

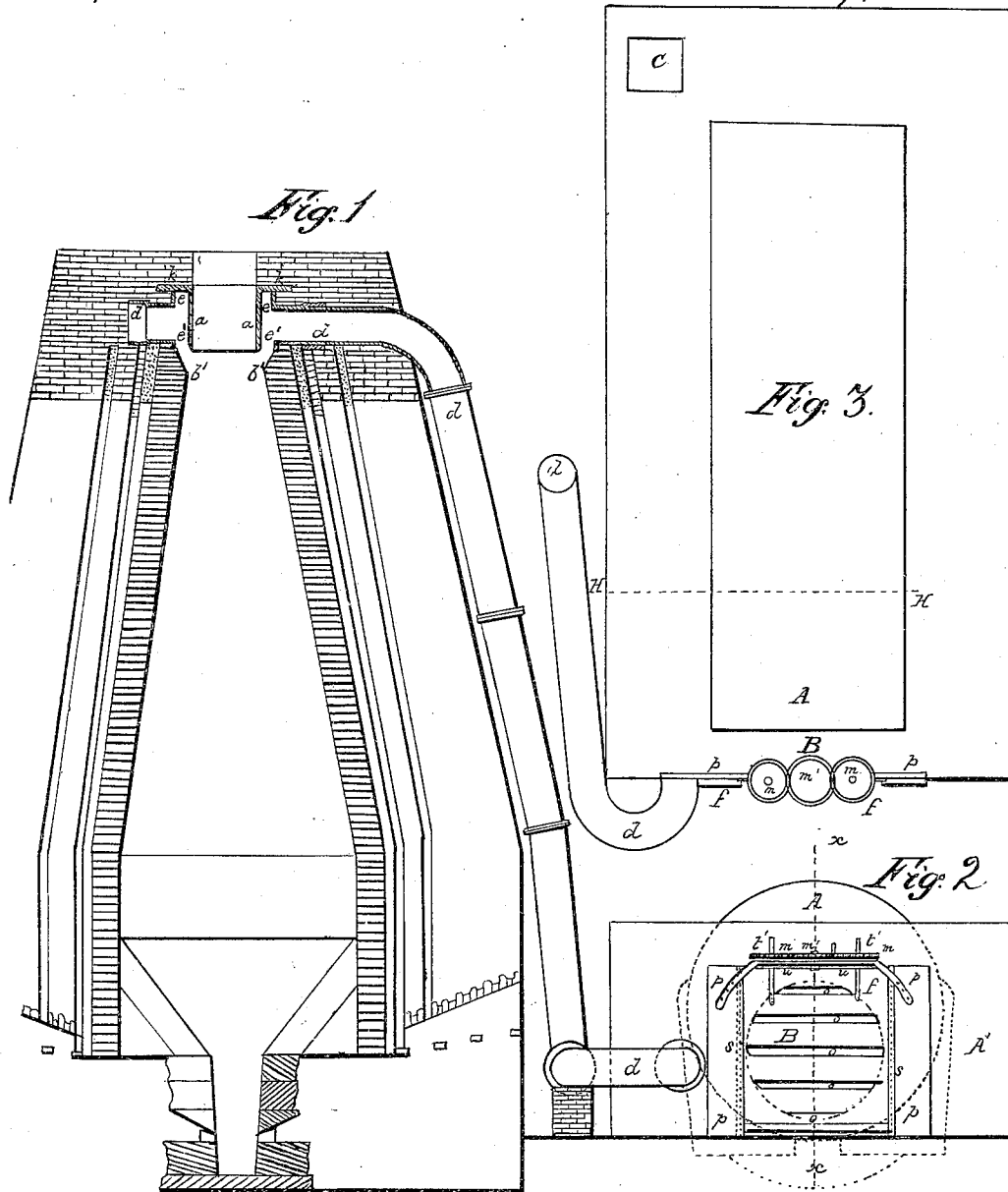
Sheet 1, of 2 Sheets.

F. C. Kropff.

Gas Furnace.

N^o 2,422.

Patented Jan. 17, 1842.



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Gas Furnace.

$N^0_{2,4,2,2}$.

