C. F. DILLER.

FURNACE.

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989,580. Patented Apr. 18, 1911.

Fig. 1.

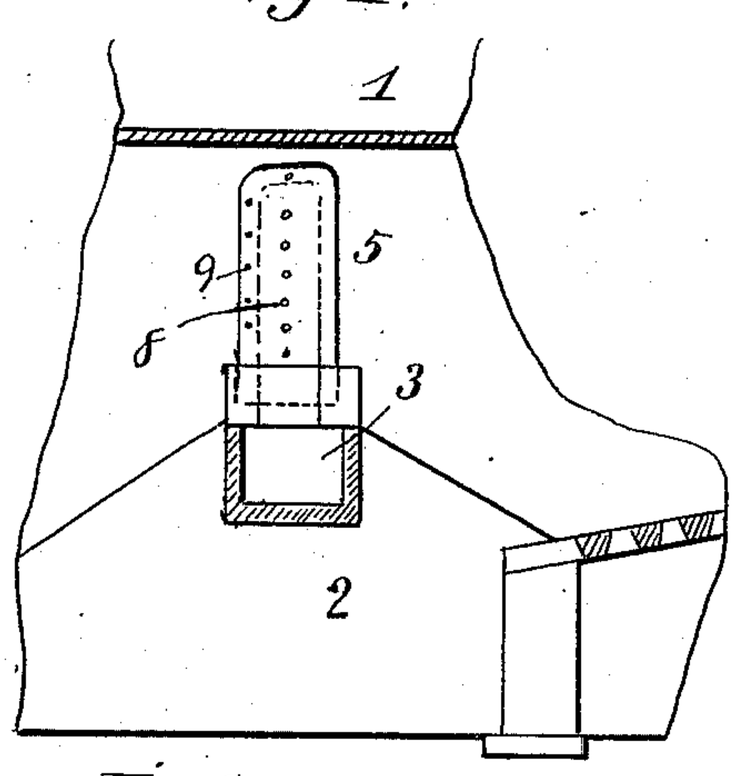


Fig. 2.

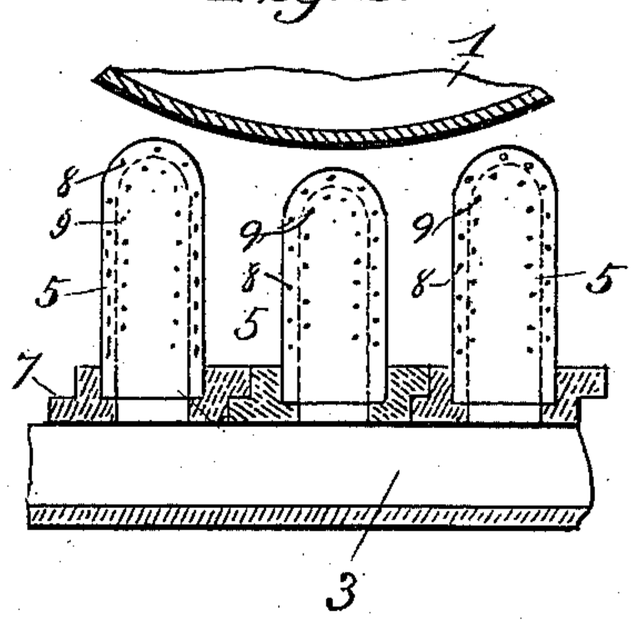


Fig. 5.

