

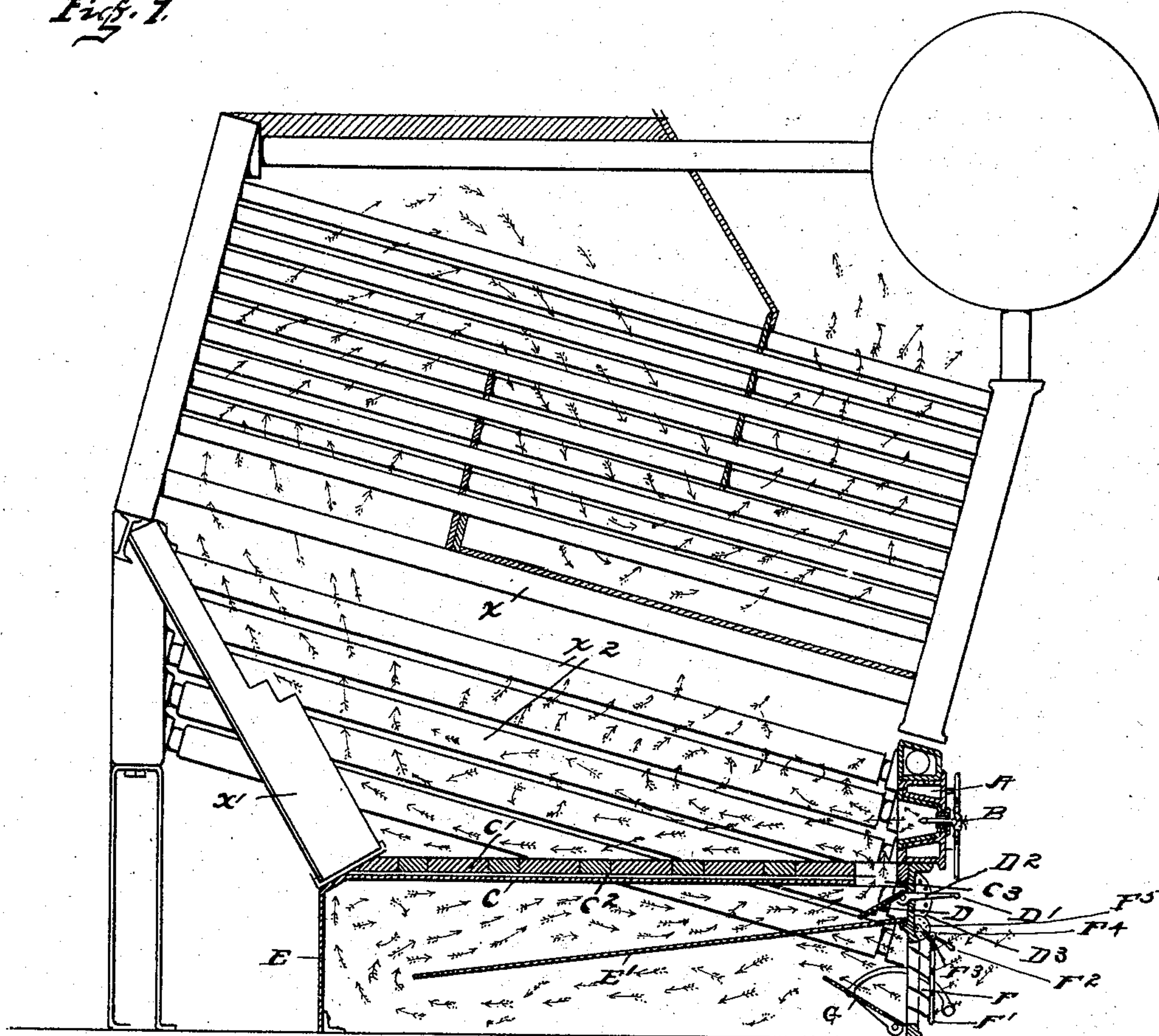
No. 782,472

PATENTED FEB. 14, 1905.

