

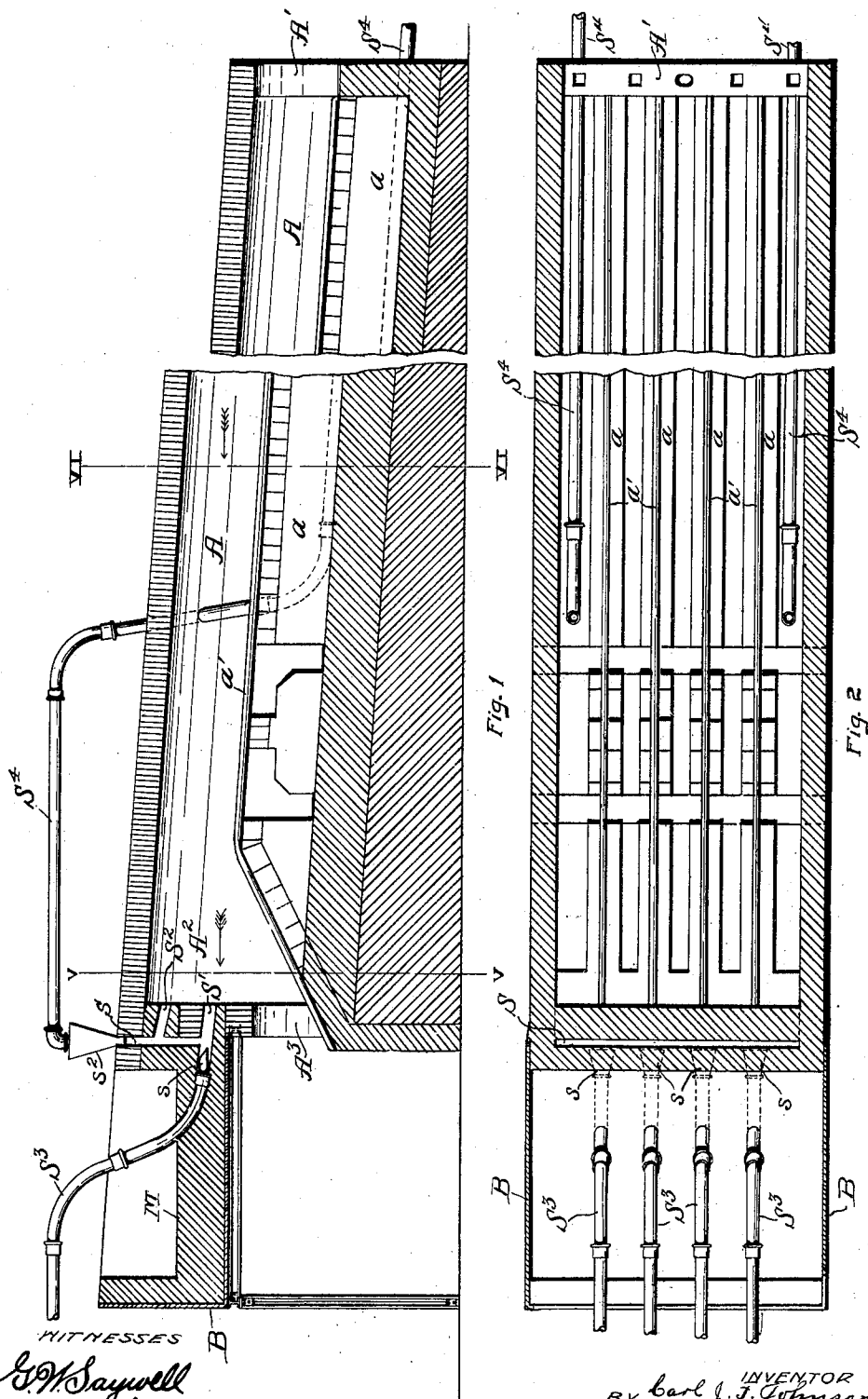
No. 897,746.

PATENTED SEPT. 1, 1908.

C. J. F. JOHNSON.
BILLET HEATING FURNACE.

APPLICATION FILED SEPT. 14, 1905.