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Fig. 4

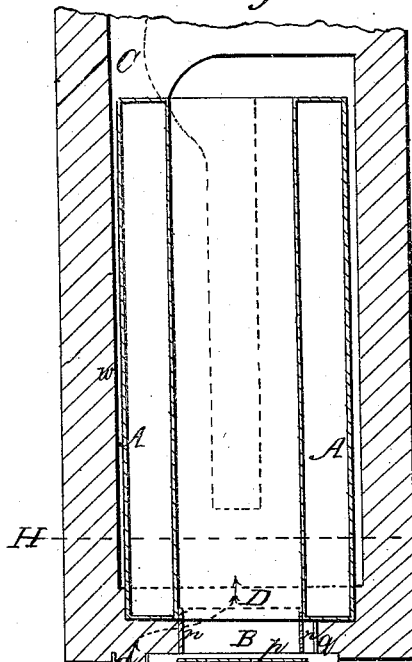


Fig. 5

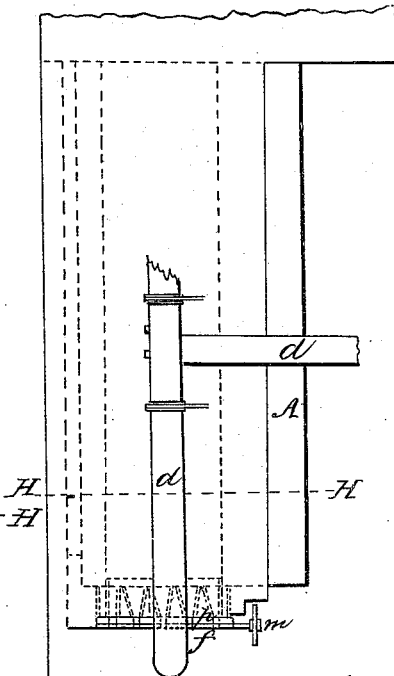


Fig. 12

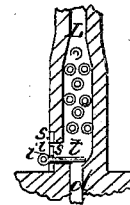


Fig. 8

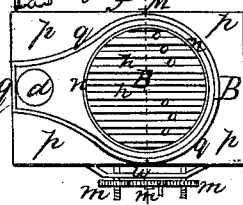


Fig. 9



Fig. 7

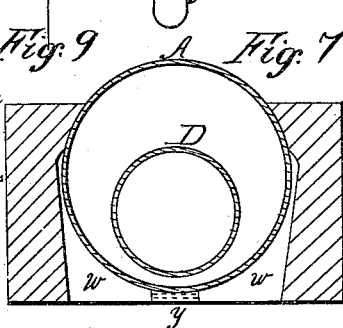


Fig. 10

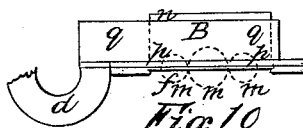


Fig. 6

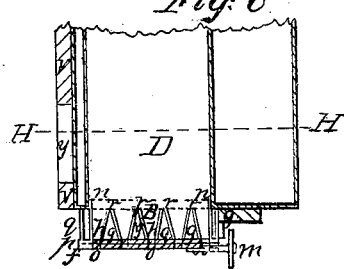
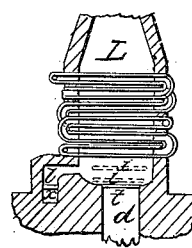


Fig. 11



UNITED STATES PATENT OFFICE.

FREDERICK C. KROPFF, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN THE METHOD OF CONSTRUCTING SMELTING-FURNACES, WITH AN APPARATUS FOR COLLECTING AND BURNING THE IGNITIBLE GASES DISENGAGED FROM THE FUEL.

Specification forming part of Letters Patent No. 2,422, dated January 17, 1842.

To all whom it may concern:

Be it known that I, FREDERICK C. KROPFF, of the city of Philadelphia, in the State of Pennsylvania, have invented an improvement in the manner of constructing furnaces for the smelting of metals by adding thereto an apparatus for collecting the ignitable gases disengaged from the fuel employed, and for burning the same in such manner as to render its combustion available in the conversion of water into steam in a steam-engine boiler, or for other useful purposes; and I do hereby declare that the following is a full and exact description thereof.

In the accompanying drawings, Figure 1 represents a vertical section of a smelting-furnace through its center, with the apparatus for receiving or collecting the gases to be used, and the conducting-tube by which they are to be conveyed to the steam-furnace or other place where they are to be mixed with atmospheric air, and made to undergo combustion. In the construction of the furnace itself I do not claim to have made any improvement, but intend to apply my improvements to furnaces of various kinds.

