

J. G. HUNT.  
Smoke-Consuming Furnace.

No. 222,824.

Patented Dec. 23, 1879.

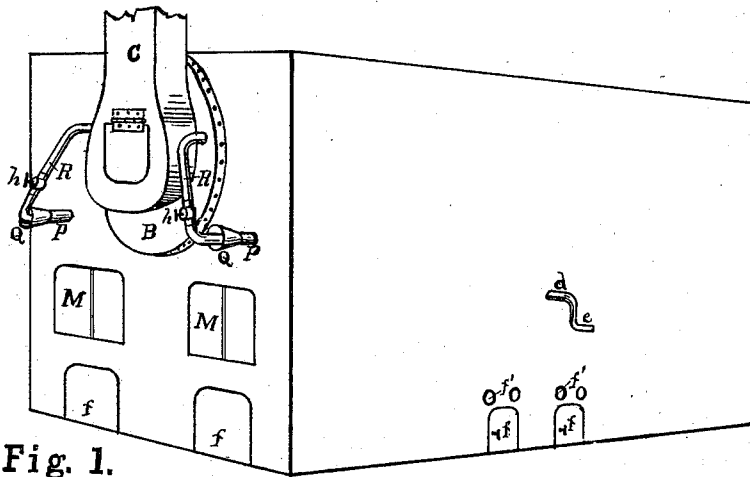


Fig. 1.

Fig. 3.

Fig. 2.

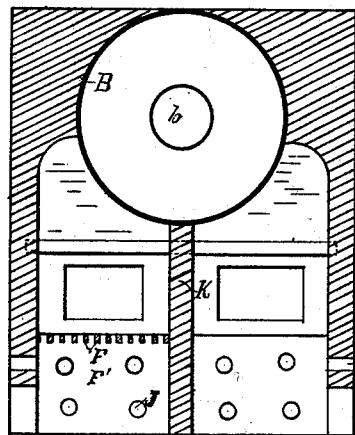
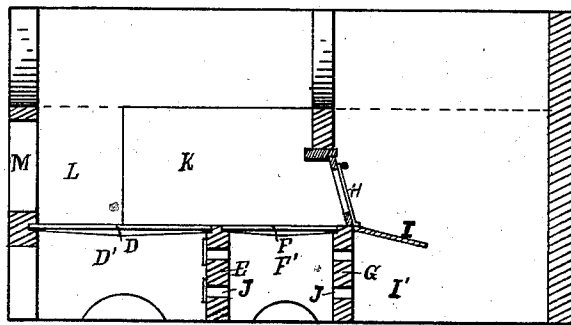
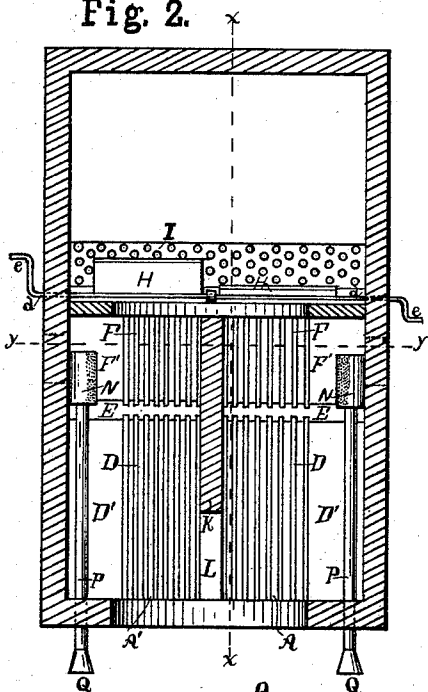


Fig. 4.

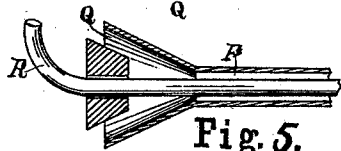


Fig. 5.

Attest.

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN SMOKE-CONSUMING FURNACES.

Specification forming part of Letters Patent No. **222,821**, dated December 23, 1879; application filed August 29, 1879.

*To all whom it may concern:*

Be it known that I, JAMES G. HUNT, of the city of Cincinnati, county of Hamilton, and State of Ohio, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a specification.

My improvement is applicable to the various descriptions of apparatus for burning fuel, but is more particularly designed to be used in connection with apparatus for generating steam; and my improvements have for their object the consumption of the smoke generated by the combustion of fuel in said apparatus.

The first feature of my invention consists in such an arrangement of the grate-bars of the furnace and of the ash-pit as that the grate-bars shall be substantially on a level with each other, and the ash-pit shall be divided into two chambers, the rear one of which shall be capable of supplying the fire on the grate above said chamber with fresh air of a desired temperature, the air thus passing up through the grate over the said rear or second chamber acting, in connection with the bed of coals thereupon, to consume the smoke generated from the greener fuel burning upon the grate over the front chamber.

The second feature of my invention consists in adding to a furnace constructed according to the first part of my invention, and behind the rear bridge-wall, a plate or grating, located in substantially the same horizontal plane as the grate, and provided with perforations to admit of the passage from beneath of air through the same to the unconsumed smoke and gases passing over the bridge-wall, for the purpose of consuming the said smoke and gases.

