(No Model.)

J. S. ZERBE.

FIRE BOX CONSTRUCTION FOR BURNING HYDROCARBON OILS.

No. 542,673. Patented July 16, 1895.

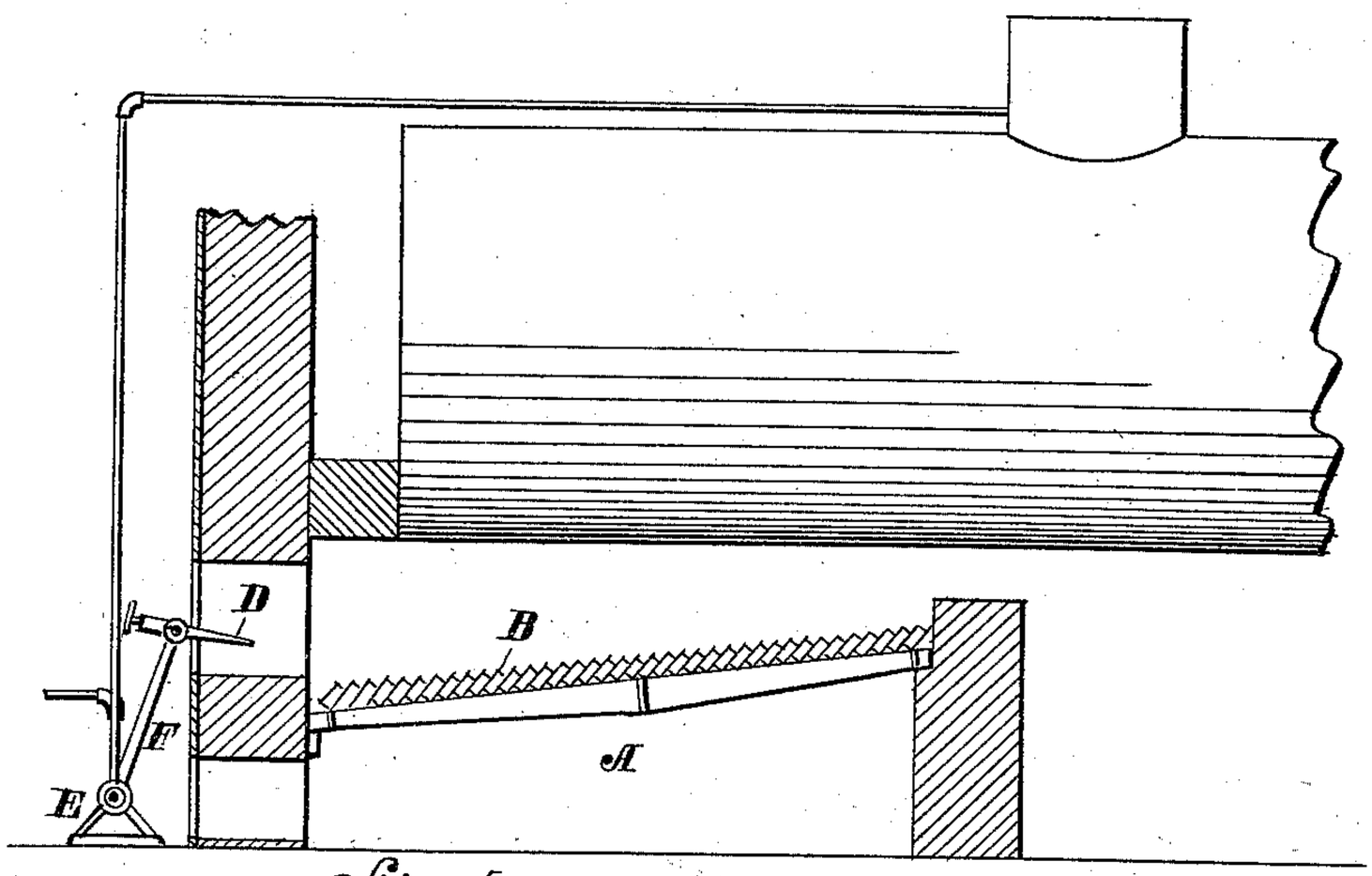

Fig. 1.

