W. A. SWEET.

HEATING FURNACE.

No. 105,738. Patented July 26, 1870.

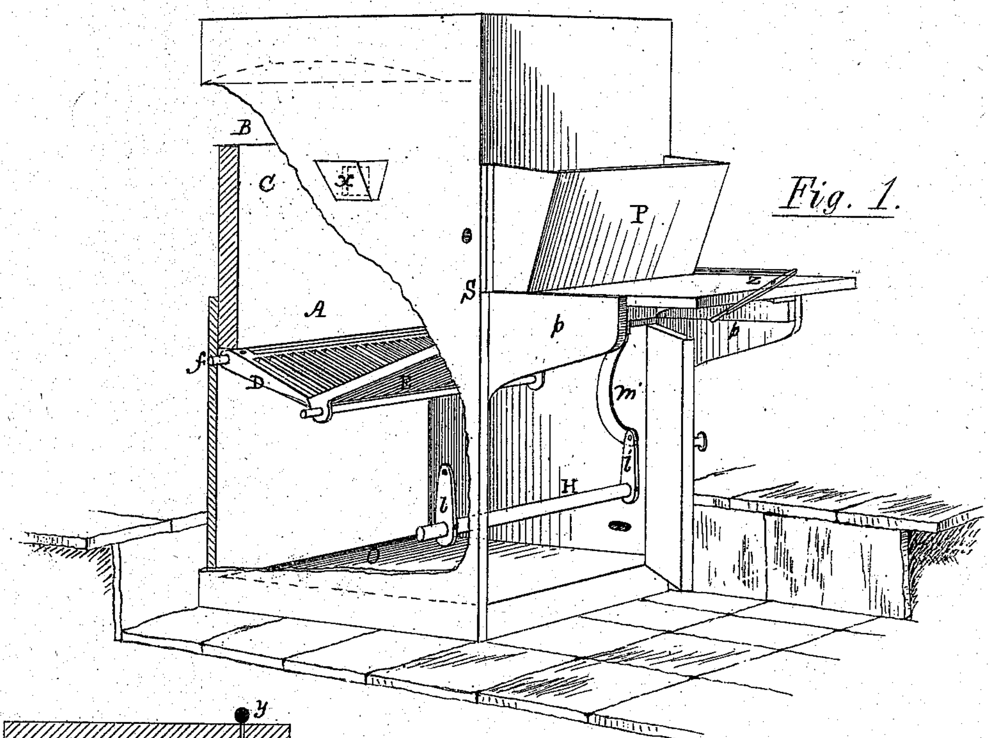
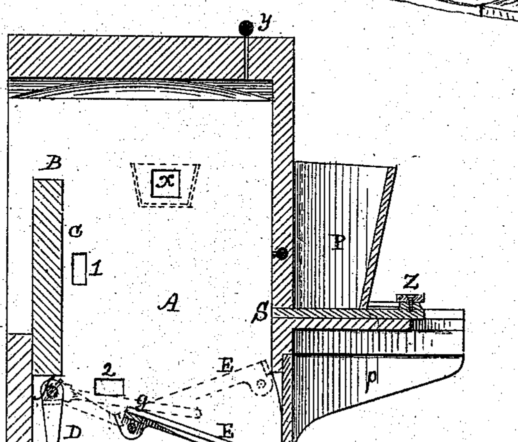
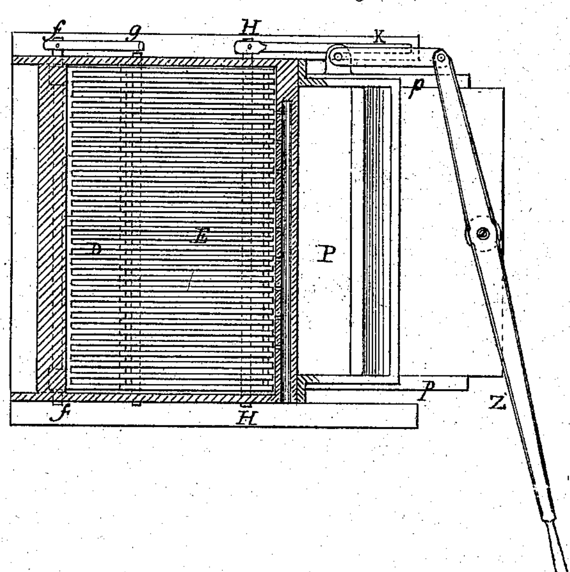


Fig. 1.

Fig. 3.

Fig. 2.





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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN HEATING-FURNACES.

Specification forming part of Letters Patent No. **105,738**, dated July 26, 1870.