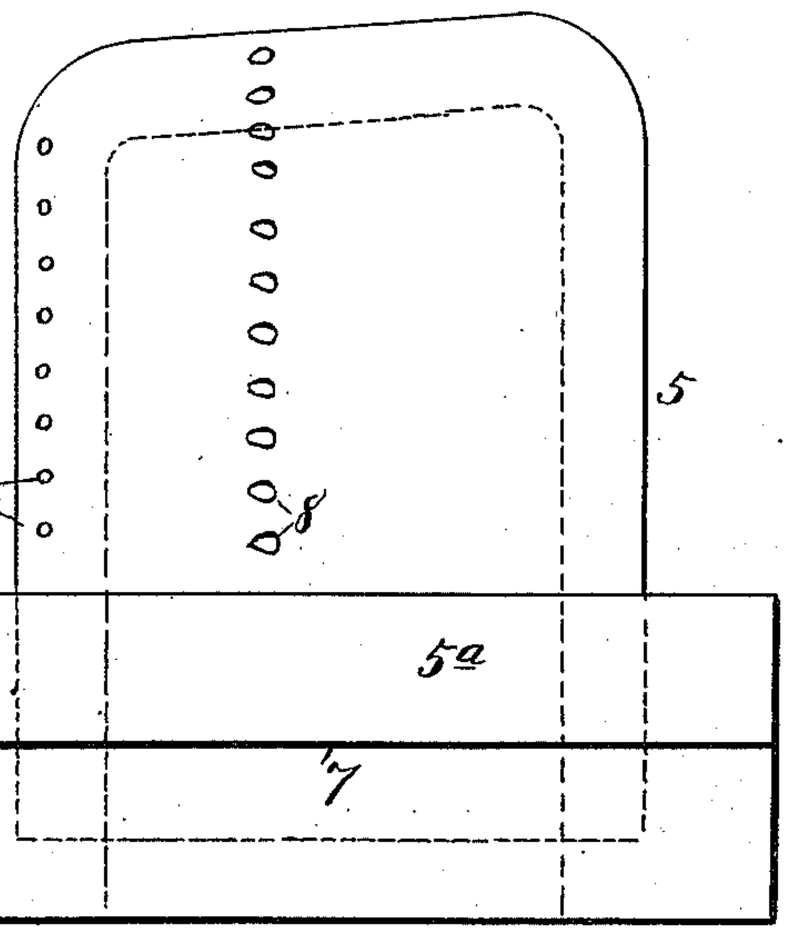


Fig. 3.

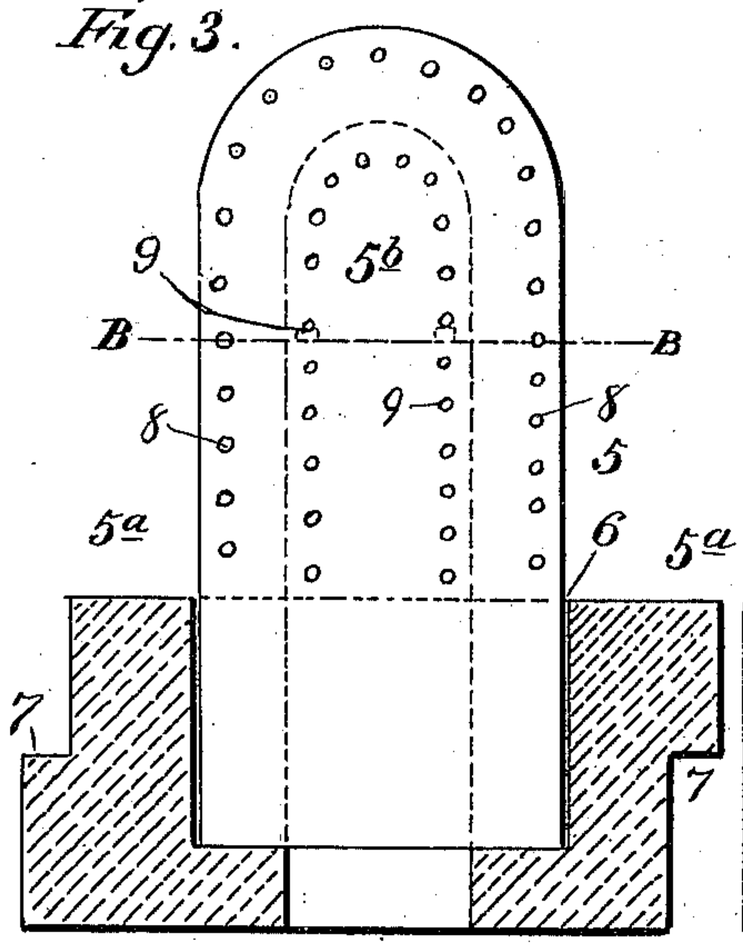
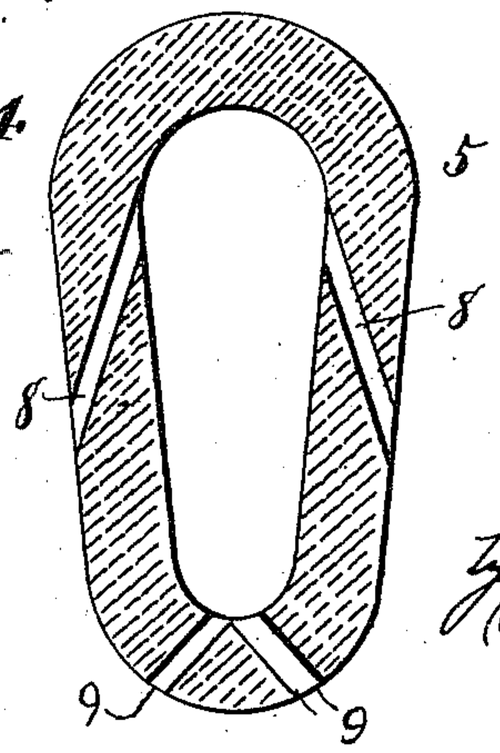