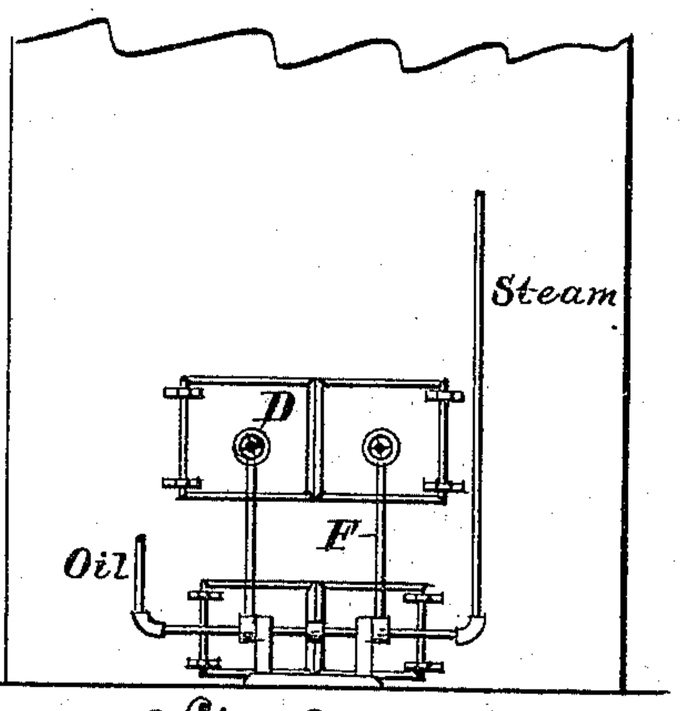

Fig. 2.

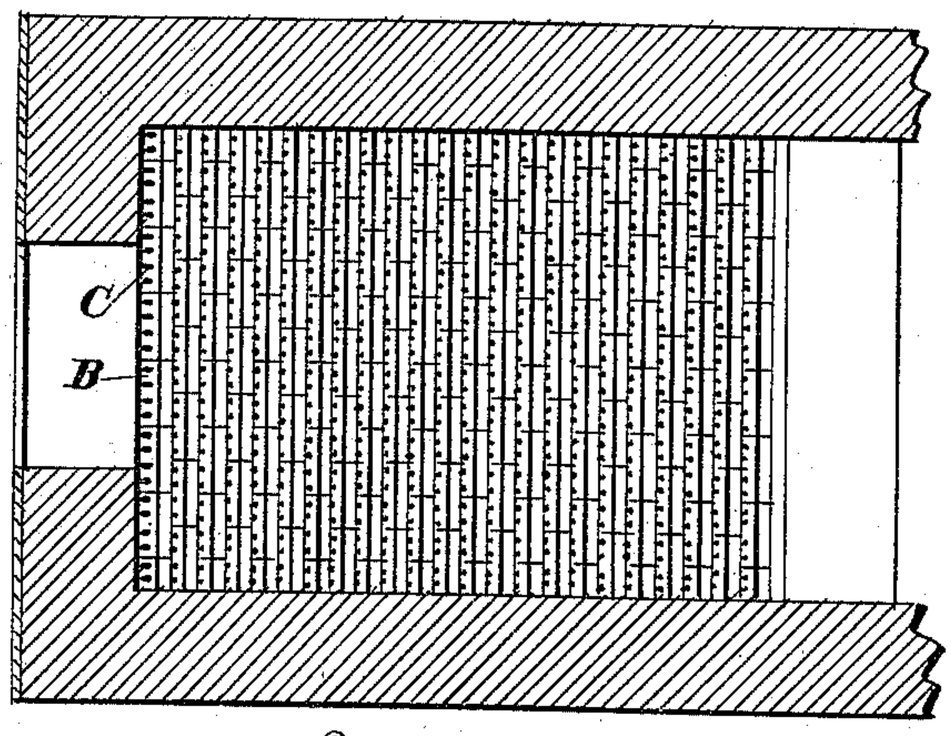

Fig. 3.

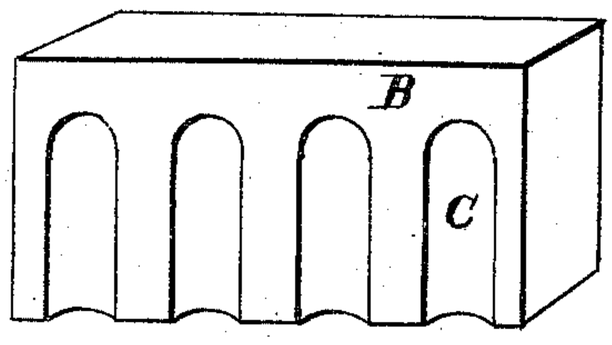

Fig. 4.

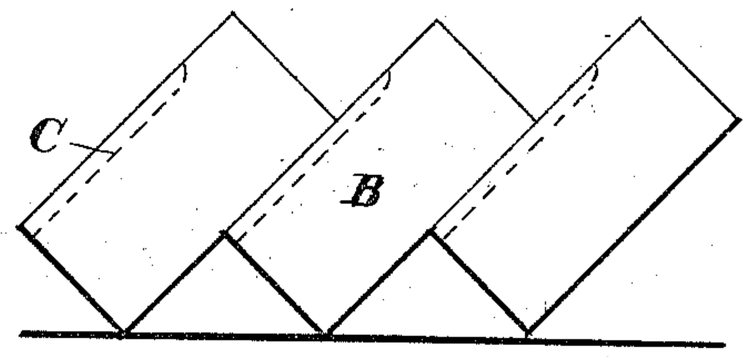

Fig. 5.

