2 Sheets—Sheet 1.

J. W. BONTA.

FURNACE FOR STEAM BOILER.

No. 182,057. Patented Sept. 12, 1876.

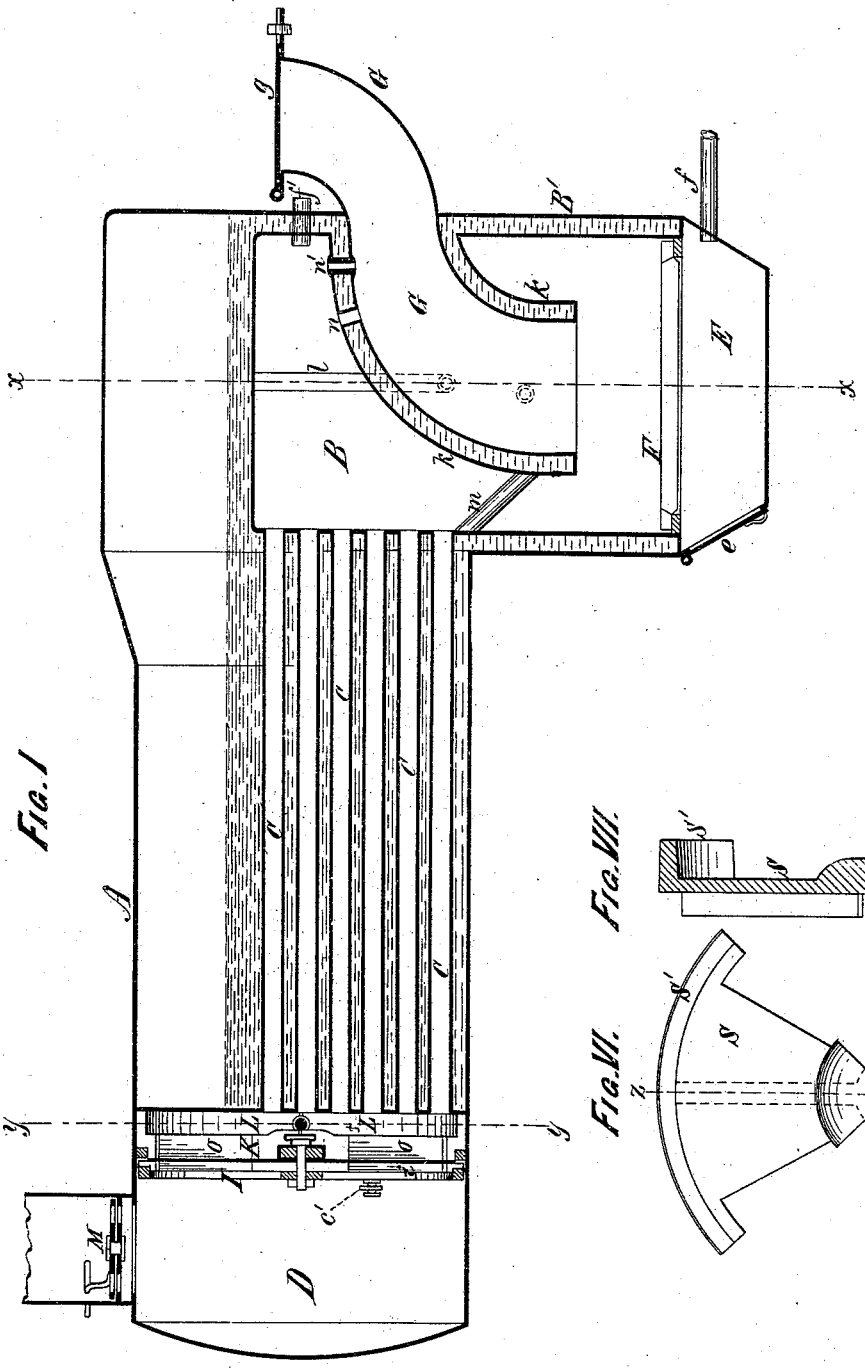

FIG. I

FIG. VII.

FIG. VIII.

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Geo. W. Miatt

INVENTOR:

James W. Bonta

Per Edw. C. Zunby

atty

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FIG. II.

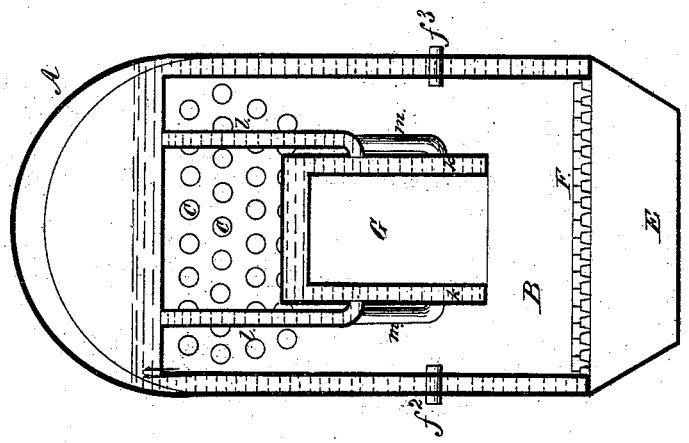


FIG. III.