Fig. 4.



Witnesses

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FURNACE.

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To all whom it may concern:

Be it known that I, CHARLES F. DILLER, a citizen of the United States, residing at Lancaster, in the State of Pennsylvania, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to improvements in steam-boiler furnaces generally, more particularly in means for promoting combustion.

It has for its object, among other things, especially to increase the efficiency of fuel now in general use by augmenting or promoting the combustion of the carbon and gases than has heretofore been practical. The coal or fuel is supplied or fed in relatively small quantities and the combustion or fire thus maintained not too thick on the grate, while the delivery in minimum amounts of obliquely directed currents or streams of air in the general direction of the flame stream at a temperature sufficient for the ignition of the coal gases and so as to be concentrated or focused at a common point in the combustion chamber, beyond their initial point of entrance, has the effect of providing (an induced) draft or air supply up through the grate, through the fuel-bed. The entire fire immediately over the grate is thus maintained for a proportionately much longer time than would otherwise be possible by the deflection of the flame stream at the bridge wall, the gases thereby having ample time and space for effective or complete combustion before being allowed impingement upon the boiler surfaces, and from which also results a smoke preventing action, lessening of consumption of fuel, and accordingly reducing cost of running expenses.

The invention consists of certain features for securing the aforementioned results, substantially as hereinafter fully disclosed and defined by the claims.

As above outlined or suggested and as will be noted from the appended disclosure, my invention is characterized from any endeavor which has been made in this art heretofore in the particulars which will be next described.

First: The air-suppliers or deflection tubes otherwise designated as induction oxidizers are so constructed or devised that they introduce the minimum amount of air to the combustion at the rear or bridge-wall end of the fire chamber, but, I find in my experience that all other furnaces of this type admit the greatest or maximum amount of air, either at the bridge wall, or at the combustion chamber, or else at the front of the fire chamber, or along the sides of the fire chamber.

Second: The air-suppliers, or induction oxidizers are so adapted that the air which they do admit is, by their structural outlines, their juxtaposition, and geometrical proportion chemically mixed with the flame-stream in a much more thorough or effective manner than would otherwise be possible, because it leaves the induction oxidizers or air suppliers at twelve hundred and ninety-two (1292) degrees and hotter, which is the ignition temperature which the flame-stream gases require for their perfect combustion. Generally furnaces or inventions along this line, admit so much air that it is impossible for the admitted air to attain the temperature of twelve hundred and ninety-two (1292) degrees and hotter, consequently the chemical mixture with the flame-stream is not attained to such a degree of perfection as in the use of my invention and which as indicated, is necessary for the ignition of the gases and accordingly the prevention of smoke.

