

W. A. STEPHENS.

BLAST APPARATUS FOR FURNACE.

No. 177,028.

Patented May 2, 1876.

Fig. 1.

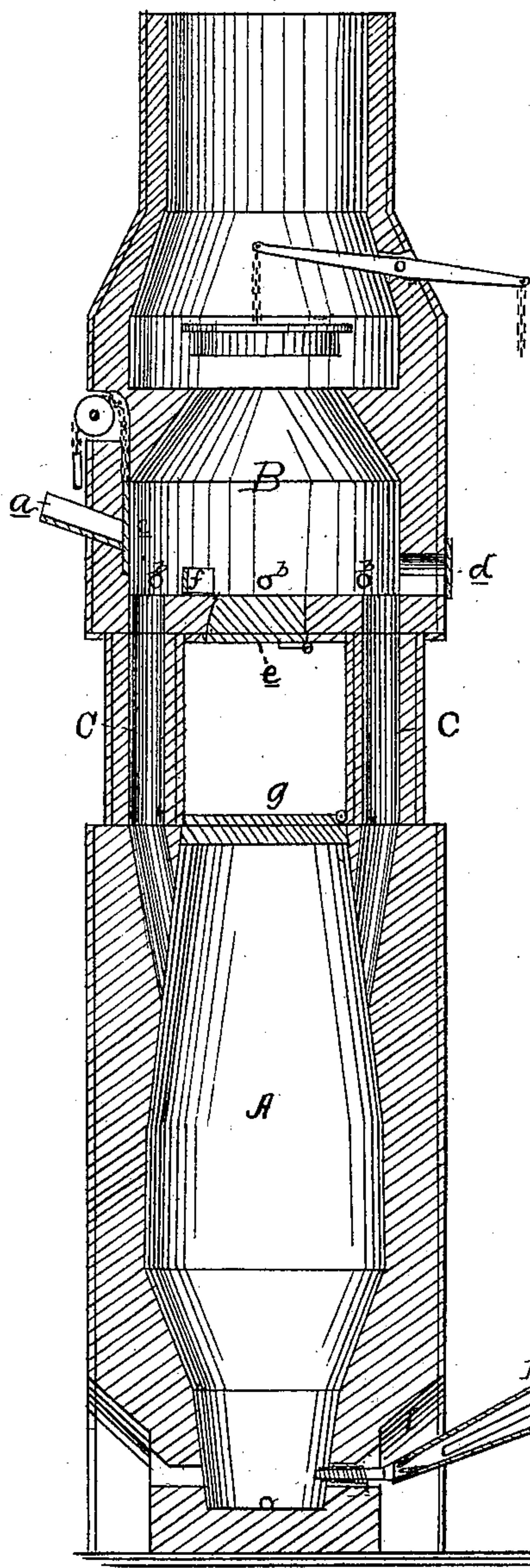
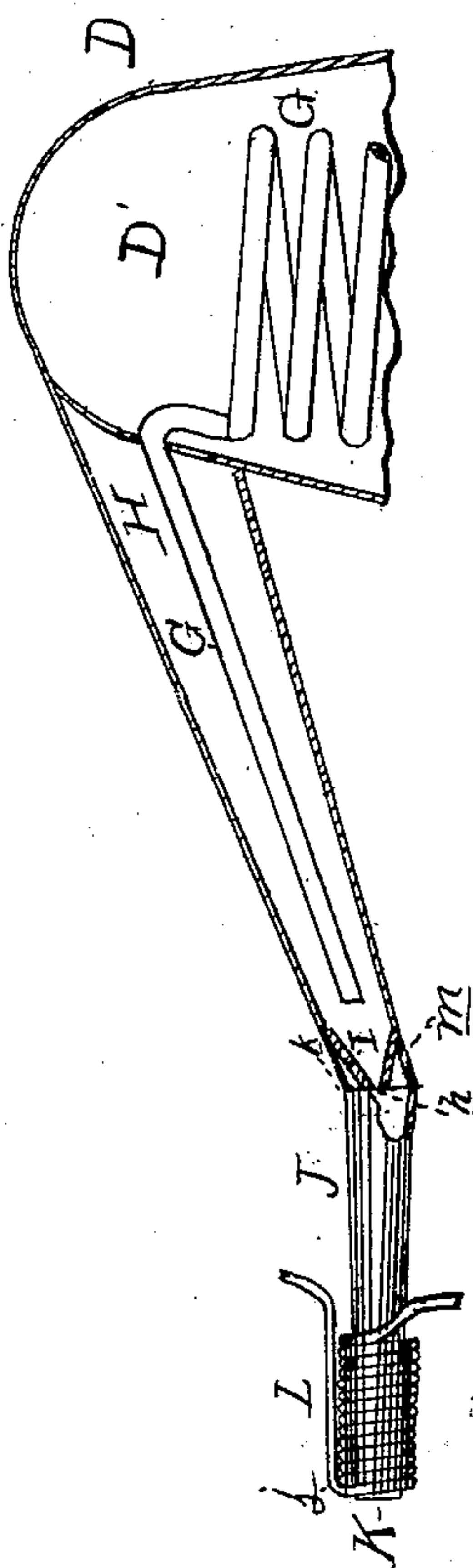