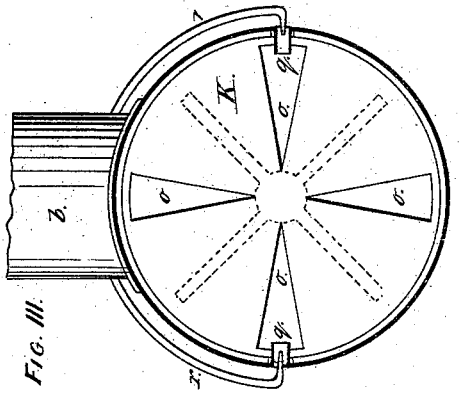


FIG. IV.

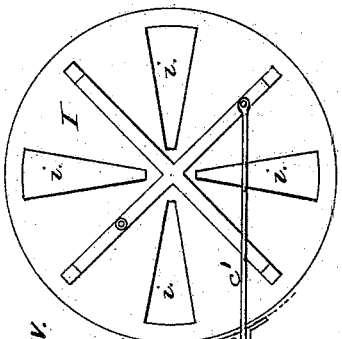
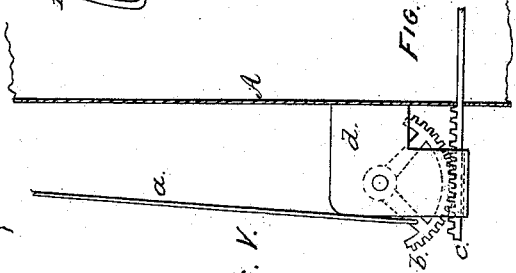


FIG. V.



WITNESSES:

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Atty.

UNITED STATES PATENT OFFICE.

JAMES W. BONTA, OF NEW BRIGHTON, PENNSYLVANIA, ASSIGNOR TO BONTA FURNACE COMPANY, OF HARTFORD, CONNECTICUT.

IMPROVEMENT IN FURNACES FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **182,057**, dated September 12, 1876; application filed May 25, 1876.

To all whom it may concern:

Be it known that I, JAMES W. BONTA, of New Brighton, Pennsylvania, have invented certain Improvements in Furnaces for Steam-Boilers, of which the following is a specification:

My improvements, which relate to the construction of furnaces for steam-boilers, are designed to promote economy in the consumption of fuel. They accomplish this object by affording facilities for regulating and controlling the fire, and insuring perfect and complete combustion without cooling the furnace by the introduction of an excessive quantity of cold air, and without the use of drafts of air powerful enough to carry off unconsumed portions of fuel in the form of sparks or smoke.

My invention consists in the following devices and their combinations, to wit: First, a coal-magazine, which is also a retort, for the generation of gas from the fuel it contains. This magazine, the external mouth of which is provided with a tight-fitting door, is situated partly within the fire-chamber, and, being open at the bottom and perforated near the top, automatically feeds coal upon the grate-surface as the fuel thereon burns away, and discharges gas into the upper part of the fire-chamber for ignition at that point; secondly, a water-jacket surrounding my magazine retort within the fire-chamber, and connected with the water-space of the boiler, and thus adding a large area of available heating-surface; thirdly, in connection with the magazine and retort, a closed ash-pit, provided with an induction pipe or pipes for supplying a jet or jets of steam or air, or both; fourthly, a supplementary combustion-chamber, or a prolongation of the fire-chamber, provided with an induction pipe or pipes for admitting an additional quantity of oxygen, either in the form of air or steam, or both; fifthly, a fire-brick damper of peculiar construction, constituting the outer wall of the supplementary combustion-chamber, and serving to reflect the flaming gases against that portion of the boiler constituting the inner or opposite wall of the supplementary combustion-chamber. These devices may be usefully employed either separately or two or more of them in combination with each other.

The subjoined description explains their application to a locomotive, and sufficiently indicates how they can be applied to a stationary boiler.

The accompanying drawings are as follows:

Figure 1 is a central vertical longitudinal section of a locomotive boiler and furnace with my invention applied thereto. Fig. 2 is a transverse vertical section through the line *x x* on Fig. 1. Fig. 3 is a transverse vertical section through the line *y y* on Fig. 1, showing the inner side of the fire-brick wall of the supplementary combustion-chamber. Fig. 4 is a front view of the fire-brick damper-valve, together with the mechanism for rotating it, to open and close the damper-openings. Fig. 5 is a plan of the rack and segmental pinion, by which the fire-brick damper-valve is operated. Figs. 6 and 7 represent details exhibiting the construction of the perforated fire-brick damper-wall.

