2 Sheets—Sheet 1.

H. W. ADAMS.

HOT-BLAST GRATE-BARS.

No. 192,630. Patented July 3, 1877.

FIG 1

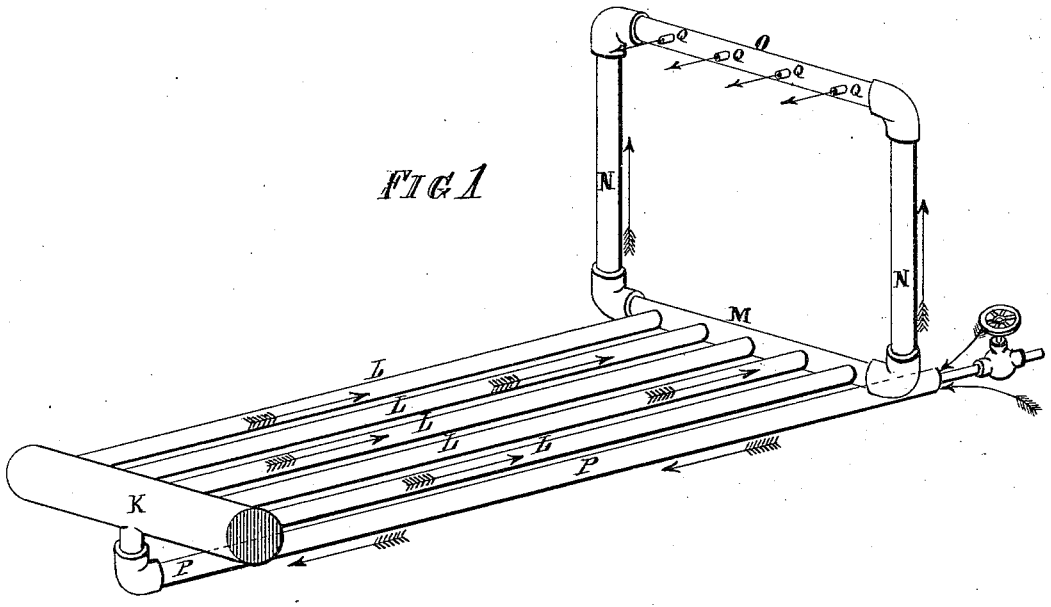


FIG 2

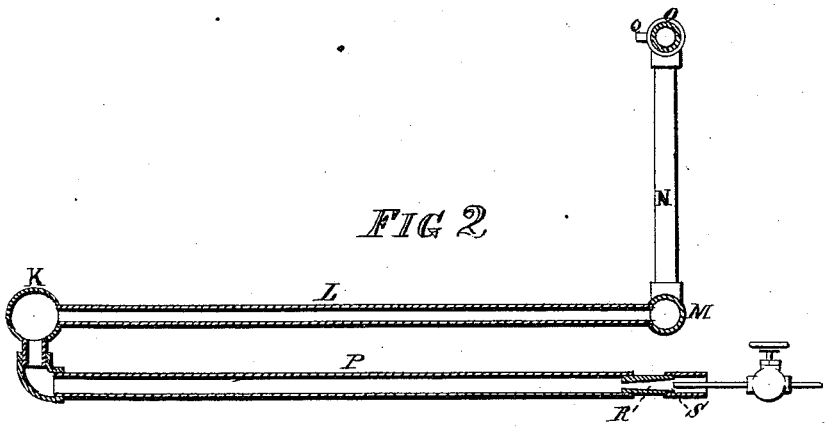
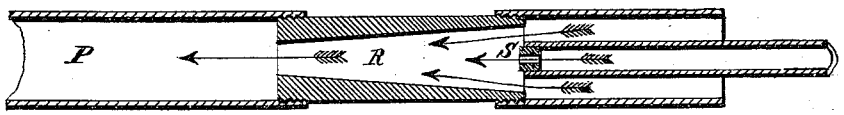


FIG 3



Witnesses.
Isaac R. Oakford.
W. Ziegler

Inventor.
Henry W. Adams.

