

M. FOSTER.

Metallurgic and other Regenerator Furnaces.

No. 155,150.

Patented Sept. 22, 1874.

Fig. 1

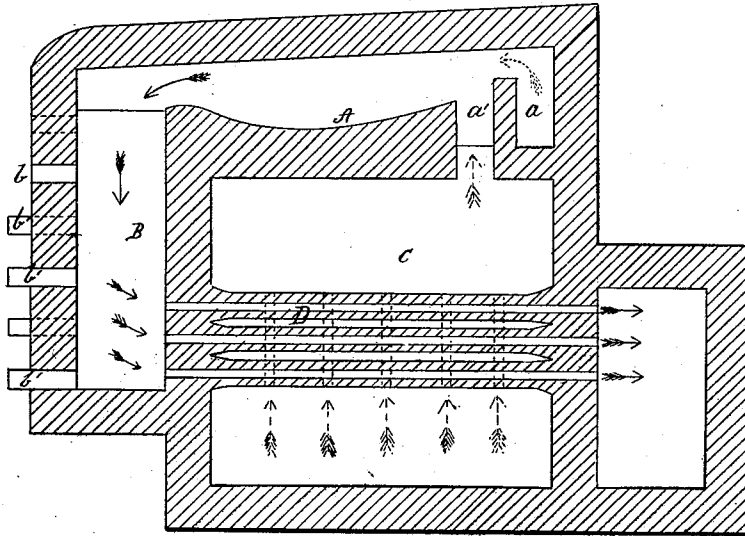
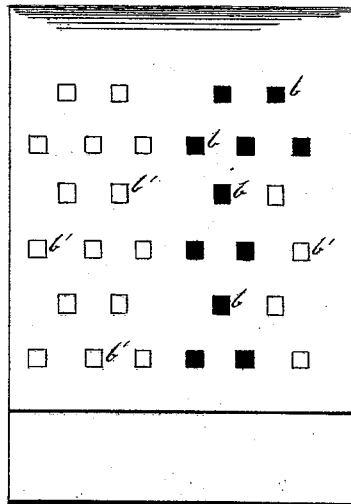


Fig. 2



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MORRISON FOSTER, OF ALLEGHENY, PENNSYLVANIA.

IMPROVEMENT IN METALLURGIC AND OTHER REGENERATOR FURNACES.

Specification forming part of Letters Patent No. **155,150**, dated September 22, 1874; application filed June 24, 1874.

To all whom it may concern:

Be it known that I, MORRISON FOSTER, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Regenerator-Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—

Figure 1 is a vertical longitudinal section of an improved regenerator illustrating my invention, and Fig. 2 is an end view of the same.

Like letters refer to like parts in each figure.

My invention relates to apparatus employed for utilizing the heat contained in the waste products of combustion, on their passage from the hearth of the furnace, in the manufacture of iron and steel, generally termed regenerators; and it consists in controlling the temperature of the products of combustion in the down-take or flue leading from the hearth to the regenerator, by the admission of air, for which purpose I usually provide a series of air-passages in the walls of the down-take, at such points that the temperature of the products of combustion escaping from the hearth may be reduced before reaching the regenerator.

Regenerator-furnaces, as heretofore constructed, have been of two general classes: First, those in which the products of combustion passing from the fire-chamber or hearth gave up their heat to the walls or surfaces of the regenerators, from which same surfaces it was again absorbed by the incoming air and gases; and, secondly, those in which the products of combustion passing continuously through a series of passages gave up the heat to surfaces which transmitted it to an incoming air and gas passing continuously over the opposite surfaces of said tubes or passages.

While the present invention is applicable to both classes of regenerators, it is more especially adapted for the second or latter classes. The difficulties to be overcome in the present regenerative furnaces are, first, the cutting or destruction of the tubular or other works subjected to the products of combustion coming directly from the hearth; and, secondly, the derangement of the furnace from the un-

equal expansion and contraction arising from alterations of temperature due to the intense heat. To such an extent have these causes militated against the usefulness of regenerative furnaces that but few have been successfully and economically worked, the intense heat to which the regenerative apparatus of furnaces is subjected inducing such unusual degrees of expansion as to require special provision to counteract this disturbing element.