Referring to the drawings, it will be seen that they represent the ordinary locomotive-boiler A, having the usual fire-chamber B, the tubes C, the smoke-chamber D, the ash-pit E, and grate F. The ash-pit is closed, and is provided with a door, *e*, which tightly fits an opening, through which the contents of the ash-pit may be removed. Fuel is supplied to the furnace from the coal-magazine G, the external mouth of which is closed by the tight-fitting door *g*.

It will be seen that the portion of the coal-magazine within the fire-chamber is incased in the water-jacket *k k*, which is connected with the boiler by means of the pipes *l* and *m*, and is also connected with the water-space B′ in the front wall of the fire-chamber. These connections of the water-jacket with the water-body of the boiler at variable elevations insure a constant circulation of water in the jacket when there is fire in the furnace, and this device affords a large additional heating-surface. The upper part of the coal-magazine within the fire-chamber is provided with one or more perforations, *n n′*, for the purpose of permitting the escape from the magazine of gases gener-

ated from the coal therein contained. A convenient mode of providing these perforations is by the use of hollow stay-bolts, one of which is shown at *n'*. The ash-pit E is provided with one or more injection-pipes, *f*, for the admission of blasts or jets of air or steam, or both. Additional injection-pipes f^2 and f^3 are inserted in the furnace-wall a short distance above the grate, as shown, for admitting similar blasts or jets at that point, if desired.

A short distance from the tube-sheet at the front end of the locomotive is a vertical perforated fire-brick wall, K, and the space between this wall and the tube-sheet constitutes the supplementary combustion-chamber L. The perforations in the wall K are closed or opened by the rotating perforated fire-brick disk I. The latter is under the control of the engineer in the cab, being operated by means of the rod *a*, connected with the segmental pinion *b*, which engages the rack *c* on the outer end of the slide-bar *c'*, the inner end of which is pivoted to the iron frame of the valve-disk I. The segmental pinion *b* has its bearings in the projecting wing *d*, which is affixed to the side of the boiler A. The perforations *o* in the fire-brick wall K have the same position with relation to each other as the perforations *i* in the valve-disk I, so that by rotating the valve-disk the respective perforations may be made to coincide in position or otherwise.

The perforated wall K and disk I, as constructed and arranged, constitute a damper, the inner face of which reflects the flaming gases in the combustion-chamber against the tube-sheet of the boiler. I therefore designate the described structure as a reflector-damper. In its construction fire-clay, soapstone, porcelain, or other similar material may be substituted for fire-brick. The wall K consists of four segments of fire-brick, or other suitable material, set in an iron frame, which is secured to the shell of the boiler. This frame consists of an iron ring having two or more iron cross-bars intersecting each other in the center of the ring, and affording a bearing at that point for the pivot upon which the disk I revolves.

The disk I is composed of a similar iron frame, supporting four flat segments of fire-bricks. Each of the segments of the wall K has substantially the shape indicated in Figs. 6 and 7, by reference to which it will be seen that the supporting-frame is wholly covered by the fire-bricks, and that each segment S is provided with a laterally-projecting flange, S', which fits around and shields the periphery of the supplementary combustion-chamber L, as shown in Fig. 1.

The object of this reflector-damper is to enable the engineer to properly adjust and regulate the passage for the exit of the nitrogenous or incombustible contents of the furnace with relation to the quantity of air or steam injected into the furnace. It will, of course, be understood that the various injection-pipes are connected with an ordinary blower or air-pump, or with the steam-space of the boiler, as may be desired.

At the base of the smoke-stack there is another damper-valve, M, for use in connection with the reflector-damper, or for independent use when the reflector-damper is allowed to remain more or less open.

In a locomotive provided with all my improvements the exhaust-pipes may be carried to the top of the smoke-stack, as the exhaust is not required for assisting the draft. By this means there is always a free exit for the exhaust steam, and, therefore, no loss of power by the existence of back pressure upon the piston arising from the choking of the exhaust.

It will be seen that the portion of my invention embracing the combined coal-magazine and retort may be used in connection with a furnace having the ordinary draft-openings; or it may be used in connection with a closed ash-pit and induction-pipes for the supply of prescribed quantities of oxygen. In either event, the operation of this part of my invention is as follows: The magazine is filled with coal, and the tight-fitting door *g* being closed to prevent the escape of gases at that point, the fuel is ignited upon the grate-bars. As it burns away, its place is supplied by fuel which falls from the magazine by its own gravity. As the fuel within the magazine is heated inflammable vapor or gases are generated, which are discharged through the apertures *n n'* into the upper part of the fire-chamber, where they are exposed to ignition. The coal is thus partially coked prior to its discharge from the magazine. By this means the fuel is partially decomposed, and is delivered from the magazine-retort in favorable condition for complete combustion.

