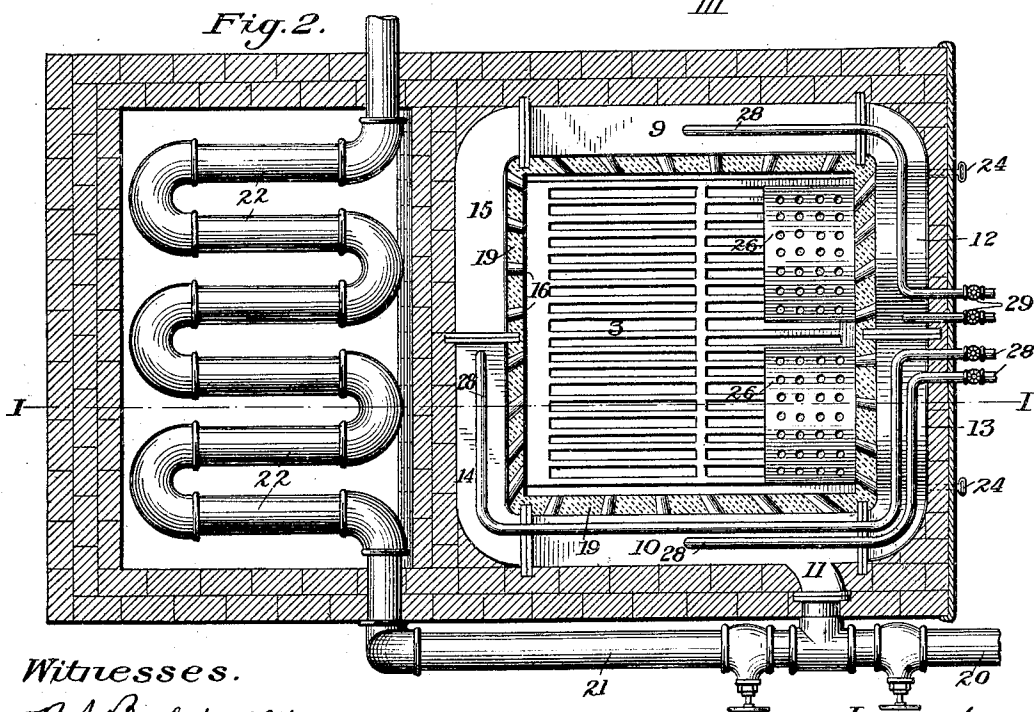
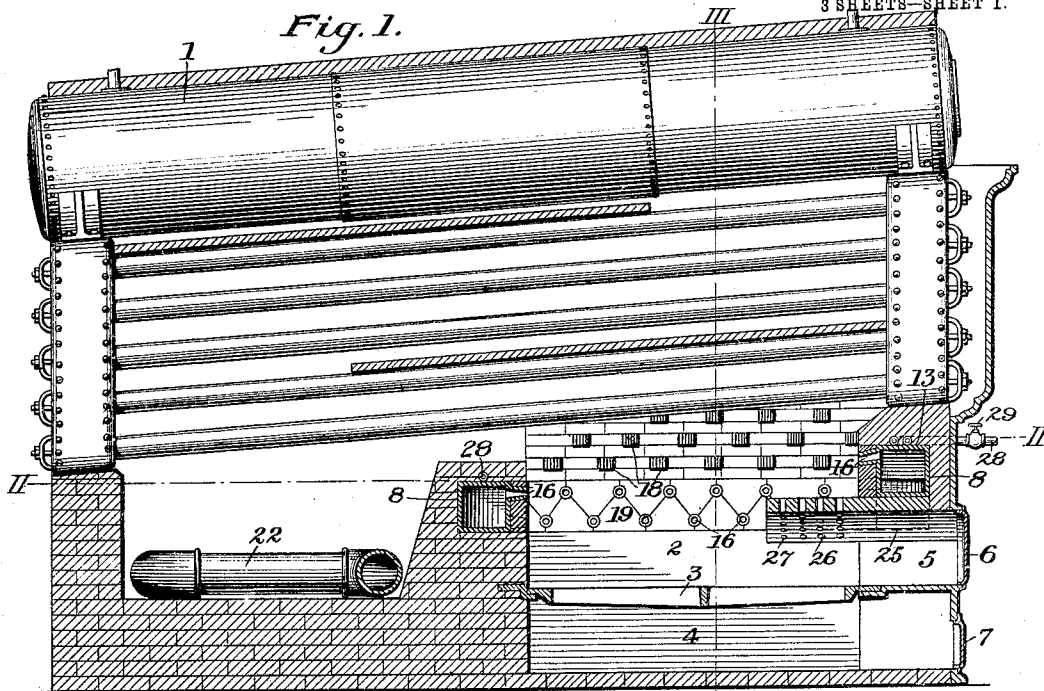


No. 791,066.