Third: The air suppliers or induction oxidizers are so adapted that the air, admitted therethrough from the outside and at outside temperatures and suddenly heated to twelve hundred and ninety-two (1292) degrees, issues with great force by reason of the expansion in volume for each degree of temperature to 1292 degrees, being nearly 1/500 greater in volume for each degree, or more than three times greater in volume at the exit than when admitted, said air being delivered from said air-suppliers through air ports or passages, arranged at twenty degree and forty-five degree angles to the axis of said air-suppliers, respectively, to a common point, in the combustion chamber, about three inches beyond or back of the air-suppliers thereby greatly increasing the induction of air through the fire-grate. Contrivances generally of this type retard the induction of air through the fire-grate, by admitting air in the reverse direction, or at right-angles to the direction of the flame-stream, or else, by admitting with the air a jet of superheated steam of a temperature of only three hundred and fifty degrees, they cool and lower the twelve hundred and

ninety-two degree ignition temperature required, and attained only by the air-suppliers herein described.

Fourth: The air-suppliers, deflection tubes, or oxidizers are adapted to deflect or throttle the flame stream which tends to retain the gases in the fire chamber immediately above the fire-grate, which causes the fuel gases to mix more readily than would otherwise be the case; prevents the H_2O in the coal from robbing the combustion chamber of nine hundred and sixty-seven degrees of heat (its latent heat of absorption) in changing its temperature to two hundred and twelve degrees when it is admitted to, or on top of, the three thousand degree fire grate. The delivery of the 1292 degree air jets concentrated and focused upon the flame-stream, intensifies the heat and also imparts great velocity to the flame-stream, greatly aiding the violent chemical mixture of one atom only of additional oxygen at this moment and under these very exceptional conditions of compression, intense heat, violent mixture and admission of only one atom of oxygen heated to ignition temperature of twelve hundred and ninety-two degrees. It is further stated in this connection that under these conditions I do actually produce at times flashes of the chemical union of hydrogen and carbon—62,000 British thermal units. Devices generally of this type either expel the gases above the fire-grate as rapidly as possible by the aid of commingled air and steam delivered thereto, or else so balance the draft by interposing a bridge or baffle between the admitted air and point of delivery of the combustion products to the smoke exit, that it is entirely impractical to attain satisfactory results by the modern method of "mass action" firing, now so generally practiced in locomotive firing.

Figure 1 is a broken sectional view, illustrating so much of a boiler furnace as necessary to show the application of my invention thereto. Fig. 2 is a like view produced vertically and centrally through Fig. 1. Fig. 3 is an enlarged partly sectional and partly front view of the invention. Fig. 4 is a horizontal section taken on the line B—B. Fig. 5 is a side elevation of Fig. 3.

A multiplicity of what may be styled air-suppliers or induction oxidizers 5, preferably, of the best fire brick, are arranged in upright or vertical position upon the upper surface of the header 3 for taking the outside air from the latter and delivering it into the combustion chamber or flame-stream for aiding and carrying out the purposes of my invention as will more fully appear hereinafter. Each air-supplier or induction oxidizer, besides being hollow, comprises two sections or members 5^a, 5^b, the base section or member 5^a being of general rectangular outline or formation and resting directly upon the air-intake or header 3, the same also communicating with the interior of the latter. Said base section or member has its passage laterally enlarged or widened suitably above a plane horizontally intersecting said passage to form a socket 6 to receive and allow of supporting therein the main or upper section or member 5^b, said socket conforming to the exterior cross-section of the latter member, said member also having a lateral base flange 7 to aid its stability in superposed position. Said upper or main section 5^b is preferably tapered in horizontal or transverse section rearwardly, and has its upper end closed, which end is also slightly sloped or inclined rearwardly, all having the combined effect to centralize and deflect the passage of the flame-stream, as it contacts with said air-suppliers in its rearward travel, to bring it more fully, than would otherwise be the case, in the range of the delivery of the air through and from the air ports or passages of said air-suppliers next described. Also, said main member has produced through its walls multiplicity of ports or passages arranged in two series, 8, 9; the series 8 opening laterally therethrough, at an angle of about twenty degrees to the axis thereof, while the series 9 open through the extreme rear end thereof at an angle of about forty-five degrees to said axis.

