(No Model.) 2 Sheets—Sheet 1.

J. JAMES.

HEATING, PUDDLING, OR BOILER FURNACE.

No. 454,359. Patented June 16, 1891.

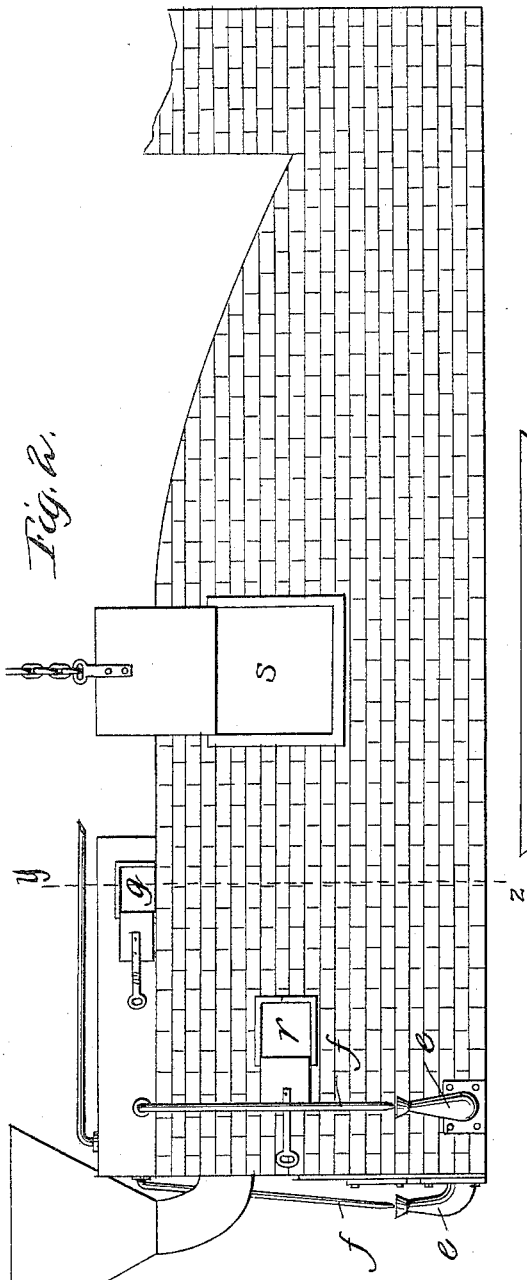

Fig. 2.