WITNESSES:

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UNITED STATES PATENT OFFICE.

JAMES S. ZERBE, OF BROOKLYN, NEW YORK.

FIRE-BOX CONSTRUCTION FOR BURNING HYDROCARBON OILS.

SPECIFICATION forming part of Letters Patent No. 542,673, dated July 16, 1895.

Application filed November 5, 1894. Serial No. 527,917. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. ZERBE, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Fire-Box Construction for Burning Hydrocarbon Oils, of which the following is a specification.

The object of this invention is to improve the methods of burning hydrocarbon oils, and it consists in the structure and arrangement of the fire-box of a boiler, so that when the jet or spray of steam and oil is injected into the combustion-chamber the requisite quantity of air will intermingle with the carbonic gases generated at the point of ignition and thus produce perfect combustion. This is accomplished without requiring any deflecting surfaces or retarding walls within the fire-box, enabling me to use the entire area of the grate-surface, all of which will now be set forth in detail.

In the accompanying drawings, Figure 1 is a side view, partly in section, of a boiler equipped with my improved system of burning hydrocarbon oils; Fig. 2, a front view of the boiler; Fig. 3, a horizontal section of the fire-box through line *x* of Fig. 1; Fig. 4, a perspective view of one of the fire-brick used on the grate; and Fig. 5, a side view of the bed of fire-brick, showing the manner of disposing them on the grate-bar.

In arranging a fire-box I prefer to elevate the rear ends of the grate-bars A, as shown in Fig. 1, thereby contracting the fire-box space vertically and assuring a more direct application of the flame against the boiler. This disposition of the grate-bars is in direct opposition to the recognized practice when coal is used; but it must be remembered that a bed of incandescent coal on grate-bars has a greater tendency to burn them than would be the case with gaseous fuel, unless the latter should be directed immediately against or beneath them. Furthermore, I provide against any liability of burning out the bars by the peculiar structure and arrangement of the superposed fire-brick base.

Fig. 4 shows in detail one of the bricks B. This is made of any desired size, preferably two inches or more thick and fully double that width. Within one face is placed a number of shallow grooves C, which extend approximately two-thirds the distance across the side. The bricks thus constructed are laid on the grate-bars A, parallel with the front wall of the fire-box and disposed at an angle of about forty-five degrees, with grooved face toward the front wall. The grooves thus furnish vent-apertures over the entire surface, so that the requisite quantity of air is provided to the flame above the bed.

I find that too much air is as ineffective as too little air and that the best results are obtained by supplying two parts of air to one part of carbonic gas, and this can be effectively regulated by means of the ash-pit door. This quantity of air applies particularly where a spray of oil is used above the grate-bars. When, however, a vapor or gas is used, a much greater quantity of air must be furnished to provide perfect combustion.

The injector or pulverizer D may be made in any of the well-known forms, adapted to communicate the oil by means of steam, as shown herein, or by compressed air, and this I prefer to mount on a frame E, and adapted to swing to and from the furnace door, and the injector itself is so mounted on the hinged tubular arm F that the pulverized oil will be thrown against the serrated bed at any angle.

In practice the jet of oil ignites when it is thrown against this bed and heats up the fire-brick, the air passing up through the grooves C and uniting with the carbonic gases generated by the contact of oil spray with the heated brick and a perfect oxyhydrogen flame is the result. In all methods of using hydrocarbon oils too little attention has been paid to the manner of supplying the air to the burning mass, and I find by practice that it is difficult to obtain perfect combustion in a furnace where sprays are used, even when air is supplied to the combustion-chamber under pressure unless the air is supplied to the flaming mass at all points, and it is obvious that where a spray is directed against a solid wall the air does not thoroughly mix with the burning mass, and as the combustion-chamber is short the flame passes beyond the bridge-wall too rapidly to permit of the formation of a perfectly ignitible gas. To overcome this various inventors inject the spray into a chamber having tortuous passages, intercepted or

fed by air-channels. I avoid all these expedients by making a bed which has a serrated face for breaking up and retarding the comminuted particles of oil and subjecting every portion of the vaporizing surface to a jet of air.

Thus far I have referred only to a jet or spray of oil. I find that this fire-brick bed is particularly well adapted to the use of either a producer gas flame, natural gas, or where used in connection with the system of producing a a vapor, as set forth in one of my pending applications, Serial No. 527,916. I do not, therefore, limit myself to the use of this fire-brick bed in connection with only the injector or pulverizer.