To all whom it may concern:

Be it known that I, WILLIAM A. SWEET, of the city of Syracuse, county of Onondaga, and State of New York, have invented certain Improvements in Heating-Furnaces, of which the following is a specification.

This invention relates to that class of furnaces used chiefly in the heating of ores, metals, and similar refractory substances, or to any department that requires a regular and uniform or high degree of temperature; and the objects of the invention are, first, the introduction or injection of the fuel into the combustion-chamber, after the fire is first started, at such a point or points below the surface of the ignited mass as that the fresh material introduced cannot set free its elements of combustion without coming in close contact with a temperature sufficiently great to produce ignition of said elements. The second object consists in the combination of certain devices for the injection of the fuel into the combustion-chamber, by which the dust and screenings, that are ordinarily considered worthless at the mines and in the yard, may be most readily utilized with the greatest possible facility, and thereby furnish a temperature of the highest degree of excellence, both in quality and quantity. Another object is accomplished in the construction and arrangement of the grates, and devices for supporting and controlling them, that the cinders and clinkers may be very quickly and easily removed from the combustion-chamber, and any repairs required in the interior of said chamber may be done without disturbing the grate-bars or requiring their removal from their supports.

In the drawings, Figure 1 is a perspective view of my invention, a portion of the side being removed to show the interior. Fig. 2 is a sectional view of the same from the front to the rear. Fig. 3 is a plan as seen from the top or above the grates.

Like letters refer to like parts in all the figures.

Experience has proven that the form and size of the combustion-chambers should be carefully proportioned to the nature of the work to be performed and the quality of the fuel to be used, in order to accomplish the best result, or to give the maximum of efficiency with the minimum of economy. The theoretic duty or extreme heating capacity of a pound of coal may be taken as the "unit" or standard upon which to estimate the shape and size of the combustion-chamber, as the shape or form must be adapted to the material to be treated and the size to the amount of heat required in the operation. As, for example, where a crucible containing some very refractory substance is to be intensely heated, or where a number of crucibles, as in the making of glass, are used, a cylindrical form of combustion-chamber may be best adapted for the operation, and in such a case the single crucible may be placed in the center of the upper arch; or, if more than one are used, as in the manufacture of glass, the crucibles can be arranged around the combustion-chamber and above the grates; also, in the generation of heat, as under boilers, or in puddling or smelting and heating chambers, the shape must conform in a great degree to the work required, and must necessarily be of sufficient size to contain the requisite quantity of coal or fuel to give at least the degree of temperature required.

In the furnace represented in the accompanying drawings the combustion-chamber (represented at A) is about twice as wide as the grate-bars are long, for the purpose of spreading the heat as it is used under horizontal boilers, and the height of said chamber should always be from one-third to one-half greater than the length of the grate-bars, so that the mass of fuel, when the chamber is fully charged, reaches to a point as high, or even higher, than the smallest dimension of the base; or, in other words, if the chamber is a cylinder, its height should be as great, or greater, than its diameter. I should recommend one-half greater. Said chamber is formed of the ordinary materials used in the construction of such furnaces—such as fire-brick, soapstone, or plumbago—to resist the action of the intense heat.

At B, or near the top, an opening is formed to serve as a flue to convey the heat to the point of utilization, as under a boiler or into a secondary chamber where the substances are to be heated. When connected with a secondary chamber or furnace the point over which the heat passes is termed the "bridge-wall" of the furnace, and, as it is exposed to the greatest temperature produced in the combustion-chamber, is usually built as a supplemental wall, as shown at C, so that it can be easily removed and replaced without disturbing the other portions of the masonry.

At D and E are mounted the grates at the bottom of the combustion-chamber, the grate D being pivoted at *f* in such a manner as to drop to a vertical position, as seen at D, Fig. 2, and capable of being controlled by a lever, as at *g*, Figs. 2 and 3, upon one end of the bearing or shaft that carries the grate. This grate may consist of simply a series of arms or tines, like those of a fork, and in length about one-third of, or less than the entire distance across the grate-space, and are mounted upon the shaft *f* by its passing through them, as shown in the drawings at *f*, Fig. 2, and fastened by a tapering pin through them and the shaft, so that they may be held firmly in a working position, and yet be conveniently separated and removed in the case of repairs to the interior of the combustion-chamber A.