3 SHEETS—SHEET 1.



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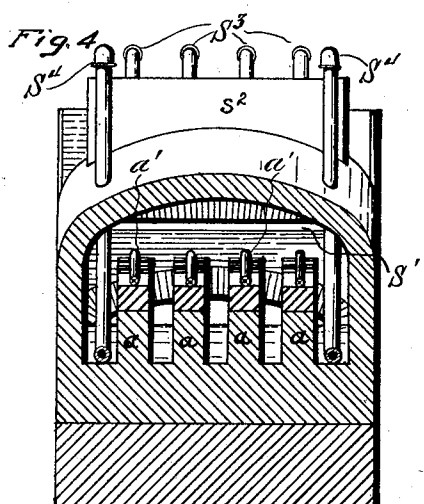
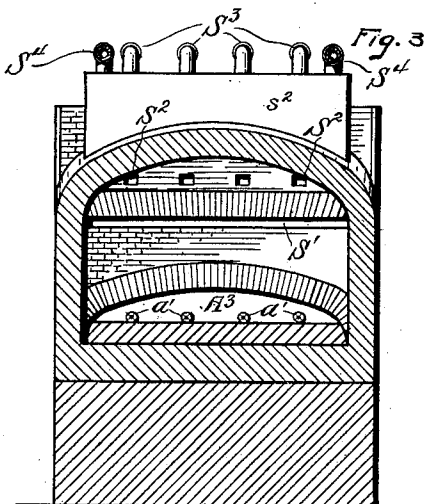
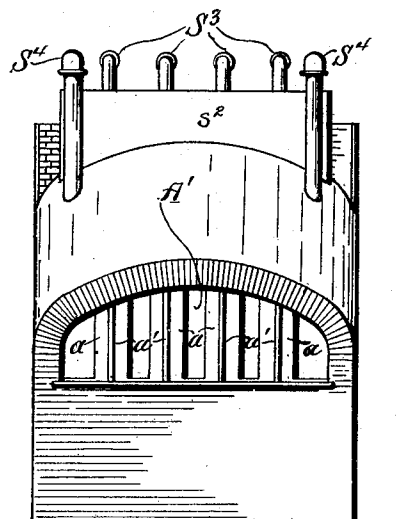
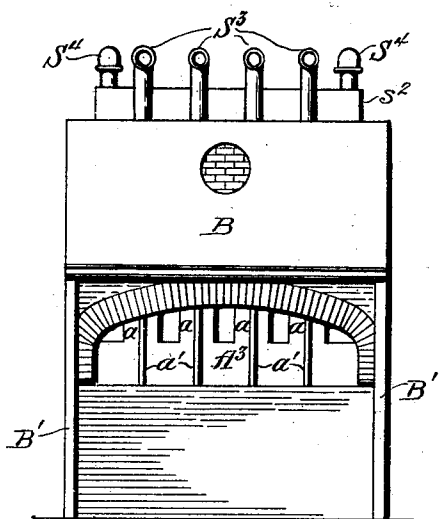


Fig. 5

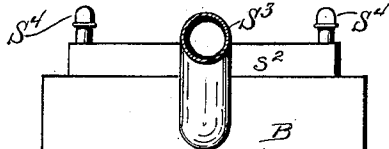


Fig. 6

WITNESSES

E. W. Saywell
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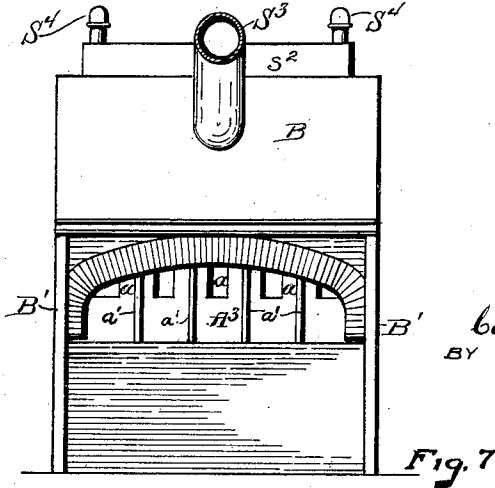


Fig. 7

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3 SHEETS—SHEET 3.

