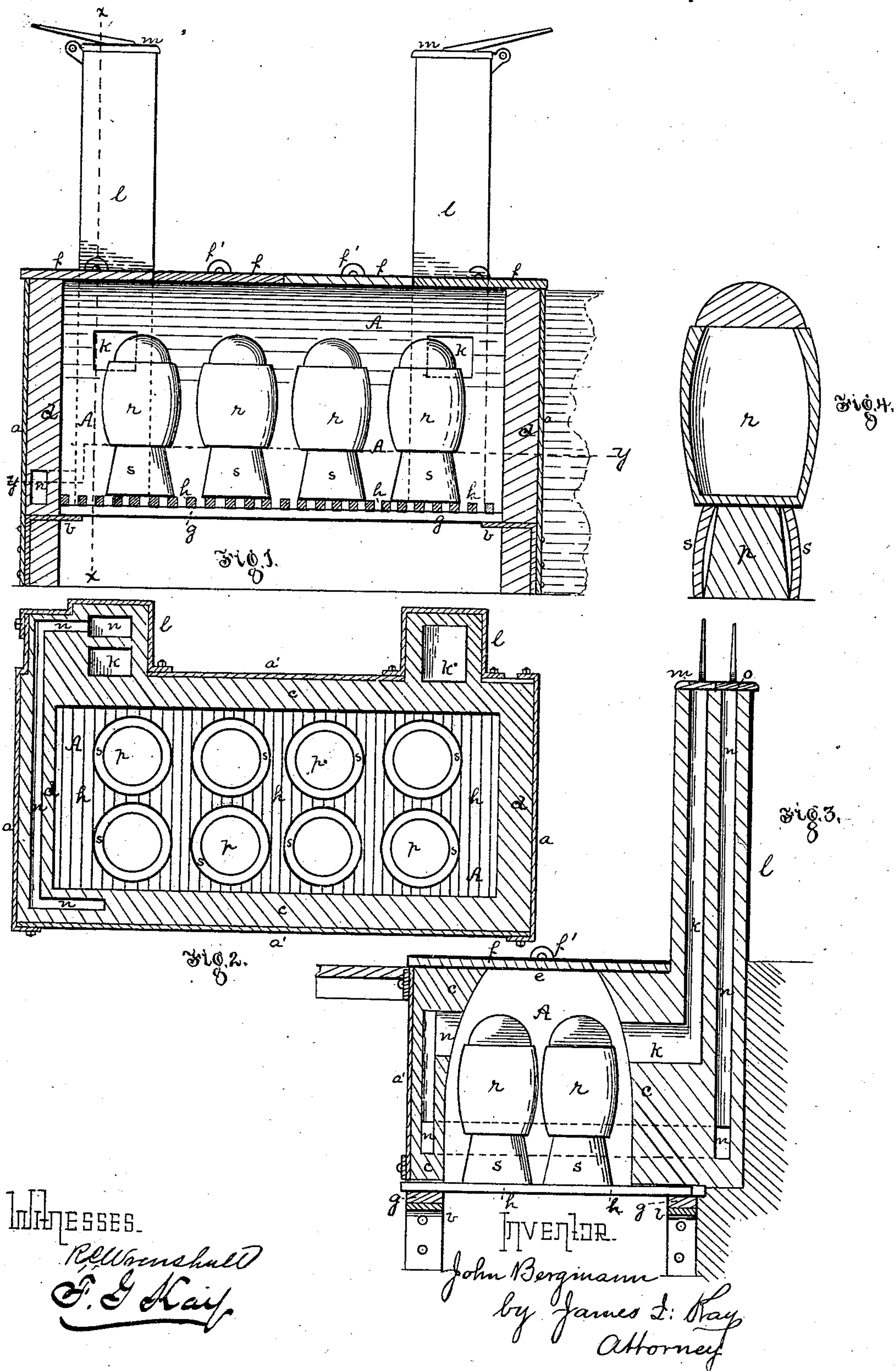


J. BERGMANN.  
Crucible-Furnace.

**No. 226,828.**

**Patented April 27, 1880.**





# UNITED STATES PATENT OFFICE.

JOHN BERGMANN, OF PITTSBURG, PENNSYLVANIA.

## CRUCIBLE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 226,828, dated April 27, 1880.

Application filed December 18, 1879.

