W. McCLAVE.

FURNACE ARCH.

APPLICATION FILED FEB. 13, 1909.

978,917.

Patented Dec. 20, 1910.

2 SHEETS—SHEET 1.

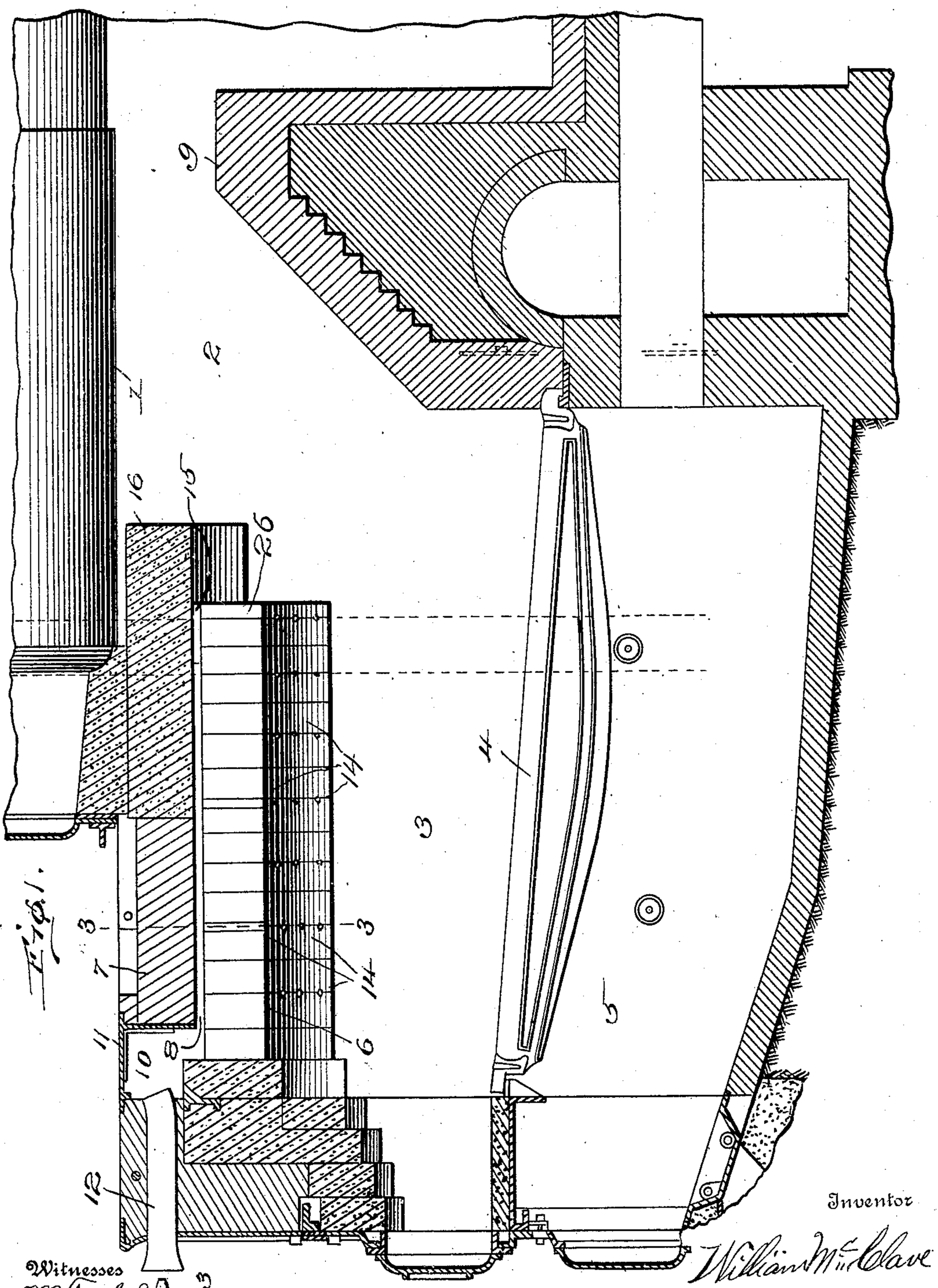

Fig. 1.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

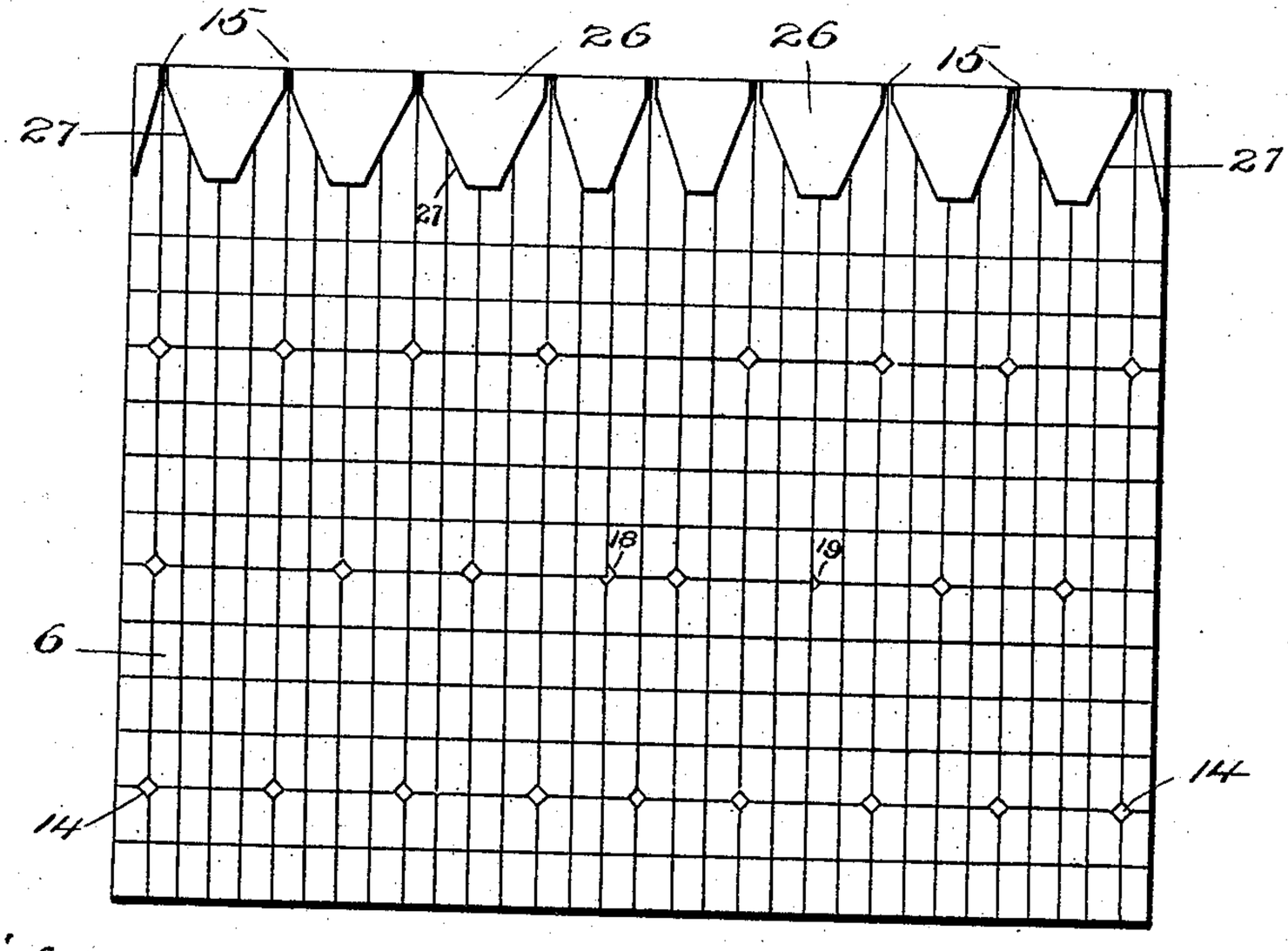


Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

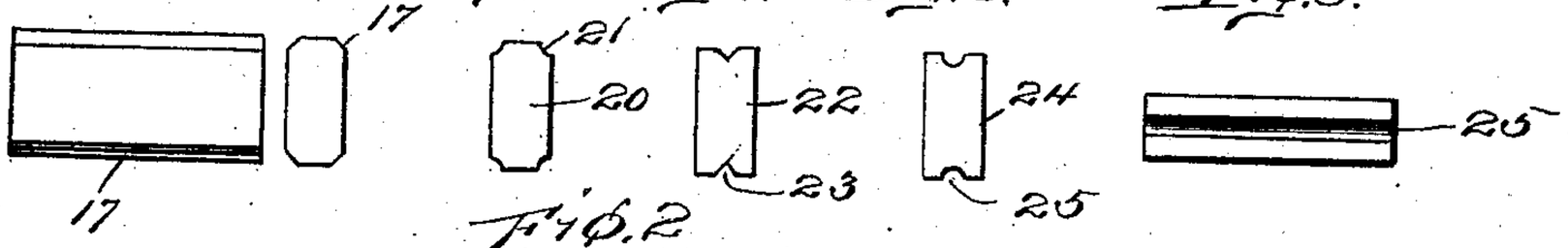
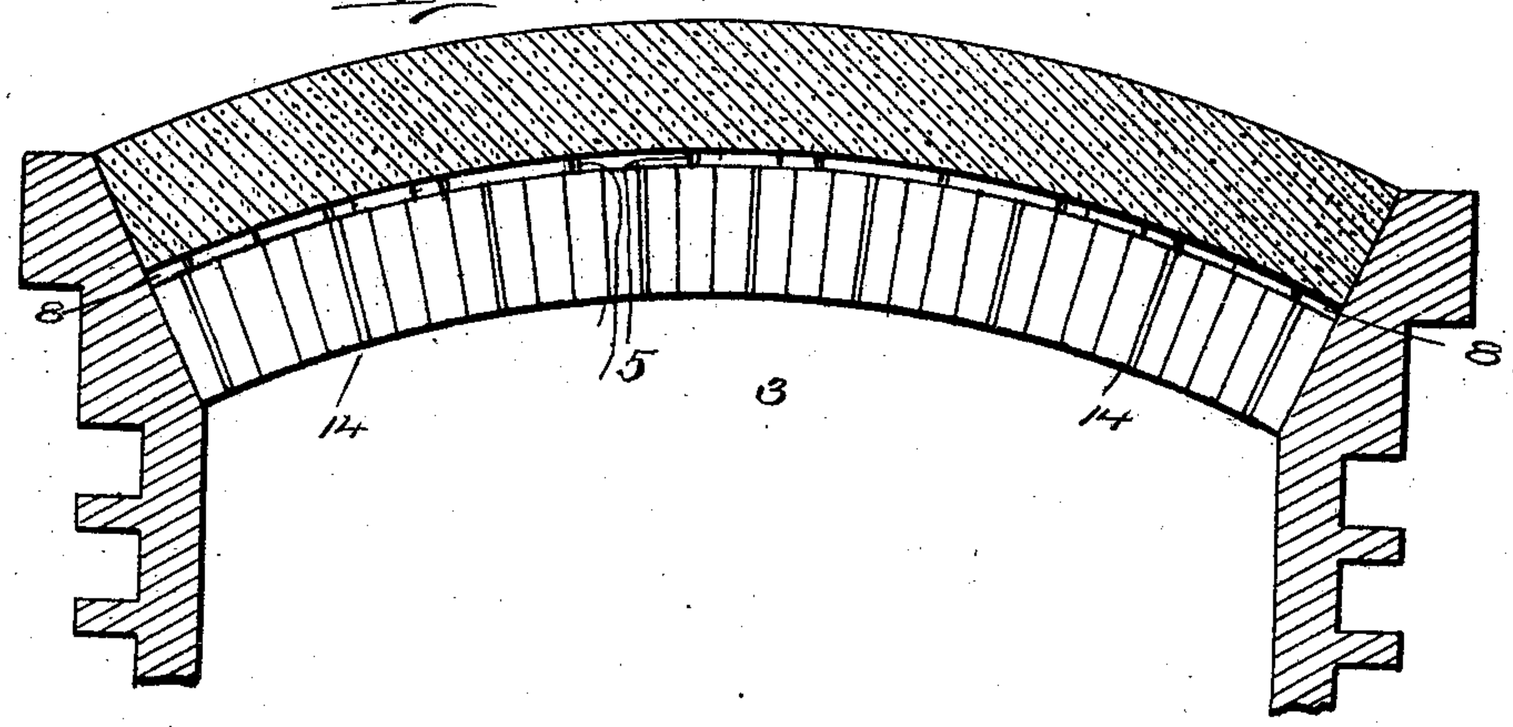