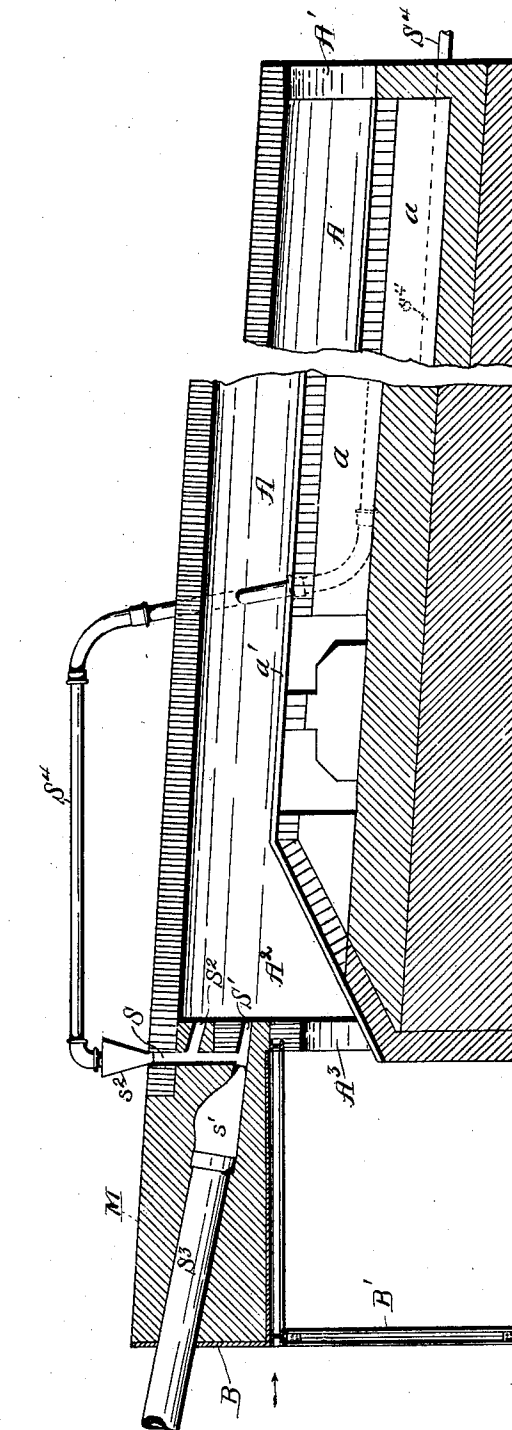


Fig. 8

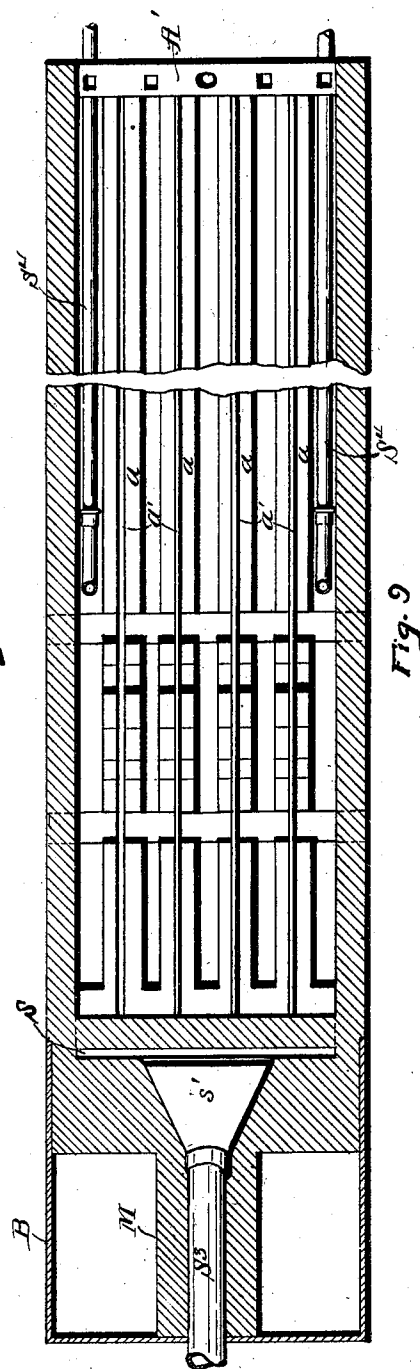


Fig. 9

WITNESSES
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UNITED STATES PATENT OFFICE.

