No. 815,562. PATENTED MAR. 20, 1906.

F. N. SPEAR.

FINE FUEL FURNACE.

APPLICATION FILED SEPT. 12, 1901.

Fig. 2.

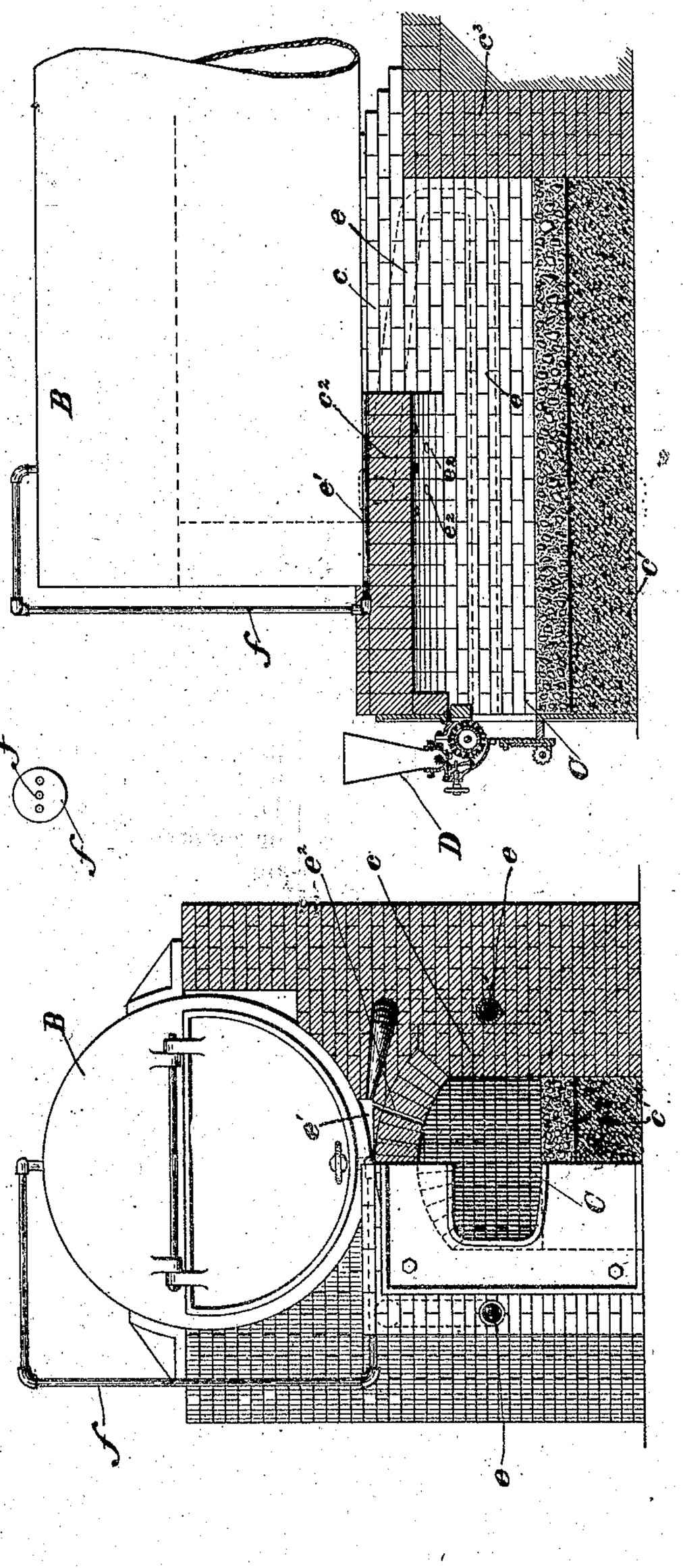

Fig. 3.

Fig. 1.

Witnesses.
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UNITED STATES PATENT OFFICE.

FRANK N. SPEAR, OF LOS ANGELES, CALIFORNIA.

FINE-FUEL FURNACE.

No. 815,562. Specification of Letters Patent. Patented March 20, 1906.

Application filed September 12, 1901. Serial No. 75,139.

To all whom it may concern:

Be it known that I, FRANK N. SPEAR, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented an Improvement in Fine-Fuel Furnaces, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to fuel-burning apparatus for steam-generators and the like; and the invention appertains mainly to the combustion-chamber and means for supplying fuel thereto.

In combustion-chambers of furnaces where intense heat is generated—such, for instance, as in furnaces wherein pulverulent fuel is used—great difficulty has heretofore been experienced in securing permanency of the brick arches or crowns of the combustion-chambers. These are usually built up dry from suitable fire-brick, and it has been found in practice that there is a tendency of the gases generated by the combustion of the fuel to melt and gutter the arch or crown of the furnace, causing early destruction thereof.

