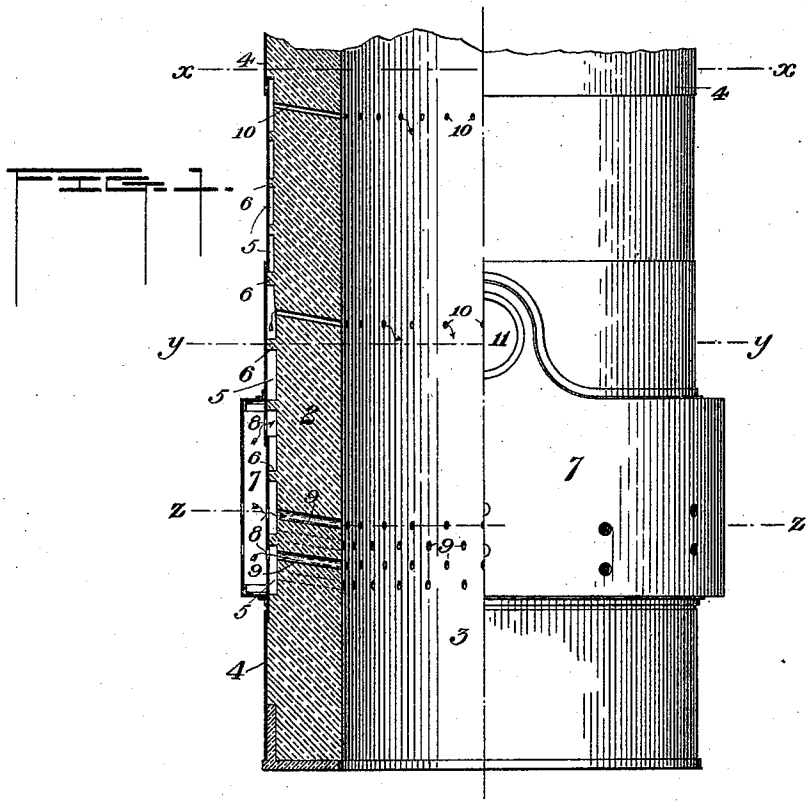
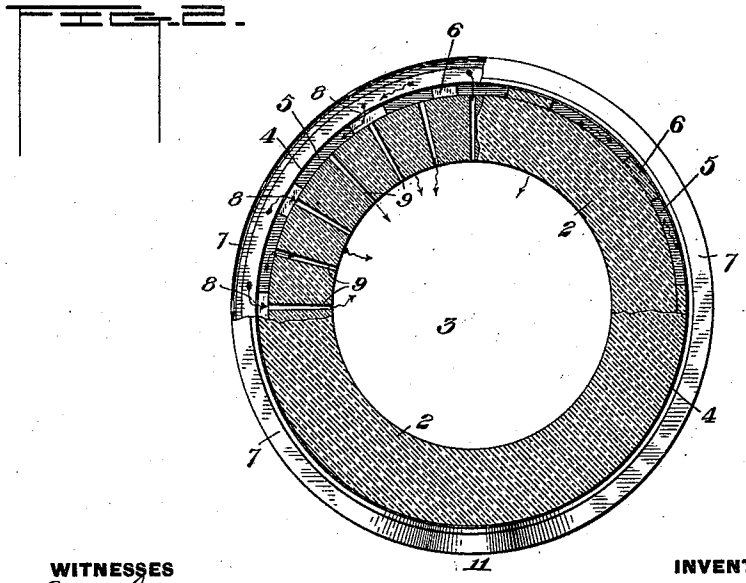
(No Model.)

W. H. BRADLEY.

FURNACE.

No. 456,134. Patented July 21, 1891.





WITNESSES

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM H. BRADLEY, OF MINGO JUNCTION, OHIO.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 456,134, dated July 21, 1891.

Application filed June 9, 1890. Serial No. 354,756. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BRADLEY, or Mingo Junction, in the county of Jefferson and State of Ohio, have invented a new and useful Improvement in Furnaces, of which the following is a full, clear, and exact description.

I will describe my improvement with reference to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of a cupola-furnace constructed in accordance with my invention. Fig. 2 is a horizontal cross-section on the lines *x x*, *y y*, and *z z* of Fig. 1.

The object of my invention is to improve the construction of cupola or iron-melting furnaces so that the furnace shall be more durable and efficient, and that its capacity for output shall be increased.

To this end the invention consists in providing around the furnace or the lower portion thereof between the outer shell and the inner brick lining an air-space or air-spaces connected with the air-blast supply and with the tuyere-openings which extend to the interior of the furnace.