I am aware that it is not new to provide inclined or ascending beds of fire-brick within a fire-box against which the oil sprays are injected. These beds are made in various forms, either of superposed layers of fire-brick or of broken up particles of fire-brick, or composed of coal or coke, which is heated up to incandescence; but such structures and arrangements of inclined beds do not produce the results obtainable by my invention, as I have repeatedly demonstrated by experiments, for the following reasons: As stated hereinbefore the important object is to provide a free and positive supply of oxygen at the point of combustion. If an ascending column of fire-brick is built upon the grate-bars the oil jet from the pulverizer is injected against the mass, so that the spray enters the interstices between the brick and is gradually forced through the entire column and to a point beyond which the heated or incandescent state of the fire-brick has no vaporizing effect on it. Hence the action of the air, which cannot be freely admitted through the mass of brickwork, does not readily unite with the evolved carbonic gas at the surface of the ascending brick, where there is the greatest heat, and a large portion of the fuel is lost. This is shown by the fact that with all brick-beds of this character the paraffine from the oil is disseminated throughout the base of the brick column and finally results in entirely choking up all the interstices, thus rendering it wholly inoperative. This is also largely true of the ascending coal and coke beds; but where these are used they are consumed in course of time and must then be replaced by a new bed, which necessarily makes the use of coal or coke undesirable, because expensive and difficult to keep in order. Furthermore, I call attention to the fact that if the grate-bars are elevated at their rear ends and a bed of coal is placed thereon and brought to a state of incandescence the bars will readily burn out, so that the practice with all steam users is to depress the rear end to obviate burning out. This is not the case where the form and arrangement of fire-brick as herein shown is placed on grate-bars having their rear ends elevated, even though the fire-brick on the extreme rear ends of the bars may be elevated above the bridge-wall, and the reason for this is that the air from the ash-pit is freely admitted through the grooves C, and this circulation of air is uniform and over the entire grate surface. With the use of coal or coke more or less of the incandescent particles find their way between the bars of the grate. Hence they are readily burned out. This fire-brick structure, although it may be heated up to a much higher temperature than a coal or coke mass, always permits a free circulation of air around and through the grate-bars, which absolutely prevents injury to them.

I also call particular attention to the angle of the fire-brick which are so disposed that the spray from the injector cannot possibly be thrown down the grooves or ducts C. This is an important feature in the arrangement of any bed of fire-brick against which a jet of sprayed oil impinges. Furthermore, the injector by its action sets up a rapid movement toward the rear end of the fire-box, and this has the effect of drawing up the air through the ducts C, so that the position of the fire-brick being rearwardly inclined and having their ducts so disposed, an abundance of air is assured at the point of combustion where it is essential to make a perfect admixture.

I am not aware that any prior invention has the entire area of the grate provided with a regular mass of fire-brick having uniform ducts throughout, nor that any fire-box has heretofore been constructed with grate-bars therein elevated at their rear ends and provided with a single layer of fire-brick thereon disposed in a regular manner, as herein shown.

What I claim as new is—

1. A fire box having on the grate bars a bed formed of fire brick nested together and inclined at an angle to the grate bars and provided with grooves to form air ducts between the ash pit and the combustion chamber, substantially as set forth.

2. A fire box having the rear ends of the grate bars elevated and provided with a single bed or tier of fire brick nested together at an angle to the grate bars, each brick having grooves to form air ducts between the ash pit and combustion chamber, substantially as set forth.

3. A fire box having the rear ends of the grate bars elevated, and provided with a single tier of fire brick over the entire surface, inclined at an angle to the grate bars, each fire brick having grooves on its front face, forming air ducts, substantially as set forth.

4. A fire box having the rear ends of the grate bars elevated, and the entire grate area covered by a serrated fire brick bed composed of a single tier or layer, each brick being disposed at an angle approximating forty-five degrees to the grate bars and inclined rearwardly said bed having air ducts in its entire surface at regular intervals, substantially as set forth.

5. A fire box having on the grate bars a bed formed of fire brick nested together at an angle

to the grate bars and provided with grooves to form air ducts between the ash pit and combustion chamber, in combination with an injector or pulverizer through the front wall of the fire box, substantially as set forth.

6. A fire box having the rear ends of the grate bars elevated and provided with a single bed or layer of fire brick nested together at an angle to the grate bars and having grooves to form air ducts between the ash pit and combustion chamber, in combination with an injector or pulverizer to inject a spray against the grooved face of said brick, substantially as set forth.

7. A fire box having the rear ends of the grate bars elevated and provided with a single layer or bed of fire brick over the entire surface, of the grate bars inclined rearwardly in regular order, each fire brick having grooves on its front face forming air ducts, in combination with an injector or pulverizer, substantially as set forth.

Signed at Brooklyn, in the county of Kings and State of New York, this 31st day of October, A. D. 1894.

JAMES S. ZERBE.

Witnesses:
HUGH MOORE,
A. J. ZERBE.