This arrangement results in delivering the air streams or jets about three inches beyond the back ends of the air-suppliers and in concentrating or focusing such delivery of each two series of air ports or passages at points in common vertical alinement in the combustion-chamber, whereby the action of effecting the chemical union between the oxygen and the carbon of the combustion-products, as well as the mechanical combustion therebetween, will be greatly intensified or stimulated, thereby rendering complete or perfect combustion an assured fact or certainty, necessary, as has been already indicated for smoke prevention. My invention is practically based upon the union of the principles underlying the Welsbach and Bunsen burners; the employment of the multiplicity of air-jetting ports and effecting ignition beyond the point of admission of the air to the combustion-products or gases answering to the elemental features common to said burners.

The air-suppliers vary or increase in length from a central point, below the boiler, each way laterally, and are thus adapted to conform at their upper ends to the general outline of the lower surface or half of the boiler shell, and have their said ends arranged conforming in outline to said boiler surface as clearly seen in Fig. 2, in order that their air-delivering capacity, as will be more fully seen presently, may be effective

for treating all of the passing heat-currents or gases from the combustion-chamber. It will be observed that the air admitted to said air-supplying tubes is delivered in oblique or diagonal streams or currents upon the carbon and gases liberated from the ignited fuel or coal in the combustion chamber to thoroughly mix air at a high temperature and thus promote or cause the complete consumption of such gases, and by chemically uniting additional oxygen at this point to change the CO to CO_2, thus chemically increasing the efficiency of the fuel. It will also be observed that the violent expansion action of the air within the air-suppliers and the lateral expansion of the gases cause an induced draft at the bridge wall, thus drawing additional air through the grate bars and promoting draft.

The open space between the air-suppliers is 10% more than the entire area of the boiler flues. The area of all the holes of said air-suppliers is the same as the area of the outside air-intake. The reason for the 10% more open space than the area of the boiler flues is to avoid offering any obstruction to the draft whatever, allowing the 10% for friction in the passage of the fire between the air tubes. The purpose of the combined area of the holes being the same in area as the air flue is that the air comes into the latter cold, and as the air tubes are heated by the fire the air therein expands in volume three times more than in its initial temperature as when entering the air-supplying tubes, suction action in the chamber in rear of said tubes serving as the motive force which drives the 1292 degree air so violently through the air ports of the oxidizers to properly mix with every particle of the combustion products no part of which combustion products, however fractional, may escape to the smoke stack without being thoroughly and effectively (the hotter the fire the more air is sucked into the air passage or pipe) mixed with all of the additional oxygen which it requires to make a perfect chemical union because of the particular arrangement of the holes of the air-supplying members as above indicated.

I claim:

1. In a furnace of the character described, a fire-chamber, a bridge-wall at the back end of the fire-chamber, an air intake supported by said bridge-wall and an air supplier adapted to receive its supply of air from said air-intake and having vertical series of air-delivering ports in its sides and rear end, the jets of air from the lateral and rear end ports meeting in vertical lines in the zone of combustion.

2. In a furnace of the character described, a fire-chamber, a bridge-wall at the back end of the fire-chamber, an air intake supported by said bridge-wall, and an air-supplier receiving its supply of air from said air-intake and provided with vertical series of air-ports in its sides and rear end, said ports being arranged at an angle of twenty degrees and at an angle of forty-five degrees to the axis of said air supplier, respectively, the air jets or streams from the side and end ports meeting in vertical lines in the zone of combustion.

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

CHARLES F. DILLER.

Witnesses:

CHAS. E. LONG,

JEANETTE R. LONG.