*To all whom it may concern:*

Be it known that I, JOHN BERGMANN, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Furnaces for Melting Steel and other Metals in Crucibles; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal vertical section of my improved furnace. Fig. 2 is a horizontal section on the line *y y*, Fig. 1. Fig. 3 is a vertical cross-section on the line *x x*, Fig. 1; and Fig. 4 is a vertical section of a crucible and stand.

Like letters of reference indicate like parts in each.

My invention relates to certain improvements in furnaces for melting steel and other metals in crucibles, and for the manufacture of brass and other alloys, in which the fuel is placed around the crucibles containing the metals to be melted. Furnaces for this purpose, where coke is used for fuel, with a natural draft, have generally been built of such size as to hold two crucibles and the surrounding fuel, and with a flue at one end, near the top of the furnace, the crucibles being placed in and removed from and the fuel fed to the furnace through an opening at the top, over which was placed a suitable cover. These furnaces have been found objectionable on account of the amount of coke used in heating the walls of the different furnaces or holes and the large furnace-space needed, but have heretofore been deemed the only coke-furnace in which it was practicable to obtain the high heat necessary to melt the metals without an air-blast.

Furnaces adapted to hold one or two rows of four crucibles have also been used with coal for fuel, with closed ash-pits and an air-blast to promote combustion, and with the flue at one end, through which the products of combustion passed to the stack. They have also been found objectionable because a uniform and regular heat could not be maintained all over the furnace, as the pots or crucibles the farthest distance from the flue were not subjected to as great heat as those near the flue.

It has also been necessary to use the blast to obtain the high heat for melting this number of pots in one furnace or hole.

By my invention I have overcome all the objections heretofore urged to the larger furnaces, and obtained the regular and uniform melting of a large number of crucibles in a coke-furnace with the natural draft, dispensing entirely with the air-blast.

My invention consists, first, in a furnace for smelting metals in crucibles, said furnace having a fuel-chamber adapted to hold two rows of crucibles, and being provided with two flues, one located at each end, near the top of the furnace; second, in providing these flues with suitable dampers, whereby the heat in the different parts of the furnace may be accurately regulated; and, lastly, in providing the incombustible stands on which the crucibles are supported with incombustible shrouds or coverings, to prevent the cinder from adhering to the stands during the melting.

To enable others skilled in the art to make and use my invention, I will describe its construction.

In the drawings referred to, my improved furnace is formed of the cast-metal plates *a a'*, mounted on a suitable foundation and bolted together at the corners. The furnace is oblong in shape, and the fuel-chamber *A* is of proper width to hold two crucibles with the necessary fuel-space around them, and preferably of a length adapted to hold a row of four crucibles, with the necessary fuel-space.

At a suitable height on the inner surface of the metal plates are the flanges *b b*, on which the fire-brick walls and lining of the furnace are supported. The walls *c c* of the furnace are built perpendicular for part of their height, and then gradually converge toward the top, so that the top opening through from the floor of the casting-house is about wide enough to remove one crucible. The end walls, *d d*, may converge in like manner, if desired, though it is not essential.

Over the top opening, *e*, are placed the removable covers *f*, which are lined with fire-brick and provided with suitable handles *f'*. Above the flanges *b b* are suitable rests or cross-bars *g g*, on which the continuous row of grate-bars *h h* are supported, said grate-bars



being pulled out by means of tongs when the fire is to be let out of the furnace. The continuous grate-bars support the crucibles and their stands

5 The fuel-chamber A is provided with two flues, *k k*, one at each end, leading to the stacks or chimneys *l l*. The flues *k k* may be formed either in the end walls of the fuel-chamber or through one of the convergent side walls, 10 as shown in the drawings, the latter construction being preferred, as they will then lead directly out to the chimneys.

At the top of the chimneys are the dampers *m m*, which are operated by rods extending 15 down to the working-floor of the casting-house. By the use of the two flues, one at each end, the draft of the furnace passes up through the grate-bars, and, instead of being drawn to one end only, is drawn to both ends 20 of the fuel-chamber, thus giving a much more even heat all over the chamber. At either end of the fuel-chamber are formed the supplemental flues *n*, which pass through the other side wall at a point about opposite the 25 flues *k k*, leading down a short distance, and thence, through the partition or end walls between the two furnaces, to separate flues in the stacks or chimneys *l l*, the chimneys being provided with separate dampers *o*, by means 30 of which these flues are regulated. The object of these flues is to turn the draft from one side to the other of the fuel-chamber and cause all the walls of the furnace to burn out evenly, as if only one set of flues were used 35 that wall of the chamber would burn out more rapidly than the other. By this construction, however, the draft can be changed from one side to the other, and the fuel-chamber will wear equally on both sides.