My gas-receiver is constructed in the following manner: At or near the tunnel head of the furnace I insert a hollow cylindrical or conical body of cast-iron, which is open at both ends, and is represented by the letters *a a* and *k k* in the above-named figure, the part marked *a a* being the sides of such "cylinder," as I will hereinafter denominate it, and *k k* being a flange at its upper end, which forms the top of the space, which I denominate the "gas-receiver." This flange extends into the wall of the furnace, and sustains the cylinder in its place. The diameter of the interior of the cylinder should correspond with that of the upper end of the furnace, and its length or depth should be such as that a column of the coal and other materials which form the charge of the furnace shall remain in it to the height of a foot or two when those materials have descended far enough to require the addition of a fresh charge—that is to say, these materials should never be allowed to descend below the lower end of the cylinder, for reasons which will presently appear. Around the cylinder *a a*, I form a hollow cylindrical

space or chamber, *e e e' e'*, which space is what I call the "gas-receiver." The cross-section of this space may amount to four or five inches, more or less. To conduct the combustible gases into this receiver, the furnace is made to flare out, or built funnel-formed at that part which corresponds with the lower end of the cylinder. This is shown in the drawings in the part extending from *b'* to *e'*, it being intended in all cases that the lower end of the cast-iron cylinder *a a* shall be situated as nearly as may be in that part of the furnace where the combustible gases can be most freely and abundantly collected. The materials contained within the cylinder will obstruct these gases in their ascent, and incline them to pass freely into the gas-receiver, whence they are to be conducted by a tube or pipe, *d d*, into the apparatus where they are to undergo combustion. It may be found necessary sometimes to cover the tunnel-head with a movable iron plate, in order the more effectually to prevent the escape of the gases therefrom, and to force them to pass into the receiver and tube *d*. The distance from the lower edge of the cylinder to the tunnel-head may be increased by extending the masonry above the flange *k*, as shown in the drawings, the opening in this mason-work being made to correspond with the line of the interior of the cylinder.

In Fig. 2, *A A'* represent the front portion of a steam-engine furnace and boiler, and of the apparatus B, in which the combustible gases conducted thereto from the gas-receiver by the conducting-tubes *d d* are to be mixed with that portion of atmospheric air which is necessary to their combustion; and in Figs. 3, 4, 5, 6, 7, 8, 9, and 10 other views of these parts of the apparatus are given. *A* represents the steam-boiler, in front of which is situated the gas-mixing apparatus B. *p p*, Fig. 2, is the front plate of this apparatus, the whole of which I make of cast-iron; and *p p*, Fig. 8, is a view of the inner side of said plate. It is cast with two wide rims, *n n* and *q q*, rising to the requisite height from it, on its inner side. The rim *n n* is circular, and rises from the plate *p p* to the distance or height of sixteen or seventeen inches, more or less. The outline of the rim *q q* may be in the form

shown in the drawings. The general distance between it and the rim *n n* may be three or four inches. The rim *q q* is made on one side to embrace the tube *d*, by which tube the gases from the furnace are admitted into the chamber or space between the two rims. These rims may be about half an inch in thickness, and that marked *q* is made to rise from the plate *p* to the distance of fourteen or fifteen inches, being two or three inches narrower than the rim *n n*. The greater width given to the rim *n n* is to allow it to enter into the fore end of the flue of the steam-boiler, while the rim *q q* is brought up against the front of the boiler and furnace, so as to form a close joint therewith.

Fig. 3 is a top view of the boiler and furnace, the air-mixing apparatus being contained under the masonry at the part B. Fig. 4 is a horizontal section of the same through the middle of the plate *p p*, Fig. 8; and Fig. 7 is a vertical transverse section of it in the line *H H* of Figs. 3 and 4. Fig. 6 is a longitudinal vertical section of the fore part of it in the line *X X* of Fig. 2. Fig. 10 is a top view of the cast-iron air-mixing apparatus separated from the other parts. In Fig. 4 the rim *n n* is shown as inserted in the boiler-flue *D*, and the rim *q* as butting up against the said boiler.

The following is the manner of arranging and regulating the gas-mixing apparatus: The plate *p p* has five or any preferred number of openings or slots, *h h*, Fig. 8, through it, situated within the rim *n n*, and this plate is covered by a sliding plate or register, *f f*, Fig. 2, which has openings or slots *o o o* through it, corresponding in number and size with those through the plate *p p*. The plate *f f* slides up and down on the plate *p p*, being held in place and guided by grooved pieces *s s*. The slots or openings *o o* and *h h* may be made to coincide; or the spaces between *o o* may be made to cover the openings *h h* entirely or in any required degree by the sliding of the plate *f f*. The plate *f f* may be made to slide by means of the toothed wheels *m m m'*, geared into each other, and by turning the middle wheel, *m'*, the two outer wheels operating on the screw-bolts *t t*, which are made fast to the plate *f f*, will raise or lower this plate. The wheels *m m* rest upon the bar *u u*, which is made fast to *p p*, and the required motion may consequently be obtained. The slots or openings in both plates are shown in Fig. 8. The rim *n n* has eight or any other preferred number of perforations through it, as shown at *g g* in Fig. 9, which represents the gas-mixing apparatus B in section from front to back in the line *M M* of Fig. 8. The openings at *g g* are shown as triangular in their form, or nearly so, the acute angles at *r r r* being truncated; but this form may be changed, or the openings may be rendered more numerous, without interfering with the general arrangement. Through these openings the gases will pass into the interior of the mixing apparatus, as indicated by the arrows in Fig. 8, while at the same time

the quantity of atmospheric air to be admitted may be regulated by means of the register-plate *f f*. The gases may be ignited through one of the openings, as at *o* in Fig. 9. Fig. 5 is a view of the steam furnace and boiler in profile, *d d* being the gas-conducting pipe, which is here represented as branching off in two directions, which it may be made to do, if desired.

