of the fire-box. At the rear of the air-heating chamber there is another transverse partition E^2, which comes up nearly to the said plate *e* at the rear end thereof, leaving a passage or flue *e'* at or near the top of said chamber, which communicates with the flue D. At the front of the air-heating chamber there is a flue or passage e^2 through the transverse partition E' at or near the bottom of the said chamber, which leads into the ash-pit G under the fire-box.

The fire-grate is composed of hollow bars F, resting on the front wall of the brick-work and supported at their rear ends by the partition E'. The passages *f* through the hollow grate-bars open the way from the outside of the furnace into the air-heating chamber for air to pass into said chamber near the top, immediately under the metal plate *e*. The brick-work is provided with suitable openings, with doors G', for cleaning the furnace.

Dampers are provided at H and connected with cranks *h* upon the outside of the brick-work for regulating the draft by partially or wholly closing the passages *e' e²*.

The operation is as follows: A fire being started in the fire-box C will cause the air to pass into the air-heating chamber through the openings through the hollow grate-bars, and thence out through the passage *e'* and up between the bars to the fire. The plate *e* will be thereby presently heated, so as to heat the air in said chamber and cause the same to be partially and to a large degree separated into its elements—nitrogen and oxygen—the nitrogenous portion remaining near the top of said chamber and the oxygen settling toward the bottom. There being a sufficient supply of air to said chamber from the outside through the hollow of the grate-bars, the chimney-draft will draw the nitrogenous portion from the upper part of said air-heating chamber off through the passage *e'*, and the oxygen will be drawn from the bottom portion of said chamber through the passage e^2 to the fire, thereby increasing the combustion. As the cool air passes into the said chamber through the hollow of the grate-bars it tends to keep them cool, so that they can better resist the action of the fire. The effect of separating the air into its elements by means of the heat-

ing-chamber provided with the passage at the rear near the top and the passage to the fire near the bottom would be the same if the air were admitted to the said chamber through openings at the sides of the furnace; but we prefer to introduce the air through the hollow grate-bars for the purpose of protecting said bars from the intense heat which is caused by the increased proportion of oxygen thus created in that part of the atmosphere that passes through the fire.

Our invention does not include a series of separate pipes placed under the grate-bars in close proximity to the fire for the purpose of heating air, but in such construction and arrangement of the grate-bars below the fire-box as will permit the cool air from the outside to pass through the hollow of the grate-bars and completely under the fire-box before passing into it, and thereby tend to keep the grate-bars cool and protect them from the heat, as described.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a furnace, the combination, with the fire-box and the flue for the products of combustion therefrom, of an air-heating chamber arranged below said flue and separated therefrom by a thin partition, and having a passage at the rear near the top communicating with said flue and a passage at the front near the bottom communicating with the ash-pit under the fire-grate, substantially as and for the purpose specified.

2. In a furnace, the combination, with the fire-box and the flue for the products of combustion therefrom, of an air-heating chamber arranged below said flue and separated therefrom by a thin partition, and having a passage at the rear near the top communicating with said flue and a passage at the front near the bottom communicating with the ash-pit under the fire-grate, said passages being provided with dampers for regulating the draft, substantially as and for the purpose specified.

3. A furnace consisting of a fire-box, flues for the products of combustion, a chamber beneath the fire-box, a hot-air chamber at the rear thereof, having a passage at its front lower part into said chamber under the fire-box, and a grate composed of hollow grate-bars forming passages from the outside of said furnace under the fire into said hot-air chamber, and thence through the passage at the front lower part thereof into said chamber, under the fire-box, and up through the fire, as specified.

4. A furnace consisting of the fire-box, the flue for the products of combustion, the air-heating chamber having the passages at the upper rear front and lower front part thereof, and the hollow grate-bars forming passages from the outside of said furnace under the fire-box into the upper front portion of the said air-heating chamber, all substantially as shown and described.

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