The third feature of my invention consists in combining with a twin furnace—that is, a furnace having duplicate chambers, each chamber provided with one or both of the aforementioned features of my invention—an opening located near the forward end of the furnace and connecting the same, and also in providing suitable dampers at the last bridge-wall of said furnaces, in such a manner that the smoke and unconsumed gases from either furnace shall be compelled to pass through the

other furnace at will, and in their passage over the fire of the latter shall be consumed.

The fourth feature of my invention consists in the application to either or any of the aforementioned features of my invention of a useful device for introducing air or steam, or both mixed together, the introduction of said gases being on opposite sides, and near the rear part of the furnace, for the purpose of increasing the draft of the fire, and also of aiding in consuming the smoke.

While this device may with advantage be located at many points in the furnace, the location hereinafter specified is a very advantageous one, and this location is another feature of my invention.

For convenience of illustration, I will describe a twin furnace employed to heat a steam-boiler, and provided with my improvements.

In the accompanying drawings, making part of this specification, Figure 1 is a perspective view of a furnace and boiler embodying my invention. Fig. 2 is a horizontal sectional view of same, taken on a level with the center of the boiler, the boiler being removed to show the parts beneath. Fig. 3 is a sectional view taken at the line *x x* of Fig. 2. Fig. 4 is a sectional view taken at the line *y y*, Fig. 2, and looking toward the rear, the boiler also being shown in position. Fig. 5 is a device for closing the orifice *Q*.

*A A'* are the furnaces, over which is a steam-boiler, *B*, provided with a return-flue, *b*, the rear end of which is suitably connected with the furnace, and the forward end to the chimney *C*. Each furnace is provided with a set, *D*, of horizontal grate-bars, supported in the usual manner in front, and at the rear by the partition or bridge wall *E*, which latter supports the forward end of a second set, *F*, of grating, supported at the rear by a bridge-wall, *g*. These two sets of grates may be one; but for the convenience of setting, wear, and repair, they are preferably made as described. Directly behind the grate a damper, *H*, is so arranged as to be capable of shutting off the space under the rear portion of the boiler from the furnace.

This damper may be connected and operated in any suitable manner, but is preferably, as here, hinged at its upper edge, and operated

by a shaft, *d*, terminating in a crank-handle, *e*, the latter being located outside of the furnace, and within reach of the stoker or engineer.

At the rear of the damper H is the perforated plate or grating I, suitably supported, as shown. This plate is preferably somewhat inclined downward from front to rear, as shown, so that ashes or dust cannot accumulate on it to such an extent as to cover over the holes.

The ash-pit D', under grate D, and the ash-pit F', under grate F, and the ash-pit I', under plate or grating I, are each provided with a suitable door, *f*, for the removal of the ashes, and for permitting, when desired, a very free flow of air through the same.

The partition-walls E and G are also preferably connected with each other by means of an opening or openings, J, as shown, closed by appropriate dampers. The ash-pit I', in addition to the dampers in the ash-pit door, may also be provided with one or more orifices, *f'*, located in its side and regulated by appropriate dampers.

The two furnaces are entirely separated by a partition-wall, K, except at their front portion above the grate and below the boiler, where an opening, L, connects them. Each of these furnaces is fed through the usual door M, suitably located at the front, as shown, or side of the furnace. At the inner side of the outer wall of each furnace, and near the junction of the latter with the boiler, is located a perforated discharge device, N, fed through a pipe, P, which is preferably continued to the front of the furnace, and terminates in a bell-shaped mouth, Q, outside the wall, into which mouth enters a steam-pipe, R, connected with the steam-space of the boiler. This pipe R is somewhat smaller than pipe P, for the reasons hereinafter mentioned, and does not extend quite to the end of P.

My improvements operate as follows:

Where but one furnace is employed, or the furnaces are operated separately, the operation of the same is as follows: A fire of green coal being kindled and allowed to burn for a short time, the incandescent coals are pushed back onto grate F and more green fuel supplied by grate D. The ordinary combustion takes place on grate D, which is supplied with air from ash-pit D', derived through ash-pit door A or any other suitable source. The gases and smoke generated by the ignition of the green fuel pass over the incandescent coals upon grate F, and, by means of a fresh supply of air coming up through the latter grate from ash-pit F' and supplying fresh oxygen to the fire at this point, the combustion is increased and intensified and the smoke and gases are ignited. Any residue of gases and smoke (if it should happen that any of same should not be consumed over the grate F) passing off of grate F are supplied in their passage over plate or grating I with fresh air (oxygen from the pit I') through the orifices in said plate I, and are thereby consumed.

The fresh air from without the furnace to be supplied to the grates D, F, or I may be introduced to the same in any suitable manner, but is preferably introduced as follows: The air for grate F may be supplied through the door of pit F', or through orifices in the side wall above the door, or from ash-pits D' or I' through orifices J in the partition-walls, as desired; and the air for grate I may be supplied through the door of ash-pit I', or through orifices in the side of the furnace above the same, as *g*, or through the orifices J from ash-pit D' or ash-pit F'.