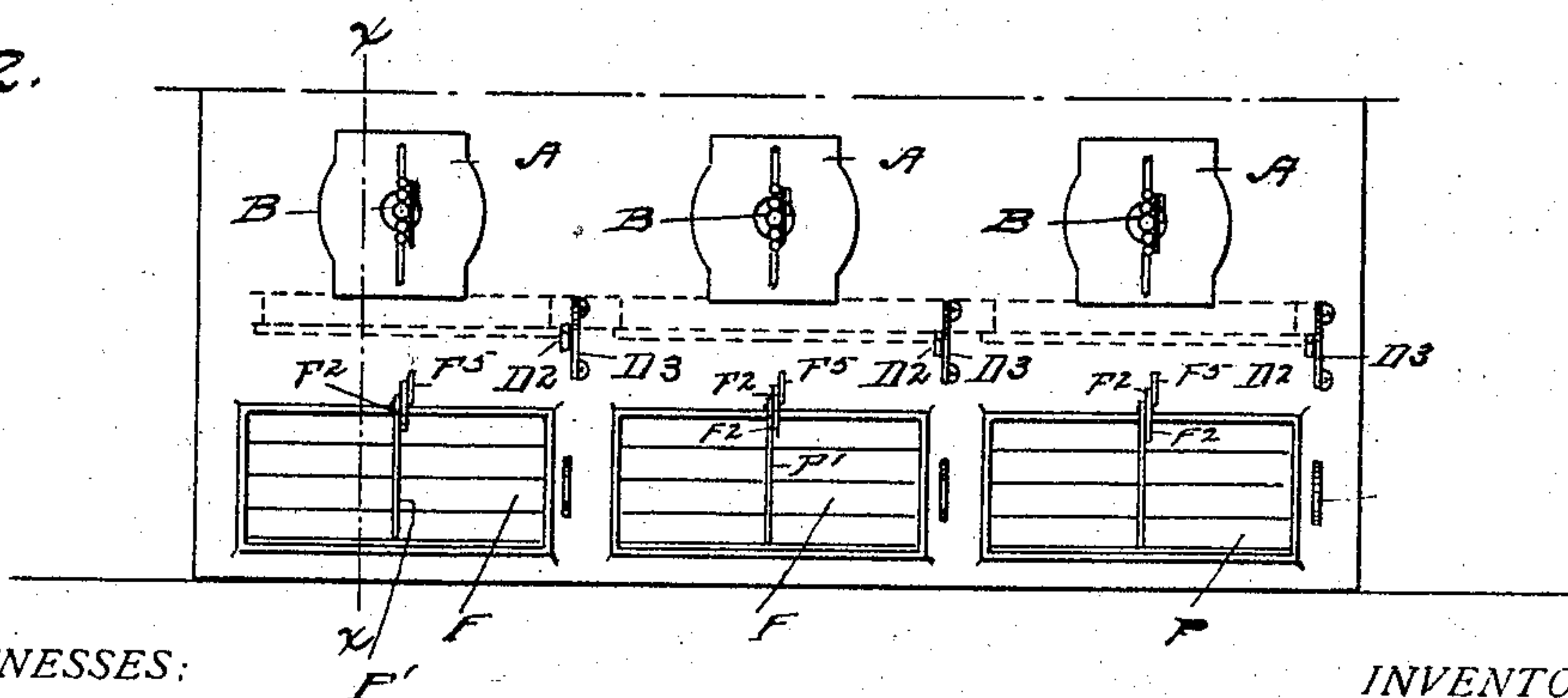
E. W. TUCKER & C. L. GRUNDELL.  
FURNACE.

APPLICATION FILED MAR. 30, 1903. RENEWED JUNE 20, 1904.

*Fig. 1.*



*Fig. 2.*



WITNESSES:

*Geo. F. Hatton*  
*V. Berka*

INVENTORS

*EDWIN W. TUCKER.*  
BY *CHARLES L. GRUNDELL.*

*Murdock, Yale & Co.*  
ATTORNEYS.