40 The crucibles *r r*, containing the metal to be melted, are placed on clay, plumbago, or other stands, *p p*, which rest directly on the grate-bars and support the crucibles in the hottest part of the fuel-chamber.

45 The slag formed from the fuel and the crucibles at the necessarily high heat is liable to stick to these stands and render them unfit for use, each stand being seldom used more than once. To obviate this I cover the stands with a 50 shroud or cover, *s*, composed of some incombustible material, on which shrouds the slag forms, thus protecting the stands *p* from the heat and the slag, and enabling me to use them for many heats.

55 The shrouds *s* may be formed of many different incombustible materials. I have found, however, that a very suitable shroud is formed from worn-out plumbago crucibles, which are cut in halves and the lower end cut off, the 60 hollow rings thus obtained being placed around the stands, forming a good protection.

Shells of the proper shape may also be formed of fire-clay or other suitable material and placed around the stands.

65 The operation of my improved furnace is as follows: The stands *p* are placed on the grate-

bars, and the incombustible shrouds *s* placed around the stands. The crucibles *r*, containing the proper charges of metal to be melted, 70 are then placed on the fire-brick stands, the furnace being arranged, as shown, to accommodate eight or more pots or crucibles. The coke is then placed around the crucibles, fitting in the fuel-space between them and all 75 around them, the dampers *m* of the main flues *k* are opened, and the furnace is lighted.

The draft of the furnace passes up from the open ash-pit through the grate-bars and around the crucibles to the flues *k k*, the draft of each flue being about equally strong, and 80 thus forming an even heat all over the fuel-chamber, and causing the conversion of the metal in the crucible to steel at about the same time.

The two flues cause so much stronger draft 85 that I am enabled to obtain the necessary high heat in a larger chamber, and consequently melt a much larger number of pots than has ever been done without the use of an air-blast, thus saving the fuel formerly con- 90 sumed in heating the furnace-walls, and also much furnace-space, which is very important.

If the heat of the furnace varies at either end, and it is desired to obtain the conversion of all the steel in the furnace at the same 95 time—as, for instance, for a large casting—the furnace may be regulated by the dampers *m*, and an even heat throughout the furnace insured.

The slag formed from the coke and the 100 burning of the plumbago crucibles runs down the crucibles and adheres to the shrouds *s*, which thus protect the stands, and enable them to be used continuously, a new shroud 105 being placed over them every few heats.

When the flues *k* are placed in one of the side walls of the furnace, as shown, that side wall is liable to burn out much more rapidly than the opposite one, necessitating the re- 110 building of the furnace when the opposite wall is comparatively sound. To obtain an even wear all over the furnace I have formed the flues *n n* in the opposite side wall, which pass around through the end walls to the 115 stacks or chimneys, and are regulated by separate dampers *o*. These flues can be used alternately with the main flues by closing the dampers of one and opening the others, and the heat will be directed evenly against both sides. 120

The supplemental flues *n* can also be used in connection with the regular flues *k* to draw the heat to the opposite side of the furnace when those crucibles are not melting with 125 sufficient rapidity, and when an exceedingly high heat is desired to give a strong draft to the furnace all the flues may be left open.

My invention has been described as especially adapted to use in coke-furnaces with a natural draft. It is evident, however, that my 130 improvements are equally applicable to furnaces in which coal is used as fuel, and that



they can be used in connection with an air-blast, and will be found equally advantageous therein.

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

1. A furnace for smelting metals in crucibles, having a fuel-chamber for containing one or more rows of crucibles, and provided with two independent flues, one located at each end thereof, near the top, substantially as and for  
10 the purposes set forth.

2. In a furnace for smelting metal in crucibles, the combination, with the fuel-chamber, of two independent flues containing dampers

for regulating the heat in the fuel-chamber, 15 and whereby the heat may be thrown to either end of the chamber, substantially as and for the purposes set forth.

3. In combination with the incombustible stands *p*, for supporting the crucibles, the in- 20 combustible shrouds or shells *s*, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN BERGMANN, have hereunto set my hand.

JOHN BERGMANN.

Witnesses:

JAMES I. KAY,  
F. G. KAY.