Fig. 2



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UNITED STATES PATENT OFFICE.

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FURNACE-ARCH.

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To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Furnace-Arches; 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 improvements in air feeding mechanism for furnaces, and more particularly to the construction of front arches of furnaces, and means for supplying air thereto from which it is distributed to the fire box in a heated condition.

The object in view is the arrangement and construction of a front arch for a furnace having a heating chamber and a plurality of apertures passing therethrough and arranged at the juncture of various bricks making up the arch.

Another object in view is the construction and arrangement of the bricks in the front arch of a furnace so that a plurality of passage ways are provided in the arch and extending therethrough at the juncture of the various bricks, the various bricks being formed with grooves or chamfered corners for forming the openings.

With these and other objects in view the invention comprises certain novel construction, combinations and arrangement of parts as will be hereinafter more fully described and claimed.

In the accompanying drawings: Figure 1 is a section through a boiler furnace constructed with an arch embodying the invention, certain parts of the furnace being broken away. Fig. 2 is a section through the arch shown in Fig. 1 approximately on line 3—3. Fig. 3 is a top plan view of the inner arch shown in Fig. 2. Fig. 4 is a side elevation of a brick constructed with chamfered corners. Fig. 5 is an end view of the brick shown in Fig. 4. Fig. 6 is an end view of a slightly modified form of fire brick having the corners formed with arc shaped grooves extending the entire length of the brick. Fig. 7 is an end view of a further slightly modified form of brick with a V shaped groove formed along one edge thereof. Fig. 8 is an end view of a still further modified form of brick having a semi-circular groove extending along one edge thereof. Fig. 9 is an edge view of the brick shown in Fig. 7.

The present improved air feeding mechanism may be utilized in conjunction with any of the common or preferred forms of furnaces desired, and therefore the detail construction of the furnace has not been illustrated, but only such portions thereof as will facilitate an understanding of the invention. In the proper combustion of coal it has been found difficult to entirely consume all of the gases arising from the coal and to therefore secure all of the heat units of the coal. In the ordinary burning of coal a large percentage of the products of combustion rises as heated gas without having been consumed and passes out the smoke stack giving comparatively little heat for the want of a proper mixture of air therewith for producing a proper combustion thereof and a sufficient amount of oxygen for supporting the combustion. In arranging the arch of the present invention I have provided a large number of comparatively small apertures therein for feeding small sprays or jets of air over the entire fire box above the fire so that the air will be distributed to the hot gases that have been evolved from the coal but not consumed and which would ordinarily pass out entirely unconsumed. The air is maintained under pressure for projecting the jets forcibly into the hot gases in order that the same may thoroughly commingle therewith. Not only do the jets of air properly mix with the hot gases for affording ample oxygen for supporting proper combustion by being projected therein but the air is heated previous to its escape in the fire box to such an extent as to approximate the same temperature as the hot gases so that there will be no chilling of the gases and consequently a thorough mixing of oxygen and gases for supporting the combustion of the hot gases.