Heretofore cupola-furnaces have generally been constructed with tuyeres connected directly with the wind-box by openings made in the shell or plates of the furnace and therefore fixed, so that they cannot be changed in number or location without alteration in the iron-work, and as the cold-air blast enters the tuyeres directly from the wind-box its low temperature is very apt to chill the slag at the tuyeres, thereby clogging them and making it necessary to devote constant attention to prevent the melting capacity from being reduced and the cupola from being clogged up from this cause. Another objection which is incident to the former construction of such furnaces is that the heat of the exterior wall is radiated uselessly into the atmosphere, and, furthermore, when the furnace-lining wears thin or burns out at or above the tuyeres the pressure of the blast within the furnace drives the flame and hot gases through the brick-work and rapidly destroys it. If the joints or seams of the outer metal shell are not tight, the hot gases will also blow through the crevices therein, the effect of which is first to warp the plates and eventually to burn them. If the joints of the outer shell are tight, the hot gases will work their way upward between the shell and the brick lining until they find an inlet again to the furnace at a point where the internal pressure of the blast is sufficiently low. These are the primary causes of most of the destructive warping and loosening of the joints so frequent in cupola-furnaces, and they may be avoided entirely by use of my improvement.

The brick lining of my improved furnace is inclosed by an air-space in which a constant pressure of air from the blast is maintained, the effect of which is not only to cool and protect the lining and to utilize the heat thereof in heating the air-blast, but also by creating an external air-pressure on the lining I prevent the hot gases and air from escaping through the crevices from the interior. Warping, burning, and opening of the joints are thus prevented, the durability of the furnace is increased, and by heating the blast the liability of the cinder to clog at the tuyeres is obviated, labor is saved, and the capacity of the furnace for output is very materially increased.

I shall now describe my invention more particularly, so that others skilled in the art to which it appertains may apply the same to use.

In the drawings, 2 represents the usual brick lining of the cupola-furnace.

3 is the interior of the furnace, which by reason of my invention may conveniently be made of constant diameter throughout, since the protection offered by the air-casing is such as to render it unnecessary to contract the diameter of the furnace-hearth and to thicken its walls.

4 is the usual metal shell by which the lining of the furnace is inclosed.

Between the lining and shell is an air-space 5, which extends from a point below the level of the tuyeres upwardly to a considerable extent which is determined by the dimensions of the furnace and the manner in which it is worked. To prevent the lining from being forced out against the shell, and thus closing the air-space, I provide headers 6, which project from the lining and fit against the interior of the shell. This may be done conveniently in constructing the lining by provid-

ing it at intervals with somewhat longer projecting bricks, as shown in the drawings.

7 is the wind-box arranged outside of the shell 4 and communicating with the air-space through holes 8.

9 9 are tuyere-openings, which extend through the lining 2 into the interior of the furnace at the zone of fusion. There may also be one or more series of supplementary tuyere-openings 10 at higher levels, the function of which is hereinafter stated.

The air-blast is admitted to the wind-box through a suitable blast-inlet 11 from a blast-pipe. (Not shown in the drawings.)

In the operation of the furnace the air-blast, being admitted to the wind-box from the blast-pipe, enters the air-space 5 and thence passes through the tuyeres to the interior of the furnace. A constant blast-pressure is maintained in this space directly around and outside of the brick lining, so that if there be any crevices or openings in the lining the air will force itself into them, thereby not only preventing the gases from escaping and attacking the metal shell, but also cooling the lining, preventing it from burning, and lessening the usual rapid wear on the furnace. The function of the tuyeres 10 is to supply air for consuming the carbonic-oxide gas above the melting-zone of the furnace. When the air enters from the tuyeres 9 and burns the coke in the furnace, it is converted into carbon dioxide, which, as it ascends through the overlying mass of hot coke, is converted into carbon monoxide. The air entering through the upper tuyeres 10 unites in combustion with this combustible gas, thereby preventing its waste and utilizing it in heating the charge in the upper zones of the furnace.

When the furnace is constructed in accordance with my improvement, it is possible to dispense with the usual iron or special brick tuyeres extending through the lining and connected to the outer metal shell. This is a material advantage, because it enables the number and location of the tuyeres to be changed without necessitating alteration in the iron-work, and I am enabled thereby to effect a considerable saving in the cost and maintenance of the furnace.

The skilled furnace-builder will perceive many possible modifications in the form, construction, and relative arrangement of the parts of the furnace within the scope and principle of the invention. For example, the location and dimensions of the air-space and the manner of constructing the furnace so as to constitute such space may be modified. An essential feature of this air-space is that it shall be in direct contact with the brick lining and shall be in communication with the source of blast-supply.

The advantages of my invention have been indicated above and will be appreciated by those skilled in the art.

I claim—

1. In a cupola or melting furnace, the combination of the inner brick lining, a metal shell exterior to the same, but separated therefrom by an intervening air-space contiguous to the brick lining, a wind-box and blast-supply around the outside of the shell communicating with the air-space and tuyere-openings, substantially as and for the purposes described.

2. In a cupola or melting furnace, the combination of an inner brick lining, an outer metal shell surrounding the same, but separated therefrom by an intervening air-space contiguous to the brick lining, tuyere-openings through the brick linings, and headers or separators bearing against the interior of the metal shell in the air-space, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 26th day of May, A. D. 1890.

W. H. BRADLEY.

Witnesses:
DAVID N. LONG,
JAMES G. SMITH.