CARL J. F. JOHNSON, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO CHARLES BERG, OF CLEVELAND, OHIO.

BILLET-HEATING FURNACE.

No. 897,746.

Specification of Letters Patent.

Patented Sept. 1, 1908.

Application filed September 14, 1905. Serial No. 278,374.

To all whom it may concern:

Be it known that I, CARL J. F. JOHNSON, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Billet-Heating Furnaces, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to reheating furnaces and particularly to furnaces for heating steel billets, where gas, either natural or artificial, is employed as fuel.

The object of my invention is to provide a furnace in which a uniform heating of the material, *e. g.* billets, is obtained, and which will at the same time require a minimum expenditure of fuel.

It accordingly has especial reference to the construction of the burner used in heating the above type of furnace, and consists of means hereinafter fully described and specifically set forth in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings: Figure 1 represents a vertical longitudinal cross-section of a furnace embodying my invention, and arranged to burn natural gas as fuel. Fig. 2 represents a horizontal longitudinal cross-section of the same; while Figs. 3 and 4 are front and rear elevations thereof, respectively. Figs. 5 and 6 are vertical transverse cross-sections thereof taken upon lines V—V and VI—VI, respectively, in Fig. 1, parts of the furnace appearing in elevation as well. Fig. 7 represents a front elevation of a furnace embodying my improved construction as adapted for the burning of artificial gas; while Figs. 8 and 9 are respectively a vertical longitudinal cross-section and a horizontal longitudinal cross-section of the same.

While my improved construction is here shown as applied to a furnace of the particular type designed for heating billets, it is evident that it is equally well adapted for use in any of the various kinds of reheating furnaces employed in connection with steel rolling mills. The billet-heating furnace here shown

is of the "continuous" type, in which the billets are introduced into the heating chamber, designated by A, at the end A' farthest removed from the portion A² where the gas burner is located. This heating chamber A is of the usual elongated form and is inclined downwardly from burner-end A² to opening A'. Extending its entire length are parallel dwarf walls *a* built up from the chamber floor and inclined at the same angle as such floor until near the portion A² of the chamber where they slant sharply in the opposite direction and lead to the discharge opening A³ of the chamber. Water-cooled skid pipes *a'*, which are laid along the tops of dwarf walls *a*, prevent injury of the walls as the billets are skidded along. Such movement of the billets along skid pipes *a'* is accomplished by means of a hydraulic ram, or similar pushing agent, not shown, which is located opposite to end A' of the heating chamber.

In the operation of the furnace the billets are introduced into the heating chamber at the end A' and are forced by the hydraulic ram to travel gradually up the incline on the pipe skids *a'*, the advance being through zones of constantly increasing temperature until the highest temperature is reached in the portion A² of the chamber. As the billets successively arrive at the point where the dwarf walls and pipe skids borne thereon slope in the opposite direction, they roll over and thus expose to the heat the darker and colder spots where they had previously rested on the pipes, and are finally discharged onto the floor or a table ready to be transmitted to the rolls.

As previously stated, my invention has particular reference to mechanism for heating a furnace of the character just described, there being nothing novel set forth in the description above given. And as has also been indicated, the fuel that my improved furnace is designed to employ is gas, either natural or artificial, only a slight alteration, and one easily made in practice, being required to change from the one to the other.