The idea has heretofore prevailed that in order to obtain the best effects in working regenerative furnaces the greatest possible heat should be imparted to the regenerator, and all waste heat of the products of combustion utilized. But it is evident, when we consider that even for steel-making from 3600° to 4000° Fahrenheit is the highest heat required on the hearth, and at the time the combustion takes place the elements entering into the flame are raised 1200° Fahrenheit, or thereabout, it is not necessary that the temperature of the regenerator should exceed 2400° to 2800° Fahrenheit, provided the regenerator is of sufficient capacity for the work expected of it; and if the temperature of the products of combustion passing from hearth to the regenerator is so controlled as to maintain the regenerator at or about that temperature, the useful purposes of a regenerator will be attained, and the heats which have been heretofore so detrimental will be avoided.

The present construction of regenerator-furnaces is not such that the temperature of the products of combustion passing to the regenerator can be regulated, but must vary according as a reducing, neutral, or melting flame is used. The object, therefore, of my invention is to provide a means for controlling the temperature of the products of combustion, as heretofore stated; and I will now proceed more fully to describe my invention, in order that others skilled in the art may be enabled to make and use the same.

In the drawings referred to, A indicates the hearth of the furnace; *a*, the flue for the admission of heated air; *a'*, the flue for the admission of heated gas; B, the down-take or flue leading to the regenerator; C, the heating-chamber, through which the air and gas pass on their way to the hearth; D, the hol-

low bricks or tubes of which the regenerator is constructed, and through which the products of combustion pass on their way to the chimney, and around which the incoming air and gas pass to take up the heat. These are, or may be, all of the usual or any approved construction. Through the outer wall of the down-take or flue B I make a series of openings, *b*, for the admission of air to the down-take, to reduce the temperature of the products of combustion on their passage from the hearth A. These openings may be partially or entirely closed at will by a series of plugs or other devices, *b'*. They may extend the whole length of the down-take, or so far up as is found by practice in each case to be best.

By this means I am enabled to dilute the products of combustion coming from the hearth at any point that I desire, either in the upper portion, near the throat, or lower down, at the points opposite the regenerator proper, as circumstances may dictate.

In the manufacture of iron and steel upon the hearth, the products of combustion coming from the hearth are at about 3600° or 4000°, if complete combustion has taken place, and the admission of air to the down-take under such circumstances does not increase the temperature, because the carbonic oxide has been completely consumed, and there is no chance for further combustion. These openings *b'* are also used as spy-holes, and as long as the structure of the throat and regenerator remains intact, (which it will generally do so long as not unduly heated,) it is not necessary that air be admitted to reduce the temperature; but, if the heat be such that the walls of the throat, or of the regenerators, are in danger of becoming affected, which will be discovered by the operator, (this will often occur when a white heat is approached,) then the temperature of the products of combustion may be reduced by the removal of the required

number of the stoppers *b'*, and the location of the openings from which they are removed will, of course, be dependent upon the part of the throat or regenerator-furnace which is affected. At such times as a neutral or reducing flame is used upon the hearth, and where much carbonic oxide is passing off with the products of combustion, it is, of course, not desirable to use the openings, or to admit air to the down-take, for the reason that the only tendency would be to promote combustion in the down-take, and negative the use for which they were intended. Moreover, under a reducing-flame, or when carbonic oxide is passing over, there will be no need of their being used, because the temperature is then not likely to be such as injures the regenerator.

My invention, therefore, consists in providing means for the admission of air into the flue or down-take in such manner as to reduce the temperature and protect the down-take and the tubes of the regenerator from the excessive heat to which they are liable; and the advantages of said invention are apparent from what has been heretofore stated.

Having thus described my invention, I claim—

1. The method of controlling the temperature of the products of combustion in regenerator-furnaces, after their escape from the hearth, by the admission of air, substantially as specified.

2. In a regenerator-furnace, the combination, with the down-take or flue B, of a series of openings for the admission of air to the down-take or flue, substantially as and for the purpose specified.

In testimony whereof I, the said MORRISON FOSTER, have hereunto set my hand.

MORRISON FOSTER.

Witnesses :

W. N. PAXTON,
JAMES I. KAY.