PATENTED MAY 30, 1905.

J. B. ARCHER.
COAL BURNING FURNACE.
APPLICATION FILED APR. 14, 1903.

3 SHEETS—SHEET 1.



Witnesses.

R. A. Baldwin
W. E. Hoff

Inventor:

John B. Archer,
by Ayres & Townsend
Attys.

J. B. ARCHER.
COAL BURNING FURNACE.
APPLICATION FILED APR. 14, 1903.

3 SHEETS—SHEET 2.

Fig. 3.

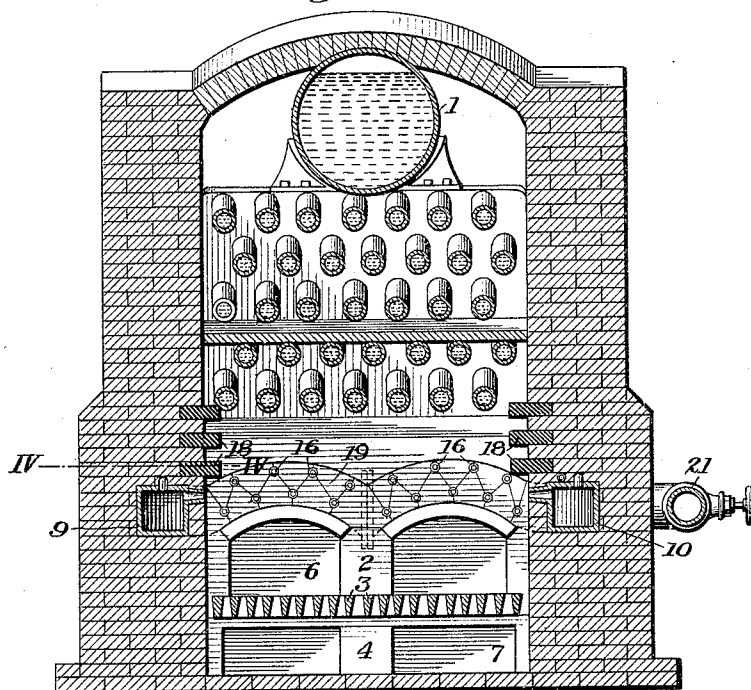
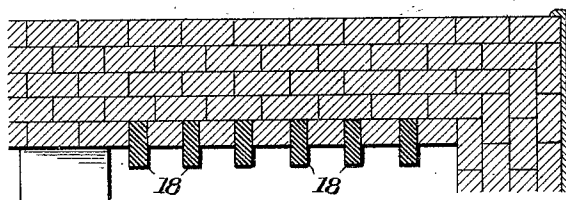


Fig. 4.



Witnesses:

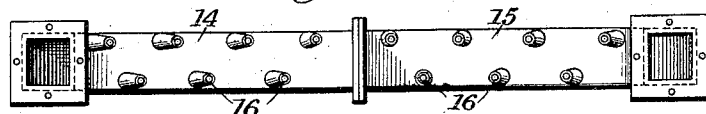
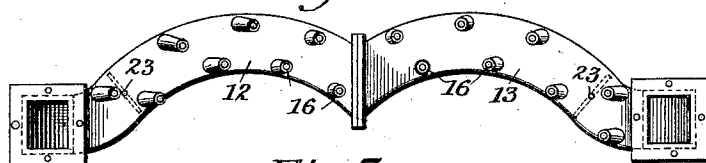
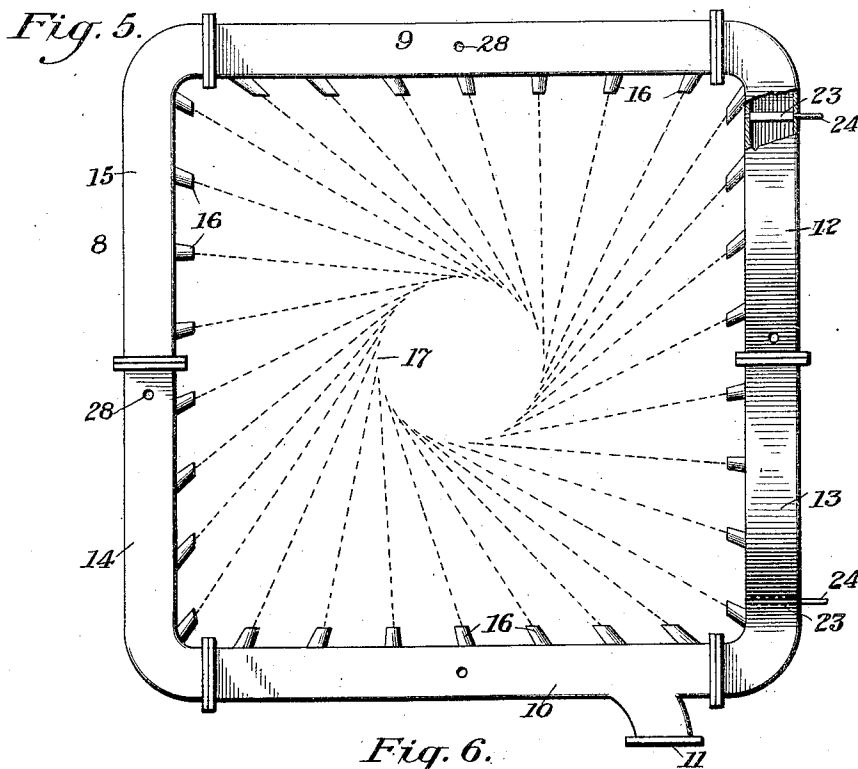
R. A. Baldwin
H. E. Neff

Inventor:

John B. Archer,
by Byrnes & Townsend,
Attys.

J. B. ARCHER.
COAL BURNING FURNACE.
APPLICATION FILED APR. 14, 1903.

3 SHEETS—SHEET 3.



Witnesses:

R. A. Balderson,
W. E. Neff

Inventor:

John B. Archer,
by Wynne & Townsend,
Attys.

UNITED STATES PATENT OFFICE.

JOHN B. ARCHER, OF KENSINGTON, MARYLAND.

COAL-BURNING FURNACE.

SPECIFICATION forming part of Letters Patent No. 791,066, dated May 30, 1905.

Application filed April 14, 1903. Serial No. 152,621.

To all whom it may concern:

Be it known that I, JOHN B. ARCHER, a citizen of the United States, residing at Kensington, in the county of Montgomery and State of Maryland, have invented certain new and useful Improvements in Coal-Burning Furnaces, of which the following is a specification.

This coal-burning furnace is of the same general construction as that described and claimed in my previous patent, No. 638,689, but embodies a number of important improvements thereon.

My improved furnace is provided with an air-box or supply-passage surrounding the fire-box a suitable distance above the grate and having inwardly-extending twyers, each of which is so arranged as to project air inwardly above the fuel in a stream which is substantially tangent to a horizontal circle. The front section of the air-box has arched portions which enable the doorways for the introduction of fuel to be higher than in my previous patent without requiring the side and rear sections of the air-box to be placed at an undue distance above the grate. The twyers extending from the arched portions of the air-box are slightly inclined downward so as to project streams of air tangent to a horizontal circle in the general plane of the side and rear sections of the fire-box. The air-box is provided with an inlet-pipe of somewhat greater cross-section than the total area of the twyers, thereby enabling a constant and equal air-pressure to be maintained at each of the twyers. The front, rear, and side sections of the air-box are each provided with a test-pipe leading out through the walls of the fire-box, by which the temperature and pressure of the air at various points in the air-box may be determined while the furnace is in operation. A shelf of refractory material, which is preferably perforated, extends rearwardly from the upper portion of each doorway, thereby preventing cold air from coming in contact with the boiler-tubes when the grate is being charged with fuel. The side walls of the fire-box above the air-inlet twyers are provided with

inwardly-projecting tiles or bricks, preferably consisting of a mixture of graphite and fire-clay, which assist in effecting complete combustion of the fuel-gases.

The invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section on line I I of Fig. 2. Fig. 2 is a horizontal section on line II II of Fig. 1. Fig. 3 is a transverse vertical section on line III III of Fig. 1 looking toward the front of the furnace. Fig. 4 is a detail horizontal section through one side of the fire-box on line IV IV of Fig. 3. Fig. 5 is a plan view, partly in section, of the air-box removed from the furnace; and Figs. 6, 7, 8 are elevations of the front, rear, and side sections of the air-box, respectively.

For the sake of completeness my improved furnace is here shown as arranged to heat a steam-boiler 1 of well-known construction. It is obviously capable, however, of general use. The furnace comprises a fire-box 2, here shown as rectangular and provided with the usual grate 3, ash-pit 4, doorways for fuel 5, having doors 6, and ash-pit doors 7. A short distance above the grate and embedded in the brick walls of the fire-box is the air-box 8. This air-box, as shown in Figs. 5, 6, 7, 8, is for convenience made in several sections of cast-iron, steel, or other suitable material. The ends of the sections are flanged and bolted together. The side sections 9 10 are each an integral casting, the section 10 being provided with an air-inlet 11. The front portion of the air-box consists of two separate arched sections 12 13 and the rear portion of two separate sections 14 15. Projecting from the inner walls of the air-box are a number of twyers 16, spaced at about equal distances from each other and arranged in superposed series, the twyers of the upper series being intermediate those of the lower series. Each of the twyers is arranged to deliver a stream of air in a line substantially tangent to a horizontal central circle 17, as indicated by the dotted lines in Fig. 5, the twyers of the arched sections be-

ing slightly inclined downward to effect this result. This arrangement causes the jets of air injected through the twyers to strike the gases rising from the fuel and set them into rapid rotation within the fire-box, effecting a thorough mixture of the gases and air. The centrifugal action caused by the rotary or cyclonic movement of the mixed gases and air throws any heavier particles, such as those of the unburned gases, outward against the hot walls of the fire-box. Bricks or tiles 18, preferably consisting of a mixture of graphite and fire-clay, project inwardly from the side walls of the fire-box above the air-box. These projections soon become incandescent when the furnace is in operation and cause any unburned fuel-gases which are thrown into contact with them to be immediately burned. The inner faces of the air-box are protected from the excessive heat by triangular or other tiles 19, of fire-clay, or by any other suitable means. Air may be supplied to the air-box through inlet 11 by means of a valved pipe 20. Hot air may be supplied through a valved pipe 21, leading from a series of heating-coils 22, arranged beneath the rear portion of the boiler 1 in position to be heated by the outgoing products of combustion. The arched sections 12 13 of the air-box are provided with dampers 23, having handles 24. One of these dampers is shown in position within the air-box in Fig. 5. The dampers enable the volume of air delivered from the arched sections to be regulated. It is sometimes desirable in operation to decrease the amount of air injected at the front of the fire-box. The greater quantity of air issuing from the twyers at the rear tends still further to hold the gases within the fire-box until they are completely burned. The cyclonic movement within the fire-box is also so controlled as to prevent a too rapid and direct escape of the gases rising from the fuel over the bridge-wall, the gases being thus held within the fire-box until all the combustible matter is consumed and the heat completely utilized in the generation of steam. The products of combustion escaping to the stack pass off as a light gray vapor containing substantially no smoke, soot, or unburned fuel-gases.

When the doors of the ordinary boiler-furnace are opened to permit charging, the inrush of cold air is so great as to temporarily chill the fire-box and boiler shell and tubes down to a temperature where the carbon in the gases is deposited as soot, which is afterward swept out by the products of combustion, causing clouds of black smoke to be emitted from the stack. This result is practically overcome by the cyclonic movement within my fire-box. If necessary, the amount of air supplied through the twyers may be so great as to cause a slight plenum within the

fire-box, entirely preventing the admission of air through the doors. In practice just sufficient air-pressure is maintained in the fire-box when stoking to substantially equal the exterior air-pressure. As a further means for preventing cold air from striking the boiler or other object to be heated the fire-clay or tile lining 25 beneath each of the arched sections 12 13 is extended rearwardly over the grate for some distance, providing shelves 26. These shelves act as baffles and cause any air that might enter through the doors to pass into the rotating mixture of gas and air. The shelves are preferably perforated with numerous small openings 27, through which a sufficient amount of the hot gases passes to keep the shelves at a high temperature and prevent deposit of soot.