Where the air to be supplied to grate F or I is needed in a warm condition, it is preferable to have it pass beneath grate D or F, or both, for grate I, and beneath grate D or I for F.

The operation of device N P Q R is as follows: The passage of steam through pipe R being controlled by faucet *h*, the pipe R is closed whenever it appears desirable to introduce air alone to the fire through the device Q P R. The draft of the fire draws air through opening Q at the sides of pipe R, and through pipe P, and through the orifices in device N, and the air thus introduced increases the combustion of the fuel, and also of the smoke and gases generated therefrom; or, should it be desirable to introduce steam alone, the orifice Q may be closed by some appropriate device around the pipe P, thus not allowing air to enter. I have found, however, that a mixture of steam and air introduced to the furnace by device N contributes much more toward a perfect combustion of the fuel, smoke, and gases, &c., than either air or steam alone. To thus introduce such a mixture by faucet *h*, I open pipe R, and thus allow the steam to pass through pipe R and into pipe P, whence it passes (by its own projectile impulsion and by the draft of the furnace-fire creating a suction through pipe P toward N) through pipe P, at which point it becomes mixed with air drawn in through inlet Q, and in this mixed condition the air and steam pass through the device N in numerous jets to increase the combustion.

The draft of the furnaces is to be regulated by suitable dampers—as, for example, damper H can be used for this purpose.

The unconsumable invisible gases and heated air pass through the flue of the boiler from rear to front, and thence into chimney C, in the usual manner.

When it becomes desirable to employ the furnaces together, by means of opening L, the green fire is first made in one of the furnaces—say A—and damper H in furnace A being closed, and damper H in furnace A' being opened, till the fire has become a bed of live coals.

The operation of this furnace in consuming the smoke is carried on by means of grates F and I, as heretofore specified, the heated air and unconsumable products of combustion passing through the open damper H in fur-

nace A, and thence through the boiler into the chimney. I then make a fire of green coals in furnace A', and the unconsumed smoke, &c., generated from said green fire in furnace A pass from said furnace through opening L into furnace A, and over the bed of coals in the latter, the air supplied by grates F and I assisting in the combustion of said smoke and gases, and the air and steam entering through device N of furnace A assisting in the result. The steam and air as they enter the furnace through the device N strike against the closed damper H, causing an eddy or whirl, thus causing the more complete mixture of the various gases. It then takes a course toward the opening L, causing a great increase in the draft.

Steam being introduced through the device N of the opposite side of the furnace does not meet with the resistance of the damper H, as this damper is open. This steam, therefore, passes through the open damper, also giving a great increase to the draft.

The perforations in device N are preferably directed at a backward angle to direct the steam and air toward the damper H. The non-consumable gases then pass through damper H in furnace A, and through the boiler, &c., as specified.

When the fire in furnace A is to be replenished the damper H of the same is to be closed, and the damper H of furnace A' is opened. The fire in furnace A is now replenished with fresh coal, and the smoke and gases pass therefrom over the fire in furnace A', where they are consumed in the manner and by the means aforesaid, and the residue thereof pass through damper H in furnace A', and through the boiler, as specified. This operation is repeated as often as fresh fuel is added, care being taken so to operate the dampers as to cause the smoke and gases from the green coal in the one chamber to pass through the other furnace, and thus over the live coals therein.

What I claim as new and of my invention, and desire to secure by Letters Patent, is—

1. The combination of the grates D and F, substantially on the same level, and the perforated plate or grating I, and the chambers D', F', and I', immediately succeeding each other, the perforated plate or grating I being immediately over the chamber I', substantially as and for the purposes specified.

2. The combination of the grates D and F, substantially on the same level, and the perforated plate or grating I, situated above the chamber I', and the chambers D', F', and I' immediately succeeding each other, and ash-doors and orifices J, said orifices being in bridge-wall G, substantially as and for the purposes specified.

3. The combination of grates D F and plate I and chambers D' F' I' and damper H, placed between grate F and plate I, substantially as and for the purposes specified.

4. The combination of the grates D F, placed substantially on the same level, and the chambers D' and F', and the damper H, placed directly after the grate F and between the boiler and bridge-wall, substantially as and for the purposes specified.

5. The twin furnaces A and A', each provided with grates D, F, and I, and chambers D', F', and I', and dampers H, located between grates F and I, said furnaces being connected by opening L, substantially as and for the purposes specified.

6. The twin furnaces A and A', each provided with grates D and F, and chambers D' and F', and dampers H, located immediately above bridge-wall G, all in combination with opening L, substantially as and for the purposes specified.

7. The combination of the perforated discharge-vessel N and pipe P, located substantially as described, and the grates D and F and chambers D' F', substantially as and for the purposes specified.

8. The combination of the discharging device N P, located substantially as described, and the grates D, F, and I, and chambers D', F', and I', substantially as and for the purposes specified.

9. In a twin furnace, the combination of the discharging device N P, and the grates D and F and I, and chambers D', F', and I', and opening L, and dampers H, located between grates F and I, substantially as and for the purposes specified.

JAMES GEORGE HUNT.

Attest:

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