In order that the invention may be more clearly understood an embodiment of the same is shown in the accompanying draw-

ings and is illustrated as being applied to an ordinary type of boiler furnace, with a boiler 1 supported by suitable walls 2. The inclosing walls 2 are provided with a fire box 3 preferably arranged forwardly of the boiler so as to extend beyond the same and is provided with a usual grate 4 and ash pit 5. Above the grate 4 the fire box 3 is provided with a covering or housing consisting in part of concentrically arranged arches 6 and 7 spaced apart vertically a sufficient distance for leaving an air chamber or space 8 therebetween. The air chamber 8 is arc shaped and extends over the entire space of arch 6. The arch 6 extends almost entirely over the grate 4 and leaves only sufficient space between the end thereof and bridge wall 9 for accommodating the hot products of combustion as the same pass through the furnace for heating boiler 1. The space or opening 8 between arches 6 and 7 extends from the inner end of arch 6 to the outer end thereof and at the outer end merges into a chamber 10 which extends for the full width of the arch. The chamber 10 is provided with an angle plate 11 that is adapted to assist in supporting the upper arch 7 and maintain the same in proper position, and is also used as an upper cover for the chamber 10. In addition the angle plate 11 forms a stop against which the air and steam projected through the injector or steam blower 12 strikes and from which it is distributed to the entire chamber 10. In this connection it will be observed that a steam pipe as 13 is arranged to project steam into the pipe or blower 12 and to suck air into the same so that the mixture of air and steam will enter chamber 10, and from chamber 10 be distributed to opening 8 from which it escapes into fire box 3 through apertures 14 and through openings 15 into the passage way formed between bridge wall 9 and the end of arch 6. It will be of course obvious that air from a fan or other blower could be connected with pipe or blower 12 and consequently fed into chamber 10 and from thence to the fire box if desired.

Immediately upon the entrance of the air or air and steam into chamber 10 the same is heated and as the same passes through opening 8 the temperature is raised to a high degree or superheated so that when the same is finally passed through openings 14 and 15 the air is of substantially the same temperature as the heated gases in the fire box so that no chilling or contracting of the same will be caused and a proper chemical union will be made for properly supporting combustion. In forming the arch 7 the same is arranged to extend at 16 beyond the inner end of arch 6 so that the apertures 15 may be left open and afford the escape of air therethrough and yet not be liable to be clogged or stopped by soot. By this construction the air is permitted to freely pass out the end of opening 8 and to mix with the products of combustion and afford a proper amount of ogygen for any of the gases that may not have been supplied by openings or passage ways 14.

In constructing the arch 6 the same is made from fire brick and arranged to be built up mainly of the ordinary fire brick, but have placed therein specially constructed bricks at any desired interval whereby the arch is provided with openings 14. The specially constructed brick as more clearly seen in Figs. 5 and 6 is formed with chamfered corners 17 that extend for the full length of the brick. Simply one of the corners may be chamfered or all four as may he desired, the brick shown in Figs. 5 and 6 being chamfered on all four corners. When, for instance four bricks with one corner on each brick chamfered off, are arranged with the chamfered corners facing each other an opening as 14 will be made which extends entirely through the arch 6. If a small opening is desired the bricks may be rearranged so that there will be only three bricks with chamfered corners having the chamfered corners meeting as shown at 18. If a still smaller opening is desired an opening as 19 may be provided by having two chamfered corners facing each other, and also facing two ordinary bricks. The specially constructed bricks may be also variously arranged for forming various sized holes as occasion may require and any desired number of the bricks may be placed in the arch 6 in any desired place for properly distributing the air in fire chamber 3 and for distributing the same in small sprays over the entire surface of the fire chamber.

In Fig. 7 is shown a slightly modified form of brick 20 having arc shaped grooves 21 formed in the corners thereof which when placed in the arch 6 will form a circular opening when the corners of four bricks having arc shaped grooves therein are arranged together.

In Fig. 8 another slightly modified form of brick 22 is provided with a V shaped groove 23 formed in each edge and extending for the entire length of the brick in a similar manner to the way in which arc shaped groove 21 extends for the full length of brick 20. When using brick 22 it is only necessary to have two abutting bricks to form a square opening through the arch.

In Figs. 9 and 10 is disclosed a brick 24 having a semi-circular groove 25 positioned in the edges thereof and extending the full length of the brick. When any of these bricks are placed in the arch 6 and have their edges in engagement the semi-circular groove 25 will form a circular passage way

through arch 6. If an ordinarily constructed brick is placed against the edge of brick 24 only a semi-circular opening will be provided which of course will permit the passage therethrough of only half the amount of air that a complete circular opening would permit.

