J. LUKENS.
Puddling-Furnace.

No. 219,282. Patented Sept. 2, 1879.

FIG. 2.

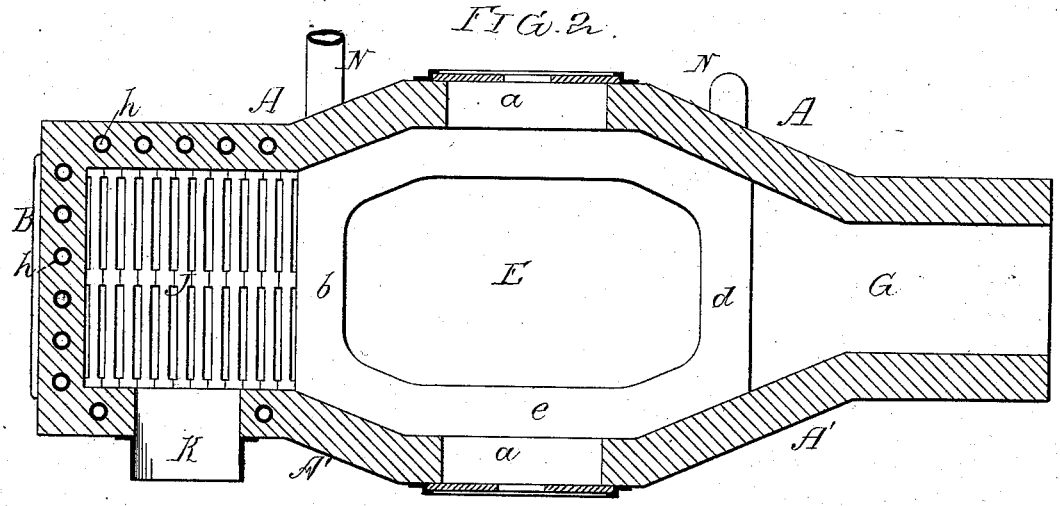


FIG. 1.

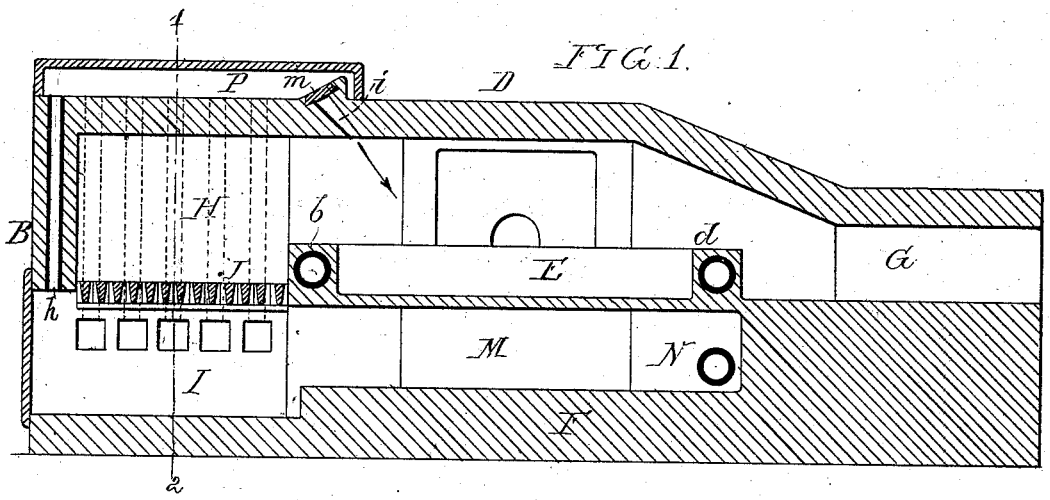
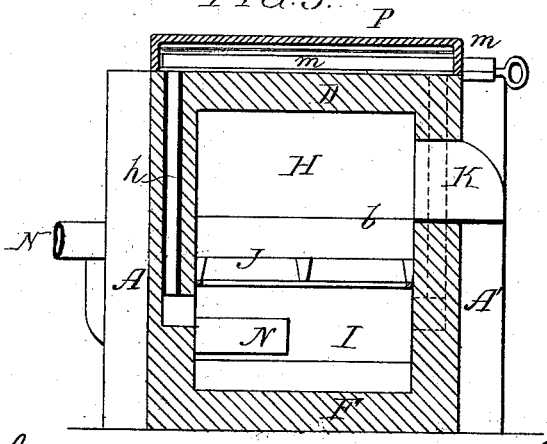


FIG. 3.



Witnesses,
Harry A. Crawford
Harry Smith

Inventor,
Jawood Lukens
by his Attorneys
Howson and Son

UNITED STATES PATENT OFFICE.

JAWOOD LUKENS, OF CONSHOHOCKEN, PENNSYLVANIA.

IMPROVEMENT IN PUDDLING-FURNACES.

Specification forming part of Letters Patent No. **219,282,** dated September 2, 1879; application filed September 27, 1878.

To all whom it may concern:

Be it known that I, JAWOOD LUKENS, of Conshohocken, Montgomery county, Pennsylvania, have invented a new and useful Improvement in Puddling and other Furnaces, of which the following is a specification.

My invention relates to that class of heating and puddling furnaces in which heated air is combined with the products of combustion from the fire-place for the purpose of igniting the unconsumed gases, and thereby intensifying the heat in the furnace; and the objects of my invention are to provide for the thorough heating of the air, and for its advantageous employment when heated to prevent the rapid destruction of the walls of the fire-place, and to provide for the ready changing of an ordinary puddling-furnace into a furnace of the improved construction.