If the magazine-retort is incased in the water-jacket *k* a large additional area of heating-surface is rendered available, and by means of the various connections of the water-jacket with the water-spaces a constant circulation of the water contained in the water-jacket is maintained, which materially assists in heating the water-body in the boiler. When the magazine-retort is arranged for use in combination with the closed ash-pit and injection-pipes for the introduction of prescribed quantities of oxygen, either in the form of air or steam, or both, the engineer injects into the ash-pit or fire-chamber, or both, more or less air or steam, according to the requirements of the occasion. If he requires less heat, instead of banking his fire he reduces the supply of oxygen. If he requires additional heat he increases the supply of oxygen, taking care not to exceed the quantity required for combustion and for the displacement and expulsion of the nitrogenous or incombustible contents of the fire-chamber. The induction-pipe f^1 delivers a supply of oxygen in favorable position for

immediate mixture with the gases discharged from the retort.

It will, of course, be understood that in case of a fire-chamber of different shape from that shown, the position of the induction-pipe f^1 will be varied according to the position occupied by the gases generated in, and discharged from, the magazine-retort, the object of the induction-pipe f^1 being to introduce an additional supply of oxygen for mixture with the gases generated in the retort to insure their complete combustion. In the locomotive-boiler which I have described this principle is further carried out by the establishment of the supplementary combustion-chamber, which is also provided with the induction-pipes for supplying oxygen at that point.

The supplementary combustion-chamber contributes a new element to the structure in the reflector-damper, which constitutes its outer wall, the reflector-damper performing the double function of reflecting the flaming gases against the tube-sheet of the boiler, and affording the engineer a means of controlling and adjusting the area of the outlet for the incombustible contents of the furnace. By means of these devices the engineer is enabled to insure in the furnace a constant supply of oxygen, accurately graduated in quantity to the requirements of the occasion. He is enabled to feed the furnace by depositing fuel in the external mouth of the coal-magazine without being under the necessity of opening a furnace-door, and thereby permitting a large influx of cold air into the fire-chamber. By the use of the damper M in the smoke-stack in connection with the reflector-damper the engineer is enabled to still more accurately regulate the outlet for the unconsumable contents of the furnace.

I claim as my invention in a furnace for heating steam-boilers—

1. A combined coal-magazine and retort, partially contained within the fire-chamber, open at the bottom, terminating a short distance above the grate-surface, having perforations in its upper wall within the fire-chamber, and an external mouth outside the fire-chamber, provided with a tight-fitting door, for the purpose of containing and automatically delivering coal upon the grate-surface, after having subjected the coal to the heat of the furnace, whereby the coal is partially coked prior to its delivery to the fire, and the gases evolved in the process of coking are discharged from the upper portion of the magazine-retort into the fire-chamber, in suitable position for contributing by their ignition to the heating of the boiler.

2. A magazine-retort, substantially such as described, in combination with a closed ash-pit and injection-pipes, for the introduction of prescribed quantities of oxygen into the ash-pit, and from thence through the grate into the fire-chamber.

3. A magazine-retort, substantially such as described, and a closed ash-pit, provided with an induction-pipe, for the introduction of oxygen below the grate-bars, in combination with an induction-pipe, for introducing oxygen into the fire-chamber, in suitable position for immediate mixture with the gases generated and discharged from the retort, substantially as described.

4. A magazine-retort, substantially such as described, surrounded within the fire-chamber by a water-jacket connected at variable elevations with the water-body of the boiler by means of suitable pipes, substantially as described.

5. A fire-chamber, provided with a magazine-retort, substantially such as described, in combination with a supplementary combustion-chamber, provided with induction-pipes for supplying the said supplementary combustion-chamber with oxygen, either in the form of air or steam, or both.

6. The tube-sheet of a boiler, in combination with the fire-brick reflector-damper, provided with mechanism whereby the damper may be opened and closed, substantially as described.

7. A perforated fire-brick wall, constituting the outer boundary of a supplementary combustion-chamber, substantially such as described, in combination with a flue or smoke-stack damper, substantially as described.

8. A steam-boiler furnace having a closed ash-pit, provided with an induction-pipe, and a fire-chamber, also provided with an induction pipe or pipes, a magazine-retort, substantially such as described, a supplementary combustion-chamber having a pipe or pipes for the admission of oxygen therein, and an external perforated fire-brick wall, provided with a perforated rotating fire-brick disk, the whole constructed and operating substantially as and for the purposes set forth.

JAMES W. BONTA.

Witnesses:
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EDWIN A. ALGER.