My invention aims, among other things, to protect the crown or arch or, it may be, other wall of a brick combustion-chamber from premature destruction, and I accomplish this, as will be hereinafter set forth, generally speaking, by the introduction of a thin film of air adjacent to and in contact with the inner face of the wall or arch to be protected, this film of air acting, as I believe, to repel the products of combustion sufficiently to save the wall so protected from destructive action thereby.

My invention also comprehends other novel features of construction relating to a furnace of this type and to its use in connection with a pulverulent-fuel-feeding apparatus, whereby an improved result is obtained.

In order that my invention may be understood, I will first describe one embodiment thereof, after which I will specifically set forth in the claims the various features of my invention.

Referring to the drawings forming a part of this specification, Figure 1, in half-front elevation and half cross-section, shows a boiler provided with a combustion-chamber built in accordance with one embodiment of my invention; Fig. 2, a vertical longitudinal central section of the apparatus, Fig. 1, showing a feeder attached thereto; and Fig. 3, a detail to be referred to.

In the embodiment of my invention selected for illustrat on herein and shown in the drawings, B indicates a usual return tubular boiler, such as commonly employed for developing steam in the arts. This boiler is arranged in a brick setting, which, with the exception of the particular arrangement of the combustion-chamber, may be of any usual or well-known type or construction.

C is a combustion-chamber, the same being formed by the side walls *c c* of fire-brick, with a concrete or other bottom *c'* and covered throughout a part of its length with a crown-wall, preferably in the form of an arch c^2, which for the best results should be laid dry with suitable fire-brick.

At the front end of the combustion-chamber is arranged the means for supplying fuel to the combustion-chamber, which in the present instance is in the form of a pulverulent-fuel-feeding apparatus, (indicated at D.) This apparatus may be of desired type or construction, the same, as here shown, being of the general type illustrated in my United States Letters Patent No. 655,464, dated August 7, 1900, to which reference may be had for a more detailed description of the construction and operation of said apparatus. It is sufficient here to say that said apparatus delivers into the combustion-chamber in suitable quantity and in suitable manner pulverulent coal or other fuel, which is ignited within the combustion-chamber either by the use of an igniting-fire or, after it is started up the contained heat of the walls of the chamber and furnishes suitable combustion in a manner well understood by those familiar with the art.

Referring particularly to Fig. 1, at opposite sides of the combustion-chamber and separated somewhat from the inner faces of the side walls thereof, but preferably in contact with the fire-brick forming the side walls, I have arranged the conduits *e e*, that may be formed of tile or other pipe or may be formed directly in the fire-brick itself, said conduits extending rearward along the side walls of the combustion-chamber to a point preferably at or near the bridge wall c^3 thereof, (see Fig. 2,) the said conduits then turning upon themselves and returning toward the front of the combustion-chamber to a point within the length of the crown or arch c^2 thereof,

when the said conduits are turned inward one toward the other and discharge into a shallow air-chamber e' directly beneath the boiler-shell and between the latter and the said crown or arch c^2, said space being made tight along its sides and front, but preferably left open at its inner end toward the bridge-wall.

The brick arch or crown c^2 is provided throughout that area only which is subjected to the highest degree of heat from the products of combustion and preferably within the limits of the area of the shallow chamber e' with a plurality of transverse air-supply openings e^2, that lead from the said chamber e' through the said arch or crown and communicate with the combustion-chamber below the crown, as best indicated in Fig. 1.

During the operation of the apparatus the draft created by combustion within the chamber and by the passage of the products of combustion from the said combustion-chamber over the bridge-wall is sufficient to draw inward through the conduits e e a current of air that becomes heated by radiation from the walls of the combustion-chamber as it flows through said conduits and is discharged into the chamber e', from which it is finally drawn through the perforations e^2 into the combustion-chamber adjacent and in contact with the inner face of the crown or arch wall at that point only which is subjected to the highest degree of heat. This air thus discharged adjacent and in contact with the inner face of the arch or crown of the combustion-chamber is there met by the outflowing products of combustion from the fuel and is caused to spread out somewhat in film form close against the inner face of the crown or arch at that portion only subjected to the highest degree of heat, and thus forms a sort of protecting layer that keeps the intensely-heated products of combustion out of such contact with the face of the crown or arch as would melt, gutter, or otherwise damage the said crown or arch.