Fig. 2.



Witnesses:
Chas. Thurman.
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UNITED STATES PATENT OFFICE.

WILLIAM A. STEPHENS, OF SUCKASUNNY PLAINS, NEW JERSEY, ASSIGNOR
TO WILLIAM MOLLER, OF NEW YORK, N. Y.

IMPROVEMENT IN BLAST APPARATUS FOR FURNACES.

Specification forming part of Letters Patent No. 177,028, dated May 2, 1876; application filed
December 3, 1875.

To all whom it may concern:

Be it known that I, WILLIAM A. STEPHENS, of Suckasunny Plains, in the county of Morris and State of New Jersey, have invented a new and useful Improvement in Blast-Furnaces; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The object of my invention is an improvement upon the hot-blast furnace for which I applied for Letters Patent, March 4, 1875; and the invention therein consists in the peculiar means adapted for increasing the force and efficiency of the hot blast and the durability of the parts connected with the same, and also in the various operative combinations connected with the same, all as more fully hereinafter described.

In the drawings making a part of this specification, Figure 1 is a vertical section of the whole apparatus; Fig. 2, a vertical section of a portion of the top of the heater, the duct, and tuyere, showing the blast-pipe within the heater and the duct.

Like letters denote corresponding parts in each figure.

A denotes the furnace proper, adapted for use with anthracite coal, and with a hot blast alone, preferably of the form shown, incased in brick and covered with a shell, preferably of boiler-iron; B, the roasting-oven, placed directly above the furnace proper, and supported upon hollow supports C C, three or more in number, leading out of the upper part of the furnace proper, and entering the bottom of the roasting-oven, and serving as flues to conduct the gases of combustion from the furnace proper into the roasting-oven. This roasting-oven is furnished with proper chutes *a*, orifices *b* to admit air for combustion of gases, doors *c* to clear out the oven, or introduce instruments to stir up or loosen the contents of the oven, a damper-cover, *d*, capable of convenient operation from the outside, to regulate the escape of heat or gases from the roasting-oven, a swing-door, *e*, in the bottom, to allow the charge to fall out, and a pivoted scraper or partition, *f*, adapted to be operated from the outside, and intended to separate

successive charges of ore placed in the roasting-oven. This roasting-oven, moreover, is incased with brick-work, and also the supports, with a shell around the same, the same as the furnace proper, which brick-work, extended above said oven, forms the top of the stack or flue of the furnace. The furnace A has a pivoted cover or door, *g*, beneath that in the bottom of the roasting-oven, and suitable openings for cleaning out the same and permitting the melted contents to flow out. Around this furnace proper are arranged two or more heaters, D, adapted to burn anthracite coal, having a combustion-chamber, D', dome-shaped or reverberating.

Upon the outside of each heater, connected with a suitable blower, is a blast-pipe, E, from which branches a pipe, F, which enters the heater below the fire-bed, and aids in combustion of the coal therein, and another branch or blast pipe, G, which enters the combustion-chamber, passes around the same in coils, and through and across the combustion-chamber into a duct, H, and along within the same toward the furnace, and nearly to the end of the duct. These several pipes have proper regulating-valves.