Small test-pipes 28, such as one-half-inch gas-pipe, extend from each side of the air-box at about the middle along the top of the air-box and out through the furnace-wall at some convenient point, such as the front, where they are provided with valves 29. These pipes serve to withdraw portions of air from different sections of the air-box, so that the pressure or temperature of the air within any particular section may be tested by applying a gage or thermometer to the outer end of the corresponding test-pipe.

The area of the air-inlet 11 should be somewhat greater than the combined areas of all of the twyers, thus keeping the air under desired pressure within the air-box and maintaining a substantially uniform pressure at each twyer.

I claim—

1. A furnace comprising an unobstructed fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, and means for forcing air into said conduit, as set forth.

2. A furnace comprising a fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, means for forcing air into said conduit, and a lateral outlet from said fire-box over and closely adjacent to one side of said conduit, as set forth.

3. A furnace comprising a fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, means for forcing air into said conduit, a bridge-wall inclosing one side of said conduit, and a lateral outlet over said bridge-wall, as set forth.

4. A furnace comprising an unobstructed fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially horizontal and tangent to a circle, and means for forcing air into said conduit, as set forth.

5. A furnace comprising a fire-box, a rec-

tangular air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, and a lateral outlet over and closely adjacent to one side of said conduit, as set forth.

5 6. A furnace comprising an unobstructed fire-box, an air-supply conduit surrounding said fire-box, twyers extending inwardly from said conduit and arranged to deliver
10 streams of air in lines substantially tangent to a circle, and means for forcing air into said conduit, as set forth.

15 7. A furnace comprising a fire-box, an air-supply conduit surrounding said fire-box and having an arched front, and twyers extending inwardly from said conduit, the twyers of said arched front inclined downwardly with reference to the other twyers so that all the twyers deliver streams of air in lines substantially tangent to a horizontal circle, as set forth.

20 8. A furnace comprising a fire-box, an air-supply conduit surrounding said fire-box and having a doubly-arched front, and twyers extending inwardly from said conduit, the twyers of said arched front inclined downwardly with reference to the other twyers so that all the twyers deliver streams of air in lines substantially tangent to a horizontal
25 circle, as set forth.

30 9. A furnace comprising an unobstructed fire-box, an air-supply conduit with air-inlet, surrounding said fire-box, twyers extending inwardly from said conduit and arranged to deliver streams of air in lines substantially tangent to a circle, the combined area of all the twyers being smaller than the area of the inlet, and means for forcing air into said conduit, as set forth.

35 10. A furnace comprising a fire-box, an air-supply conduit surrounding said fire-box, twyers extending inwardly from said conduit, a plurality of test-pipes extending from different portions of the air-conduit out
40 through the wall of the furnace, and means for controlling the amounts of air delivered

to the different portions of said conduit as set forth.

11. A furnace comprising an unobstructed fire-box, an air-supply conduit surrounding
50 said fire-box and having air-passages which are substantially tangent to a circle, means for forcing air into said conduit, and a shelf extending rearwardly from the front wall of the fire-box a short distance over the grate,
55 as set forth.

12. A furnace comprising an unobstructed fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, means
60 for forcing air into said conduit, and a perforated shelf extending rearwardly from the front wall of the fire-box a short distance over the grate, as set forth.

13. A furnace comprising an unobstructed
65 fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, means for forcing air into said conduit and thereby rotating the fuel-gases, and projections ex-
70 tending from the sides of the fire-box in position to intercept the unburned particles thrown outward from the rotating body of gases, as set forth.

14. A furnace comprising an unobstructed
75 fire-box, an air-supply conduit surrounding said fire-box and having air-passages which are substantially tangent to a circle, means for forcing air into said conduit and thereby rotating the fuel-gases, and projections ex-
80 tending from the sides of the fire-box in position to intercept the unburned particles thrown outward from the rotating body of gases, said projections consisting of a mixture of graphite and fire-clay, as set forth.
85

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

JOHN B. ARCHER.

Witnesses:

EUGENE A. BYRNES,
C. A. NEALE.