The invention consists in the combination of an ash-pit communicating with a supply of air, a chamber above the fire-place, vertical pipes or passages arranged in the walls of the fire-box, and forming a direct communication between the ash-pit and the chamber on the roof, and inclined orifices formed in the roof of the furnace, and so arranged as to direct the heated air from the air-chamber into the bed of the furnace beyond the bridge.

The invention further consists in the combination of the walls of the fire-place with metal pipes built into the walls, so as to strengthen the same and prevent their rapid destruction by heat, and at the same time afford a communication between the ash-pit and the air-chamber.

In the accompanying drawings, Figure 1 is a vertical section of a puddling-furnace with my improvements; Fig. 2, a sectional plan; and Fig. 3, a transverse vertical section on the line 1 2, Fig. 1.

A and A′ are the opposite side walls of the furnace, these walls having the usual doorways *a a*, provided with the ordinary doors. B is the end wall; D, the roof; E, the bed of the furnace; F, the base; G, the flue communicating with the chimney; H, the fire-place; I, the ash-pit; J, the grate, and K the opening for the introduction of fuel to the fire-place.

Furnaces having the above-described parts are used for puddling, heating, and reducing purposes, the character of the structures being varied to some extent, as the uses to which the furnaces are put may suggest.

Beneath the bed of the furnace is a chamber, M, which has direct communication with the ash-pit I, air under pressure being introduced into the chamber and ash-pit through a pipe, N, which passes first through the bridge-wall *b* of the furnace, thence through the edge *e* of the recess in the bed, thence through the rear wall, *d*, of the bed, and terminates finally in the said chamber M, the pipe being built into the brick-work while the furnace is being erected. The precise course of this pipe will, in a measure, depend upon the character and shape of the bed of the furnace; but the pipes should, by preference, be embedded in the walls which bound the bed, and should take such a course that, while they are necessarily exposed to heat, they are protected by the brick-work. In some cases more than one inlet-pipe may be used.

On the top of the furnace, immediately above the fire-place, and extending across the structure, is an air-chamber, P, the walls and top of which may be of cast or wrought iron or fire-brick, a series of vertical pipes, *h*, built in the side and end walls of the fire-place, forming communications between the ash-pit and the said air-chamber, the latter having a series of inclined outlets, *i*, through which jets of air can be discharged, in the direction of the arrow, to the bed of the furnace, the volumes of air and force of the jets being determined by a valve or damper, *m*, which has orifices corsponding with the outlets, and which can be adjusted at pleasure.

The volume of air under pressure admitted to the pipe N is first heated in passing through the same, and then subjected to further heat by being exposed to the under side of the bed of the furnace, so that it will be in good condition for promoting the fierce combustion of the fuel on the grate; but the volume of air being more than sufficient for this purpose, the surplus passes through the vertical pipes *h* into the chamber P, whence it may be discharged, in a highly-heated condition, onto the bed of the furnace, to insure the thorough combus-

tion of the gases from the fire-place, and thus aid the fuel in performing the duty for which the furnace is intended, whether it be used for puddling, heating, or reducing.

It is important that there should be a provision for regulating the volume and force of the jets of heated air, hence the damper *m;* and it is preferable for the chamber P to derive its air from the ash-pit, whence air is also obtained for supporting combustion, as by the simple adjustment of the damper the volume and force of air for supporting combustion may be diminished simultaneously with the enlargement of the orifices *i*, or the reduction of the latter simultaneously with an increase in the volume of air for promoting combustion may be effected, as circumstances may suggest.

The forcible jets of heated air, directed in the course pointed out to the bed of the furnace beyond the bridge, will, in all cases and in the most effective manner, aid the products of combustion in performing their duties.

Instead of a number of orifices, *i*, a single slot extending across, or partly across, the furnace may be employed.

The pipes *h* strengthen the walls of the fire-box, and prevent that rapid destruction of the same due to the burning out of the walls at a point just above the grate, where the hot coals are massed against the walls, the effect of the pipes being to check the burning away of the wall at this point, and to prevent the caving in of the upper portion of the wall due to the weakening of the lower portion of the same. The pipes also facilitate the change of an ordinary puddling-furnace into a furnace of the improved construction, as said pipes can be readily built into the walls of the fire-place during one of the periodical reconstructions of the latter.

I am aware that furnaces have been constructed with inclined orifices located in respect to the bridge-wall as in my furnace, and I therefore do not desire to claim this feature separately. It has been found in practice, however, that when the inclined orifices, located as described, are used, the air, in order that it may have the desired effect, must have a very high degree of heat imparted to it, as the jets of air are projected directly onto the molten metal on the bed of the furnace. By combining these orifices with pipes or passages arranged in the walls of the fire-box, so as to convey air from the ash-pit to a chamber on the roof, I am enabled to impart such a high degree of heat to the air that it can be used most advantageously in the manner set forth.

I am also aware that two fire-places have been connected by vertical pipes in the side walls of a furnace, said pipes conveying the heated products of combustion from one fire-place to the other; but such pipes have obviously not the same tendency to preserve the walls of the fire-place as the pipes for conveying air from the ash-pit to the roof.

I claim as my invention—

1. The combination, in a furnace, of the ash-pit I, communicating with a supply of air, a chamber, P, above the fire-place, vertical pipes or passages *h*, arranged in the walls of the fire-box, and forming a direct communication between the ash-pit and the chamber P, and the roof D, having an inclined orifice or orifices, *i*, formed therein, the inclination being such as to direct the heated air from the air chamber P onto the bed of the furnace beyond the bridge-wall *b*, all substantially as directed.

2. The combination of the ash-pit I with the metal pipes *h*, built in the walls of the fire-box, and serving to convey air from the ash-pit to the top of the furnace, all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAWOOD LUKENS.

Witnesses:
HARRY A. CRAWFORD,
HARRY SMITH.