# UNITED STATES PATENT OFFICE.

EDWIN W. TUCKER AND CHARLES L. GRUNDELL, OF SAN FRANCISCO,  
CALIFORNIA.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 782,472, dated February 14, 1905.

Application filed March 30, 1903. Renewed June 20, 1904. Serial No. 213,413.

*To all whom it may concern:*

Be it known that we, EDWIN W. TUCKER, residing at 818 Page street, and CHARLES L. GRUNDELL, residing at 1638 Hyde street, in the city of San Francisco, county of San Francisco, and State of California, citizens of the United States, have invented certain new and useful Improvements in Furnaces; and we do hereby declare the following to be a full, clear, and exact description of said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

This invention relates to improvements in furnaces, and particularly to the adaptation of the furnaces of water-tube and all externally-fired boilers to the use of liquid fuel.

Because of the circulation of water around and about the furnaces of most water-tube boilers the furnace heat is rapidly absorbed, rendering the boiler very sensitive to thermal fluctuations. The principal source of trouble is the cold air rushing into the furnace-space through the dead-rise at the front through the grate-bars above the ash-pit and during the stoking period through the open furnace-doors. Heretofore in the adaptation of coal-burning furnaces to the use of fuel-oil little attention has been paid to the absence of regenerative action in an atomized oil-flame. In a bed of embers there is a constant radiation and reaction of heat with an intensity capable in a measure of withstanding the cold drafts, whereas injected oil, giving a sublimated flame of high velocity and suction, must be protected against intrushes of cold air, which hugging the walls and surface of the furnace and mixing with the flame reduce the absorbent power of the former and weaken the latter.

The objects of this invention are to overcome the objections above set forth by controlling the inlet of cold air and warming it before admission to the combustion-chamber and to accomplish heating of the air by refraction of heat within the combustion-chamber.

In carrying out our invention we provide hollow superheating-chambers fixed within the front of the furnace in place of the usual

stoke-doors and through which the burners extend. The usual grate-bars are replaced by a solid flooring of fire-brick having a narrow opening constituting the dead-rise across the front under the burners. Dampers are arranged whereby the inlet of air through the dead-rise is controlled from the outside. A deflecting-diaphragm is disposed across the width of the furnace between the floor of the combustion-chamber and the floor of the ash-pit. The inlet of air through the lower damper-opening is controlled by a door horizontally hinged at its bottom, whereby the ingress of air is directed against the deflecting-diaphragm when the door is partially open. When the said door is wide open, the draft is controlled by a series of horizontally-pivoted slats or deflectors operated in unison, whereby the current of air may be deflected at any desired angle. In internally-fired boilers (marine type) the deflectors can be fixed in the opening at a definite angle.

In the drawings, Figure 1 is a vertical cross-section on the line X X, Fig. 2, of a water-tube boiler having this invention adapted thereto. Fig. 2 is a front elevation of furnace-fronts thereof.

In detail the construction consists of the hollow superheaters A, around and through which the vehicle of atomization (compressed air or steam) circulates before passing to the burners B. The superheaters A, situated in the front of the furnace, absorb the heat radiating therefrom and return it through the flame issuing from the burners. The combustion-chamber is formed by the shell or tubes of the boiler  $\alpha$  (according to the type) above, bridge-wall  $\alpha'$  at the rear, the usual brick or tubular sides  $\alpha''$ , the superheating-fronts A, and the floor. The floor consists of the sheet-iron base C, suitably supported and having a layer of fire-brick C' laid thereon, with a thickness of asbestos millboard C<sup>2</sup> between to protect the iron from the intense heat of the combustion-chamber. The air-draft is admitted to the combustion-chamber through the dead-rise openings C<sup>3</sup> through the floor near the furnace-front. The area of the dead-rise is controlled by the dampers D,



pivoted adjacent to the edge of the opening and controlled by the handle D', projecting through the face-plate of the furnace. To control the said damper, the handle is perforated at D<sup>2</sup> to receive a pin engaging the quadrant D<sup>3</sup>, provided with perforations into which the pin may be inserted to fix the damper at the desired angle. As described, the dead-rise is the only inlet for air to supply the demand of the stack-suction. To admit cold air at this point would defeat the objects of this invention. Therefore the space below the floor of the combustion-chamber is utilized as a heating zone for the incoming draft.