Actual tests have shown that whatever be the exact action of this air in repelling or modifying the action of the products of combustion adjacent the crown or arch the melting or damaging of the arch by the products of combustion is entirely eliminated, yet without detracting materially from the desired heat imparted to the arch from the products of combustion. In other words, the air thus admitted having been heated during its passage through the conduits readily combines with the products of combustion in the combustion-chamber and promotes combustion, and while it permits the arch or crown of the furnace to be sufficiently heated for the best results, yet it prevents such injurious contact of the products of combustion with such crown or arch as would cause premature destruction of the same. Admitting air at this point I find tends to promote combustion as compared with air admitted otherwise. I also find that the flow of the products of combustion from beneath the arch c^2 toward the bridge-wall tends to produce such a circulation of gases adjacent the inner end of said arch that the air that issues from the open inner end of the shallow air-chamber e' is drawn downward close against the inner end of said arch until it meets the products of combustion issuing from beneath the arch, thus effectually preventing destruction of the inner end of the arch, which ordinarily would become quickly destroyed under the action of the intense heat of the products of combustion flowing in contact with it. Further, to promote combustion within the combustion-chamber I have provided a steam-pipe f, that leads from the steam-space of the boiler into and through the shallow air-chamber e', with its end preferably at the end of the arch c^2. The end of this steam-pipe is preferably provided with a number of fine perforations f', (see Fig. 3,) through which fine jets of steam are projected into the upper part of the combustion-chamber and beyond the arch or crown, the steam being thus projected substantially in the line of flow of the products of combustion toward and from the bridge-wall. I find that steam admitted at this point produces better results than when admitted in the ordinary manner. The arch or crown c^2 of the combustion-chamber serves not only to protect the steam-jet device from direct contact with the products of combustion and from consequent destruction thereby, but also acts as a superheater to superheat the steam, and thereby increase its effective action in the combustion-chamber.

I have here described my invention in connection with one embodiment thereof; but it is to be understood that my invention is not limited to the embodiment or disclosure here made, but may be variously modified within the spirit and scope of the invention set forth.

I claim—

1. A pulverulent-fuel-feeding furnace, having a retort-like combustion-chamber, an arched crown extending part way through said chamber and provided with a plurality of transverse openings at its inner end only, an air-supply chamber located above said arched crown and communicating with said openings, and a bridge-wall beyond the end of said arched crown for directing the products of combustion toward the inner end of said arched crown and causing a supply of air to be drawn through the transverse openings in said crown into contact with the products of combustion, whereby the crown is protected at that point only subjected to the highest degree of heat of the products of combustion.

2. A pulverulent-fuel-feeding furnace, having a retort-like combustion-chamber, an arch or crown extending part way through said chamber, an air-supply chamber ar-

ranged above said arch or crown and in open communication with the combustion-chamber above the inner edge of said arch or crown, a plurality of transverse openings in said arch or crown at its inner end only and communicating with said air-supply chamber and said combustion-chamber, and a bridge-wall beyond the end of said arch or crown for directing the products of combustion toward the inner end of the arch or crown and causing a supply of air to be drawn through the open end and said transverse openings of the arch or crown into contact with said products of combustion, whereby the inner edge and under surface of the inner end only of the arch or crown is protected from the intense heat of the products of combustion.

3. A pulverulent-fuel-feeding furnace, having a retort-like combustion-chamber, an arch or crown extending part way through said chamber, an air-supply chamber arranged above said arch or crown and in open communication with the combustion-chamber above the inner edge of said arch or crown, a plurality of transverse openings in said arch or crown at its inner end only and communicating with said air-supply chamber and said combustion-chamber, means for supplying air to said air-supply chamber, and a bridge-wall beyond the end of said arch or crown for directing the products of combustion toward the inner end of the arch or crown and causing a supply of air to be drawn through the open end and said transverse openings of the arch or crown into contact with said products of combustion, whereby the inner edge and under surface of the inner end only of the arch or crown is protected from the intense heat of the products of combustion.

4. A pulverulent-fuel-feeding furnace having a retort-like combustion-chamber, an arched crown extending part way through said chamber, means for delivering a supply of pulverulent-fuel particles at the entrance end of said combustion-chamber and to cause their travel along the same, a bridge-wall at the rear of said chamber to cause the upward deflection of said fuel particles, means beyond said bridge-wall to cause said fuel particles to assume a substantially horizontal line of travel, and means for supplying steam to said combustion-chamber beyond said arch toward said bridge-wall and in the same general direction as the direction of travel of said fuel particles and products of combustion.

5. In a fuel-burning apparatus the combination with a pulverulent-fuel-feeding device of a combustion-chamber having an arched crown extending part way through said chamber, a hot-air-supply chamber above said arched crown, a bridge-wall in said combustion-chamber beyond said arch, and a steam-supply pipe leading through said air-chamber for supplying heated air and steam to said combustion-chamber beyond said arch and in a direction toward said bridge-wall.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK N. SPEAR

Witnesses:
FREDERICK L. EMERY
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