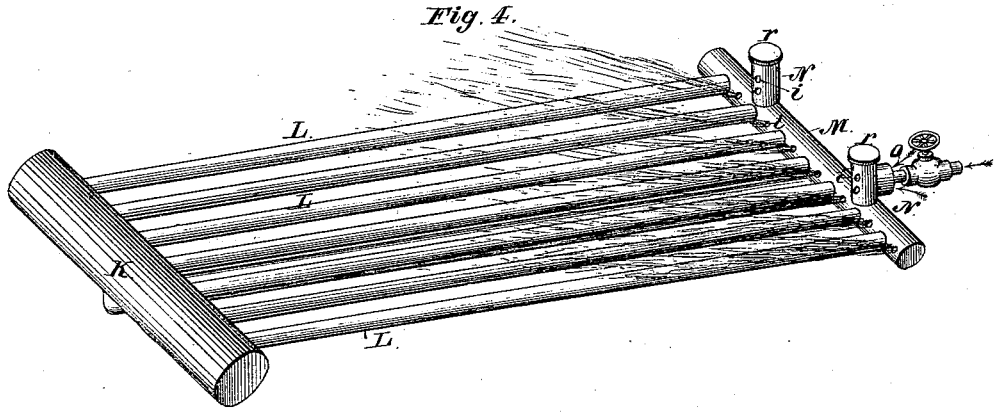
2 Sheets—Sheet 2

H. W. ADAMS.

HOT-BLAST GRATE-BARS.

No. 192,630. Patented July 3, 1877.

Fig. 4.



Attest.

Isaac R. Oakford.

W. H. Tiegler

Inventor.

Henry W. Adams.

UNITED STATES PATENT OFFICE.

HENRY W. ADAMS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF HIS RIGHT TO JOHN QUINCY ADAMS ZIEGLER.

IMPROVEMENT IN HOT-BLAST GRATE-BARS.

Specification forming part of Letters Patent No. **192,630**, dated July 3, 1877; application filed May 1, 1877.

To all whom it may concern:

Be it known that I, HENRY W. ADAMS, of Philadelphia, Pennsylvania, have invented certain Improvements in Hot-Blast Grate-Bars, of which the following is a specification:

The object of my invention is to produce a hot-blast for all sorts of furnaces to consume more perfectly the smoke of the fuel, and to intensify the combustion by means of forcible currents of highly superheated air, either alone or mingled with a small portion of steam injected into and mingled with the partially-oxidized products of combustion immediately over the surface of the burning fuel. I have found by long experience that every particle of cold air admitted into the fire-box of a furnace, though it may help to consume smoke, absorbs heat, and cools the said furnace. In most furnaces which are highly heated the grate-bars frequently melt and soon burn out.

The object of this invention is to keep the temperature of the grate-bars below the fusing-point by causing forcible currents of cold air, or cold air mingled with steam, to pass continuously through their interiors, and to become intensely superheated at the expense of their otherwise excessive heat, and to transfer perpetually their local caloric into the fire-box, over the burning fuel of the same, to add new heat to the fires.

Figure 1 shows my hollow grate-bars, and their hollow connections, in the manner they are manufactured and placed in the fire-box of a furnace.

L represents my hollow grate-bars. K and M show the two hollow drums into which the respective ends of the said grate-bars are screwed. N shows the two upright tubes connected by their respective ends to the two hollow drums M and O. When placed in a fire-box of a furnace the upright tubes N N are situated on each side of the furnace-door, and the drum O is immediately over it, all being inside the fire-box. Into this drum O are inserted several nozzles, Q, which look into the furnace, and are parallel with it. P shows the injection-pipe, which is situated underneath the said grate-bars, one end of which is screwed into the under side of the drum K, and the other end is open to the air, and is situated in the upper part of the ash-pit near its front end. Into the mouth of P is inserted the injection-nozzle S, which is connected either to a steam-boiler, in order to receive a forcible jet of steam, or to any known mechanism for supplying a forcible jet of compressed air. R shows a beveled reduction of the internal diameter of the mouth of the pipe P in front of the nozzle S. This arrangement is fully illustrated by Fig. 3.

A sectional view of my hot-blast grate-bars and their respective connections is shown in Fig. 2. Although I do not confine myself to any restricted diameters or sizes of the various pipes which compose my improved hot-blast grate-bars, as these must necessarily vary with the ever-varying dimensions of different furnaces, yet the following sizes are very suitable for an ordinary furnace having but one fire-door: The tubular bars L may be four feet long, more or less, and one inch and a quarter in internal diameter, and may be placed parallel with each other, so as to leave open spaces between them three-quarters of an inch wide, more or less. The drum K, which is situated close to the front side of the bridge-wall and beneath the burning fuel, may be four inches in internal diameter, more or less. The drums M and O, and the upright tubes N N, may be an inch and a half in internal diameter, more or less. The injection-pipe P may be an inch and a half in internal diameter, more or less. The beveled reduction-tube, in the mouth of the pipe P, as shown in Fig. 3, may be half an inch in internal diameter at its narrowest point, leaving a shoulder beyond to aid in resisting the backward pressure of the compressed air forced by the injector into the said pipe.