In the construction of arch 6 any of the bricks shown in Figs. 5 to 10 inclusive may be used or all of the same at the same time and the same may be arranged in various manners as occasion may require or as might be most desirable. For instance, the brick formed with chamfered corners 17 may be used and arranged with full square openings centrally of the arch and with only partial openings on the outer edge of the arch so as to provide a larger amount of air centrally of the fire chamber than at the edges thereof. By constructing bricks with the edges having passage ways therein the same may be arranged to answer any desired requirement in the furnishing of heated air to the fire chamber. In the construction of the special bricks seen in Figs. 5 to 10 inclusive it will be observed that all of the chamfered corners, grooves and ways formed in the bricks are arranged on the outer surface of the brick and at the ends thereof. The bricks are constructed in this manner in order not to weaken the same, and yet to provide ample passage ways for the air to pass into the fire box in small jets or streams. The bricks are preferably arranged so that the chamfered corners 17 form a square passage way or aperture through the arch in order to provide sufficient area for permitting a sufficiently large quantity of air to be forced through the apertures for maintaining the same sufficiently cool to prevent closing up by the heat from the fire chamber. By experiment the shape of the apertures has been found to afford less resistance to the passage of air than triangular or other shaped apertures, and yet be sufficiently small for permitting a large number to be arranged in the arch, whereby a large number of jets of air under pressure are provided which, by their size and force, penetrate into the gases evolved from the fuel, and thoroughly mix and unite chemically therewith. An aperture too large, regardless of the shape thereof, will provide air in bulk which will necessarily move comparatively slowly or gently into the fire chamber, and will, as a consequence, retard combustion rather than assist the same, by chilling the hot gases and eventually passing out the chimney with the unburned products of combustion. An aperture too small will on the contrary close up, by reason of the excessive heat natural to furnaces, so that the function of the aperture will be destroyed. For these reasons the bricks having chamfered corners 17 are arranged for forming substantially square apertures of such a diameter as to permit a small jet of air to be forced therethrough of sufficient quantity for preventing the silica or other material from the bricks of the arch from melting and gradually closing the aperture.

The openings 14 are arranged for distributing heated air to a position above grate 4 while openings 15 are arranged to distribute air to the products of combustion as the same pass from the fire chamber over the bridge wall 9. A plurality of bricks 26 are arranged with beveled sides 27 for directing air through opening 15. By this construction the air passing through openings 15 will be rapidly projected therethrough and will consequently thoroughly mix with the products of combustion as the same pass over bridge wall 9.

What I claim is:

1. In a furnace, a fire box, an arch arranged above the fire box formed of a plurality of independent bricks, some of which are provided with chamfered adjacent corners whereby there is defined a plurality of apertures extending from one surface of the arch to the other, a superimposed arch spaced above the first mentioned arch, and together with the first mentioned arch defining an air chamber from which air may escape through said apertures into said fire box, means for supplying air to said air chamber under pressure, which air passes from thence through said first mentioned arch into said fire box in a plurality of jets, and a plurality of blocks formed with beveled sides spaced apart between said arches at their inner ends, but contacting therewith for providing restricted openings, whereby some of the air forced into said air chamber escapes in jets longitudinally for mixing with the products of combustion as the same pass from the fire box, while the remaining air escapes at the same time at right angles to the general direction of the arch and transversely of the draft from the fire box for mixing with the gases before their escape.

2. In a furnace, a fire box, an arch arranged above the fire box formed with a plurality of apertures, a superimposed arch spaced above the first mentioned arch and together with the first mentioned arch defining an air chamber, a metallic plate connected with said upper arch, and together with the front wall of the furnace and said arches defining a preliminary air chamber communicating with the air chamber provided between said arches, means for supplying air to said preliminary chamber from which air passes into the chamber formed by said arches, and from thence through said first mentioned arch into said fire box in a plurality of jets, and a plurality of blocks spaced apart positioned between said

arches at the inner end, but contacting therewith for providing restricted openings, whereby some of the air forced into said chamber formed between said arches will escape in jets longitudinally for mixing with the products of combustion as the same pass from the fire box.

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

WILLIAM McCLAVE.

Witnesses:
MAX F. HENKELMAN,
C. A. KEEGAN.