This is accomplished by closing the rear of this space with the vertical wall E under the bridge-wall. The heating-chamber thus formed is divided horizontally by the sheet-iron diaphragm E', extending from the front above the damper-door downward to near the center and terminating short of the rear wall E to leave a rise for the draft.

The volume of incoming air is controlled and directed by the doors G and divided shutter, consisting of a series of horizontal deflectors or shutters pivoted at each end on the sides of the damper-opening. The shutters F are connected by the vertical rod F' in such a manner that the shutters are caused to open or close in unison with the action of the rod which is controlled by the lever F<sup>2</sup>, hinged at F<sup>3</sup> and fulcrumed to the rod at F<sup>4</sup>. The position of the lever F<sup>2</sup> is fixed by a pin extending through the same and the perforated quadrant F<sup>5</sup>. The incoming air receives its preliminary heating by being directed by the shutters F and doors G against the diaphragm E', which is heated by the heat radiated beneath the floor C. Following the diaphragm the current of air curls around the lower end into the intense heat existing between the floor C and the diaphragm and enters the combustion-chamber through the opening C<sup>3</sup> at a high temperature. From the opening C<sup>3</sup> the air passes directly into the flame of the burners, mixing therewith, to be carried forward and distributed to the heating-surface of the boiler. By thus making a pocket of the combustion-chamber disturbing-currents of air are eliminated and a certain amount of regenerative action created thereby, whereas where open grate-bars and direct ventilation exists the excess of cold air, which is beyond control, rushes up the smoke-stack, chilling the boiler-surface as it passes. By this arrangement of dampers a reserve of hot air can be banked in the space below the floor C by opening the shutters F and doors G and restricting the openings C<sup>3</sup> by the dampers D. It will be noted that when the doors G are partly open they serve to direct the air against the diaphragm; but when said doors are open to their fullest extent the air is deflected by

the shutters F. It will also be observed that the angle at which the air enters is controlled by the shutters independent of the angle of the doors G.

The type of superheater furnace-front and also the type of burners constitute separate applications for patent and are not herein claimed.

It is obvious that this invention relates to other types of boilers, and applicants do not wish to be confined to the exact type illustrated in its interpretation.

Having thus described this invention, what is claimed, and desired to secure by Letters Patent, is—

1. In combination with a steam-generating boiler, a furnace adapted to the use of fuel-oil, having hollow superheating-chambers through which the vehicle of atomization circulates before admission to the burners, a solid floor having a draft-opening at its front, dampers arranged to control the volume of air passing through said opening, a closed air-space being formed beneath said floor, a diaphragm dividing said space horizontally, openings being formed in the front below said diaphragm, hinged doors arranged to regulate the volume of air entering said opening, and a series of shutters or deflectors arranged in said openings and adapted to regulate the angle at which the air enters.

2. In combination with a steam-generating boiler, a furnace adapted to the use of fuel-oil having a solid floor provided with draft-openings across its front, dampers arranged to close said openings, means for adjusting said dampers with relation to said openings and holding them in their adjusted position, a closed air-space being formed beneath said floor, a diaphragm dividing said space horizontally, openings being also formed in the front below said diaphragm, hinged doors arranged to regulate the volume of air entering said openings, and a series of shutters or deflectors mounted in said opening and adapted to regulate the angle at which the air enters, and means for holding said shutters or deflectors in any adjusted position.

3. A furnace adapted to the use of fuel-oil having a draft-opening, a swinging door adapted to regulate the volume of air entering said opening, a series of shutters or deflectors mounted in said opening and adjustable to regulate the angle at which the air enters said opening, and means for holding said shutters or deflectors in any adjusted position.

In testimony whereof we have hereunto set our hands this 23d day of March, 1903.

EDWIN W. TUCKER.  
CHARLES L. GRUNDSELL.

Witnesses:

BALDWIN VALE,  
GEO. F. HATTON.