The burner is located at the forward and upper end of the heating chamber, the ignited gases being admitted into the chamber through openings arranged as hereinafter described. The various parts of the burner are supported in suitable masonry work M built upon a box-like platform B made of steel

plates and resting upon posts B'. In this masonry, near where it abuts against the end of the furnace structure proper, is provided a narrow vertical passage or slot S, Figs. 1 and 2, and 8 and 9. At its lower end this passage communicates with a similar passage or slot S' disposed at approximately right angles thereto, Figs. 1 and 8, and opening along its entire length into the forward end A² of the heating chamber A, Figs. 5 and 6. As shown in Figs. 1 and 8, this slot has a slight downward inclination from the line of its junction with the vertical slot S so as to be substantially parallel with the slid pipes along which the billets are advanced. Above the slot S' in a line parallel therewith is a series of apertures S², also communicating with vertical slot S and downwardly inclined therefrom, Figs. 1, 5 and 8.

Gas is admitted to the passage S' through suitable nozzles embedded in masonry work M connected with the supply main S³. When natural gas is employed I have found it advantageous to employ a plurality of such nozzles s mounted in the manner clearly indicated in Figs. 1 and 2. Where, however, the artificial product is used, a single large nozzle s' of the form shown in Figs. 8 and 9 gives the best results. The burner is designed with a view to facilitate the removal of one style of nozzle and the substitution of the other to meet the exigencies that frequently arise in the supply of gaseous fuel. Thus it is merely necessary to remove from the box platform B the masonry M inclosing one type of burner and to erect the other in its place, the furnace structure being undisturbed.

The air required to form a combustible mixture with the gas is admitted to slot S' through slot S. The details of such air supply comprise a closed, laterally elongated funnel or hopper structure s² fitted into the outer opening of slot S. Connected therewith are air supply pipes S⁴ through which the air is forced under suitable pressure. These pipes S⁴, of which there are preferably two, as shown, lie for a portion of their course within chamber A, being conveniently disposed between the side walls of such chamber and outer dwarf walls a, Figs. 2 and 9. By this arrangement of the pipes, instead of embedding them within the walls or floor-foundation of the furnace as has heretofore been the practice, they are rendered readily accessible for the purpose of making alterations or repairs. They are at the same time exposed to the heat of the furnace chamber and the air is thus raised to the proper temperature without the employment of extraneous heating means. The effect of the funnel or hopper s² is to render the pressure of the heated air, thus forced into the burner, uniform across the entire length of vertical slot S.

From the manner in which horizontal slot

S' and apertures S² are connected with vertical slot S it is evident that only a portion of the air will be forced down the entire length of such slot S to mingle with the gas from nozzles s or nozzle s', to thence escape through slot S' and be ignited. The size of the openings provided for the passage of the gas and air must be proportioned with the pressures employed so as to produce a properly combustible mixture. The remainder of the air escapes into the heating chamber through the apertures S² situated, as has been explained, above the opening of horizontal slot S'.

Aside from the arrangement of the air supply pipes and the novel structural features appearing in my improved burner, it is to the effect produced by the admission of this air above the ignited gaseous mixture issuing from slot S' to which I desire to call particular attention. Such incandescent gases are discharged in a downward direction, by virtue of the downward inclination of slot S', so as to pass below as well as above the billets as they advance along the dwarf walls a. The tendency, however, of heated vapors to rise would cause the hottest portions of such gases, as soon as the effect of the initial downward discharge was lost, to flow along the ceiling of the chamber instead of around the billets, and much of the heating effect would thus be wasted. I have found that the introduction of a blast of air just below the ceiling of the chamber and above this blast of incandescent gases, very effectively blankets the latter and, by preventing their rising, prolongs their confinement to the lower portion of the chamber. Such a blast of air I produce by the employment of apertures S², the effect being heightened by having the air at a high enough temperature to prevent its having an undue cooling effect and by also imparting to it an initial downward direction.

My improved billet-heating furnace, therefore, is not only adapted to be readily changed to employ either artificial or natural gas as fuel, but by its construction utilizes to the fullest extent the heat produced by the combustion of such fuel. The economy thus effected in the operation of the furnace is a very important item in the operation of steel rolling mills.