In setting the boiler I prefer the following arrangement: The interior flue *D*, I make circular, and the exterior flues are divided into two parts, as shown at *w w*, Fig. 7, the bottom of the boiler resting upon the wall *v v*, as shown in Fig. 6, through which wall there is a flue-space, as at *y*. Under this arrangement the course of the gases will be as follows: After being conducted into the gas-mixing apparatus, being duly mixed with atmospheric air, and ignited, the draft will be through the inner flue, *D*, from the front to the back of the furnace; thence into one of the exterior flues *w*, as shown by the arrows in Fig. 4, along this flue toward the front, and through the flue-space *y* into the other exterior flue, and back along this to the chimney *c*, Figs. 3 and 4, which chimney should be of such height as to insure a strong draft.

It will be manifest to every competent engineer that the form of some of the parts of the above-described apparatus may be varied without in any way departing from the principle upon which my improvements are dependent. The gas-conducting tube may, for example, constitute a square or other formed flue or conduit, of brick or of stone, instead of being made of metal. The parts of the gas-mixing apparatus, also, may be differently arranged, while the desired end, that of mixing the combustible gases with a due portion of atmospheric air, may be accomplished by devices analogous to those herein described and represented.

The air for supplying a hot-blast to the furnace may be heated in a manner similar to that above described for heating a steam-engine boiler.

In Figs. 11 and 12 I have represented two sections of an air-heating apparatus of a well-known construction, being of the kind which has frequently been employed for heating air by the waste heat of the furnace at the tunnel-head. Fig. 12 is a transverse, and Fig. 11 a longitudinal, section thereof. In these sections, *d* is the gas-conducting tube, which leads directly into the heating-chamber *L L*, containing the tubes for the passage of atmospheric air. At the upper end of the tube or conduit *d* there is a sliding damper or shutter, *t*, by which to regulate the quantity of combustible gases to be admitted.

In the transverse section Fig. 12, *s s* is an iron plate furnished with openings *i i*, for the admission of atmospheric air, which openings may be regulated by a sliding or rotating register or damper operating in any of the well-known ways. By heating the air in this manner it will not be necessary to place the appa-

ratus on the tunnel-head, but it may be located anywhere, as dictated by convenience.

In the longitudinal section Fig. 11, I have represented, and intend to use, an additional fire chamber or furnace at *l*, having grate-bars at *x*, all made in the ordinary manner. An appendage of this kind will be useful when it may be desirable to employ a large portion of the gases for heating a steam-boiler, or for other purposes. It will also serve for heating the air when repairs may be required in the gas-conducting tube or conduit *d*.

Having thus fully described the nature of my invention and shown the manner in which I carry the same into operation, what I claim therein as new, and desire to secure by Letters Patent, is—

1. The manner of constructing a gas-receiver near the top or tunnel-head of a smelting-furnace by combining therewith a cylinder, such as is marked *a a* in the accompanying drawings, around which a space, *e e*, is left, constituting the said gas-receiver, and from which the combustible gases disengaged from the fuel in the furnace are to be conveyed by a tube or conduit, *d*, to undergo combustion where it may be required, the respective parts being arranged and combined substantially in the manner and applied to the purpose herein made known.

2. The manner of constructing and arranging the cast-iron apparatus marked B, and denominated the gas-mixing apparatus, for duly mixing and combining the combustible gases with atmospheric air, such apparatus being combined with a steam-engine furnace and boiler, or with whatever else it may be desired to heat, substantially as described. I do not claim the merely mixing or combining of the combustible gases with atmospheric air for the purpose of producing combustion, this being an operation well understood and frequently practiced; but I limit my claim in this particular to the manner in which I have effected this object in the apparatus B, or one substantially the same.

3. As a modification of the same operation and apparatus, the manner of employing the combustible gases for the heating of air for producing the hot blast, or for any analogous purpose, by means of such apparatus connected and combined with the gas-receiver, constructed as herein described.

FRD. C. KROPFF.

Witnesses:

JOS. BERENS,
C. SCHMOLE.