The duct H may be cast with the top of the heater opening directly out of the combustion-chamber, or attached to the same near its top in any suitable manner, in which latter instance proper openings must be made to give passage of the gases of combustion from the combustion-chamber into said duct. This duct, moreover, is preferably bent down, and gradually contracted toward its end next to the furnace. At this smallest end of the duct is properly secured a conical deflector, I, made of wrought-iron or refractory material, with its mouth toward the end of the blast-pipe G, which approaches quite near the center of it, and having an opening, *h*, for the passage through it of the hot air from the blast and the gases contained in the duct. This deflector, it is to be observed, fits as tightly as possible in the duct, so that there is no air-passage around its periphery. At the end of the duct is secured, in any suitable manner, another duct, J, made of wrought-iron or of refractory material, having an inside diam-

eter at least equal to the inside diameter of the smallest end of the duct H, and preferably turned up a little at *k*, so as to assume a horizontal plane, and tapering a little toward the furnace. To the smallest end of this duct J is secured the tuyere K, which enters the bottom of the furnace proper through a proper channel-way or recess in the brick-work around the same. This tuyere is protected by a coil, L, of water-pipe connected with a proper supply, which coil is carried closely around the tuyere from its heel to its front, then bent back, as at *j*, along over the main body of the coil, so that the water, entering, passes along the pipe at *j*, and is presented first at the front of the tuyere, and then circulates around it back toward its heel, thus presenting the coldest water at the part where the heat is the greatest.

On the under side of the duct J, at the angle *k*, is an opening, *m*, passing directly into said duct, and closed by a suitable plug or other equivalent means, the object of which opening is twofold, being to enable the operator to thrust in a rod, preferably of zinc, in order to test, by melting it, the degree of heat within said duct, and also to enable the operator to introduce a rod to clear out the interior of the tuyere.

In the operation of my apparatus the same course is followed with regard to starting the blast, charging the roasting-oven, heating and charging the furnace proper, and in manipulation generally, as is described in the application of March 4, 1875, previously referred to.

In the special operation of the blast it will be perceived that, the coils of the blast-pipe in the combustion-chamber becoming intensely heated, the air within such pipe becomes correspondingly heated, and under the pressure exerted is delivered at the very mouth of the deflector, not only with great force, but at a high degree of temperature. At this point it meets the volume of the gases of combustion, driven out of the combustion-chamber by the air-force exerted through the branch pipe F, and compressed by the diminishing size of the duct H, and forces said gases through the orifice *h* in the deflector I. Immediately upon their passage through the orifice named the gases take fire, and there occurs instantaneously an expansion in volume of them, limited by the greater interior area of the duct J as

compared with the area of the orifice *h*. In this expansion the inclination of the gases in combustion to force themselves back into the duct H is controlled and prevented by the interposition of the outside walls of the deflector, which present shoulders against such back pressure, and include between themselves and the inner walls of the duct H recesses or chambers *n*, which receive and sustain the back pressure. This back pressure is, however, less than the forward pressure through the orifice *h*, and therefore the forward movement of the blast is uninterrupted.

The advantages of my peculiar construction and arrangement of the various ducts, the blast-pipe, and the deflector are, that I am enabled to develop a greater degree of heat in the blast than has heretofore been had, which is of the utmost consequence in the reduction of iron ores by anthracite coal, as it not only makes the reduction quicker, cheaper, but produces a better quality of pig, inasmuch as, by the increased temperature of the blast, I am enabled, under comparatively low air-pressure, to force burning gases into the coal in the furnace proper, and to force fresh gases arising out of the combustion of the coal in the furnace proper into the roasting-oven, there to take fire again, and roast and desulphurize the ore contained therein. At the same time the operation of smelting is performed upon ores which have been desulphurized and deoxidized by anthracite coals which have been in a great measure deprived of gases which would injure the quality of the iron.

Having thus described my apparatus and its manner of operation, what I claim as new therein and my invention is—

1. In combination with the ducts H and J and deflector I, the opening M placed directly at the rear of the deflector and adapted to give access to the interior of the tuyere, substantially as and for the purposes described.

2. In combination, the blast-pipe G, the ducts H and J, and the deflector I, substantially as and for the purposes set forth.

This specification signed and witnessed this 24th day of November, 1875.

WILLIAM ALEXANDRE STEPHENS.

Witnesses:

S. B. GOODALE,
GILBERT SMITH.