The grate E is best formed of a frame and bars, the back edge (or end, as the case may be) of which is pivoted at a point below the shaft *f* of the grate D, and sufficiently far from said shaft to permit the arms or tines of the grate D to reach it. Consequently when the front edge of the grate E is raised as high as the rear of D the grate-bars will reach across the entire space, and also have an inclination toward each other, as shown at Fig. 1. The front edge of said grate E is supported upon a shaft, H, provided with crank-levers *l* and *l'*, to which are attached links *m* and *m'*, connecting said shaft to the grate. Upon one end of said shaft is a lever, K, for partially rotating it, and it is evident that by turning the crank-levers up and down the front edge of the grate will be raised and lowered.

Underneath the grates, as at O, is a considerable space or chamber to receive the ashes and to serve as a reservoir for the blast when a fan or blowing engine is used.

At P, upon the front of the combustion-chamber, is a hopper or receiver for the coal, mounted in any convenient manner, as upon brackets *p p*, attached to the furnace. The bottom of said hopper communicates with the interior of the combustion-chamber A by a slot, as at S, through the wall of the chamber A, made at such a point above the grates that when a fire is once made in the furnace any coal forced through said slot will come in contact with the already ignited mass upon the grates. In practice I find that said slot, as at S, may be best located from a quarter to a third of the distance from the grates to the top of the bridge-wall or flue-space, (best seen at Fig. 2;) but this point may be anywhere between the flue-space and the grates, provided there is ignited fuel above and below it, so that each charge of fresh fuel shall come in immediate contact with so much heat that its carbon may not be carried off without being ignited. Through said slot, at S, the fuel is injected in various ways; but the simplest form is shown in the drawings, and consists simply of a sliding plunger operated by a lever, as at Z, so arranged that a considerable degree of force can be applied to the plunger or injector. For small or portable fires I am now using such a construction as shown in the drawings, as the plungers are quite small and the mass is easily penetrated; but in my heating-furnaces for rolling-mills a multiplication of power is necessary, as I prefer to keep the mass of fuel upon the grates as high or higher than the smallest dimension of its base.

Instead of a reciprocating plunger, as shown, rollers may be used, so that a continuous injection of the fuel may be produced.

Through the arch above the slot S air-holes are introduced, so that in using highly-bituminous fuel an additional supply of oxygen can be added just above the point where the fresh fuel is introduced. A similar series of jets may also be found to be beneficial in the arch, as indicated at *y*, Fig. 2.

At X, upon opposite sides of the furnace, openings are made and furnished with hoppers to supply fuel in starting the fires, as in the ordinary furnaces.

Holes, as at 1 and 2, Fig. 2, are also formed in close proximity to the bridge-wall and grates, so that bars may be introduced for removing the cinders and ashes when desired.

The operation is as follows: A fire is first started in the combustion-chamber, the grates being placed as in Fig. 1, and fuel is introduced through the openings at X until a burning or ignited mass is raised above the opening at S, which communicates with the bottom of the hopper P. Then the fuel is afterward supplied exclusively by the plunger or injector, carrying it from the bottom of the hopper through the opening S into the already burning or ignited mass. This action tends to move the ashes and cinders back toward the bridge-wall, or about to where the two grates meet. Each fresh charge of fuel soon becomes coked or charred and unites to form a mass of lumps, even when the dust or screenings or "slack" of the mines and yards are used for fuel. The mass so formed rests chiefly upon the front grate, E, and against the bridge-wall C. Consequently when it is desirable to clean the grates the grate D is dropped to the position shown at D, Fig. 2, and by introducing a poker through hole 2 the operator can very thoroughly remove the ashes and cinders without disturbing the mass of burning fuel. This operation completed, the blast may then be shut off and the doors in the front of the ash-pit opened, so that on lowering the front edge of the grate E by turning the crank-levers *l* and *l'* down, as at *l*, Fig. 2, the front grate may be cleaned without essentially disturbing an efficient fire. After the grates are thus cleaned a poker may be introduced through holes 1, which are formed on each side of the furnace and just in front of the bridge-wall, and the cinders may be easily removed without stopping the operation of the furnaces or waiting for fresh charges of fuel to become ignited.

Under some circumstances I prefer to use more than one injector, feeding into the mass from opposite points or sides; but the principle remains the same—that of injecting the fuel into the burning mass of the first fire.

What I claim is—

1. In combination with a combustion-chamber, one or more injectors for forcing the fuel into the side of a previously-ignited mass of fuel in said chamber, as described.

2. In combination with a combustion-chamber having one or more injectors, an adjustable grate or grates, for the purposes hereinbefore set forth.

3. In combination with said chamber A and fuel-injector, an arch with air-holes for forcing additional supplies of oxygen into the chamber just above the opening S, as described, and for the purposes set forth.

4. In combination with the combustion-chamber A, fuel-injector and grates D and E, the holes 1 and 2, as described, and for the purposes set forth.

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Witnesses:
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