The injector-pipe, which is inserted into the mouth of the pipe for about three inches, may be half an inch in internal diameter. Into the end of this pipe is screwed a plug, through which a hole is bored one-fourth of an inch in diameter, more or less. This constitutes the injector-nozzle S looking toward the beveled reduction-tube R, which is situated immediately in front of it.

Fig. 4, Sheet 2, represents a plan, in perspective, of my improved grate ready to be applied to a locomotive-boiler fire-box; the perforated end to be located immediately un-

der the mouth of the tubes, and abutting against the tube-sheet, or to take the place of the old grate-bar.

The nipple or nozzle is arranged in such a manner that when air or air and steam, or any liquid or gaseous fuel, or hydrocarbon, or other gaseous compounds, are to be injected, they will be directed in such a manner and at such an angle as not to be lower than the top of the furnace-door, so that when it is opened the jets will not flow out of the same.

Referring more in detail to this figure, K represents the main or supply drum. Q represents the nozzle for injecting the jet into the furnace, as shown on Sheet 1, the operation of which is the same. L shows the hollow grate-bars; M, the drum, uniting them at one end; and N N, the upright connections.

When used in a locomotive fire-box my hot-blast grate-bars are reversed. The tubes N N are removed from the drum M, and into this drum are inserted nozzles, or holes may be bored into it, as shown by I, so that the forcible jets of gases, or air, or steam, or other vapors under pressure may shoot into and through the hot products of combustion of the furnace in a contrary direction, and thus mix with them better, and retard their escape from the furnace, and supply to them hot oxygen and produce better combustion.

Forcible jets, as aforesaid, may be thrown from either or both of the drums K and M through holes bored into them, so as to throw said jets in any desirable directions to improve the combustion of the fuel in the fire-box.

All the parts of my hot-blast grate-bars may be cast in iron. They may be cast in one piece or in several, and fastened together. The injecting-pipe P may be connected directly to a steam-boiler, and convey only steam to the drum K, or to a reservoir of air, under pressure, for the same purpose.

The operation of my improved hot-blast grate-bars is as follows: By opening a cock in the pipe, which connects the nozzle S with a steam-boiler, or a reservoir of compressed air, a forcible jet escapes from the nozzle S into the beveled reduction-tube R, and expands in the same, and impinging under pressure against the sides of the narrowest part of R creates a vacuum in the mouth of the pipe P, and causes an abundance of air to rush with the forcible jet into the pipe P beyond the shoulder of the beveled tube R, and pass under pressure into the drum K, and fill the said drum, and become intensely heated in the same, and then to pass under pressure through the several tubular bars L, in which it is still further superheated, and from which it passes into the drum M, and from thence into the upright tubes N N and into the cross-drum O, which is situated directly over the inside of the fire-door, from whence it escapes in forcible and superheated jets from the nozzles Q, which may be four or more in number, and three-eighths of an inch in diameter, more or less, into the furnace over the surface of the burning fuel to mingle with its products of partial combustion, saturate them with oxygen, consume the smoke, and eliminate the purest and highest degree of heat. In furnaces which are operated by a powerful blast in the smoke-stack, like those of locomotives, in which the hot products of combustion are drawn with violence into the mouths of the tubes which pass through the boiler into the smoke-box, and which hot products of combustion require no forcible jets to hurry them more speedily out of the fire-box, but which abscond too quickly to be consumed, and to leave their heat behind, it is better to reverse the ends of my said hot-blast apparatus, and allow the jets to escape from the drum, which will be situated, in this instance, next to the water-box, immediately below the mouths of the boiler-tubes, as clearly shown by Sheet 2 in Fig. 4, at an upward angle of about forty-five degrees, so as not to blow out of the door when opened, but to drive forcibly into the said hot products of combustion in a contrary direction, and hold them back, and mix with them more perfectly, and consume them, and generate a much higher heat in the fire-box; but this reversed arrangement, in such cases, does not in any manner alter the principle of my invention.

Having thus described the construction and operation of my hot-blast grate-bars, what I claim, and desire to secure by Letters Patent, is—

1. The nozzle S, the injection-tube P, the drum K, the hollow bars L, the drum M, the tubes N N, the drum O, and the nozzles Q, when constructed and operated substantially in the manner and for the purposes hereinbefore shown and described.

2. The combination, with the injection-pipe and nozzle Q, of the mixing-drum K, the hollow bars L, and the perforated drum M, substantially as and in the manner set forth and described.

3. The combination of the drum K, hollow bars L, and perforated drum M, cast in one piece, in the manner and for the purpose described.

HENRY W. ADAMS.

Witnesses:
ISAAC R. OAKFORD,
J. Q. A. ZIEGLER.