Having thus described my invention in detail, that which I particularly point out and distinctly claim, is:

1. In a furnace, the combination with a chamber having two downwardly inclined openings into its interior; of connections with one of said openings for discharging therethrough into said chamber in a downwardly inclined direction, a blast consisting of a combustible mixture of gases; and connections with the other of said openings for conveying in a downwardly inclined direc-

tion a heated blast of non-combustible gases into said chamber, whereby the incandescent gases are effectively confined to the lower part of the chamber.

2. In a furnace, the combination with a chamber having two downwardly inclined openings, one above the other, into its interior; of connections with the lower of said openings for discharging therethrough into said chamber in a downwardly inclined direction, a blast consisting of a combustible mixture of gases; and connections with the upper of said openings for discharging into said furnace in a downwardly inclined direction a blast of heated non-combustible gases for confining the incandescent gases toward the lower portion of the chamber.

3. In a furnace, the combination with a chamber having two downwardly inclined openings, one above the other, into its interior; of air and gas connections with the lower of said openings whereby a blast consisting of a combustible mixture of gases may be discharged therethrough into said chamber in a downwardly inclined direction; and an air connection for the upper of said openings whereby a blast of heated air may be discharged into said furnace in a downwardly inclined direction above said first blast, substantially as described and for the purpose set forth.

4. In a furnace, the combination with a chamber, of means for heating said chamber comprising a gas-burner having a burner-head formed with two downwardly inclined openings, one of said openings being adapted to discharge the products of combustion there taking place into said chamber in a downwardly inclined direction and in the form of a blast, and the other of said openings being adapted to discharge a blast of heated air above the blast from said gas-burner and in a downwardly inclined direction for effectively conveying and maintaining the first named blast in the lower portion of the chamber.

5. In a billet-heating furnace, the combination with a chamber, of a gas-burner adapted to heat said chamber and comprising a burner-head formed with communicating vertical and horizontal slots, such horizontal slots opening into said chamber throughout the width thereof, a gas supply connected with said horizontal slot, and an air supply connected with said vertical slot; and apertures connected with and approximately at right angle thereto said vertical slot and opening into said chamber above said horizontal slot.

6. In a billet-heating furnace, the combination

with a chamber, of a gas-burner adapted to heat said chamber and comprising a burner-head at one end of said furnace formed with communicating vertical and horizontal slots, such horizontal slot opening into said chamber, gas nozzles mounted to open into said horizontal slot, air supply pipes connected with said vertical slot, and downwardly-inclined apertures connected with said vertical slot approximately at right angle thereto and opening into said chamber above said horizontal slot.

7. In a billet-heating furnace, the combination with a chamber, of a gas burner adapted to heat said chamber and comprising a burner-head at one end of said furnace formed with communicating vertical and horizontal slots, such horizontal slot opening into said chamber throughout the width of said chamber, gas nozzles mounted to open into said horizontal slot, a closed elongated funnel fitted into said vertical slot, pipes for supplying heated air connected with such funnel, and downwardly-inclined apertures connected with said vertical slot and opening into said chamber above said horizontal slot.

8. In a billet-heating furnace, the combination with a chamber, of a gas-burner adapted to heat said chamber and comprising a burner-head formed with communicating vertical and horizontal slots, such horizontal slot opening into said chamber throughout the width of the chamber, a gas supply connected with said horizontal slot, and an air supply above and connected with said vertical slot; and means for discharging a stream of air into said chamber above said horizontal slot.

9. In a billet-heating furnace, the combination with a chamber, of a gas-burner adapted to heat said chamber and comprising a burner-head at one end of said furnace, formed with communicating vertical and horizontal slots, such horizontal slots opening into said chamber throughout the width of the chamber, gas nozzles mounted to open into said horizontal slot, air supply pipes connected with said vertical slot, and downwardly-inclined apertures connected with said vertical slot approximately at right angle thereto and opening into said chamber above said horizontal slot, such air supply pipes lying exposed for a portion of their length within said chamber.

Signed by me this 12th day of September 1905.

CARL J. F. JOHNSON.

Attested by—

JNO. F. OBERLIN,
A. E. MERKEL.