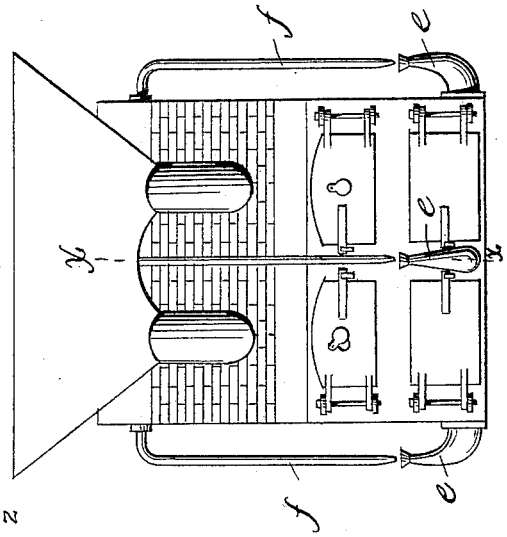

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

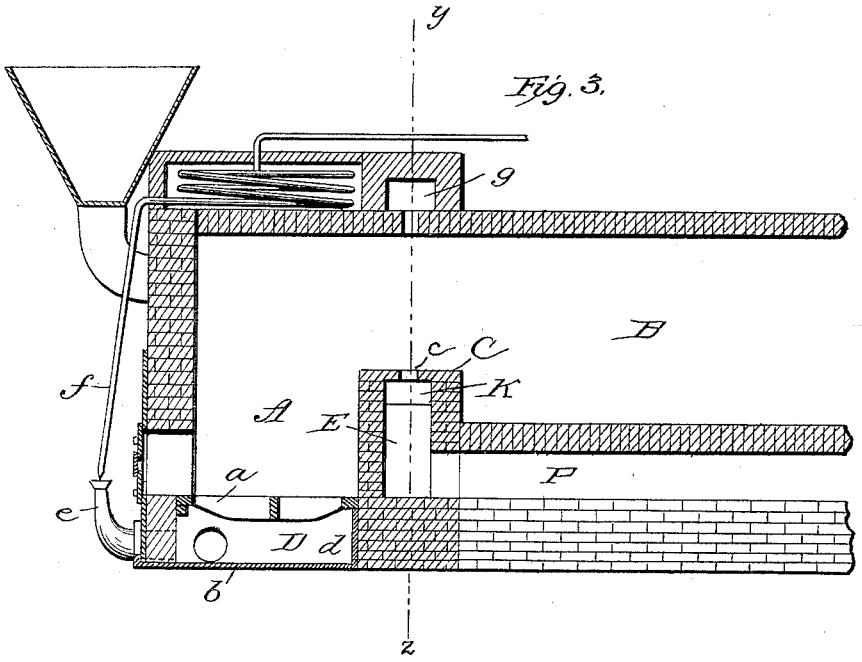
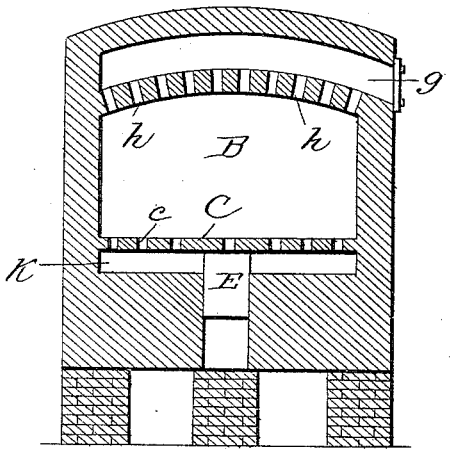


Fig. 4



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UNITED STATES PATENT OFFICE.

JACOB JAMES, OF NEW CASTLE, LAWRENCE COUNTY, PENNSYLVANIA.

HEATING, PUDDLING, OR BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 454,359, dated June 16, 1891.

Application filed November 19, 1890. Serial No. 371,978. (No model.)

To all whom it may concern:

Be it known that I, JACOB JAMES, a citizen of the United States, residing at New Castle, in the county of Lawrence and State of Pennsylvania, have invented certain new and useful Improvements in Heating, Puddling, or Boiler Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in heating, puddling, or boiler furnaces; and its object is to so construct such furnaces that the flame, heat, and waste products of combustion will be utilized to their maximum extent, thus producing a greater intensity and uniformity of heat from a given quantity of fuel than is possible in furnaces of ordinary construction.

My improvements consist of devices combined with a furnace for supplying steam mixed with air in connection under the grate with a supply of hot air through the bridge of the furnace and a regulating supply of cold air over the bridge under the arrangement hereinafter shown, described, and claimed.

My improvements can be readily adapted to furnaces of the ordinary construction, and the means by which I attain the objects of my invention are fully set forth in the accompanying drawings, in which—

Figure 1 is an end elevation of a furnace. Fig. 2 is a side elevation. Fig. 3 is a vertical longitudinal section on line *x x*. Fig. 4 is a vertical transverse section on line *y z*.

The interior of the furnace, which may be of ordinary construction or built especially for the use of my improvements, is provided with a fire or fuel chamber A and the heating or melting chamber B, between which I place the bridge C. The said bridge is constructed of fire-bricks or other suitable materials, is hollow or formed with a transverse flue K, and is provided with a number of openings or apertures *d*, leading from the interior space through the upper or top side.

P represents a flue, having one open end and the other connected with the interior of said bridge, through which a current of cold air is admitted to said bridge, where it is heated and passes up through the openings or apertures *c*. Under the fuel-chamber A and beneath the grate-bars *a*, I provide an air-chamber D. The said air-chamber consists of the tight box *b*, constructed of cast-iron, steel, or other suitable material, the main object being to make it as nearly air-tight as practicable.

Leading to and connected with the air-chamber D, I provide air-pipes *c*, the number of which is determined by the size and capacity of the air-chamber in which they are used, one in the front and one on each side of the said chamber being found in practice to meet the requirements usually. The air-pipes are formed, preferably, of the shape indicated by the drawings, having a bell-shaped mouth or nozzle in which is an opening or aperture of about one inch in diameter, and which is gradually increased in size to four and one-half inches at the point of connection with the air-chamber D. This increase in the size of the openings of the air-pipes *e* is to provide for the expansion of the air and steam admitted to said pipes. Leading to the air-pipes *e*, I provide the pipes *f*, which are connected with a steam-boiler or other suitable steam-supply. These pipes are about one inch in diameter, and are formed, preferably, with a tapering end, in which is a small opening or aperture, usually about one-tenth of an inch in diameter, through which a jet of steam is forced into the nozzle of the pipes *e*. The pipe-nozzles are set in the mouth of the air-pipes, so as to leave an annular space about the end, and so that the steam draws or forces the air along with itself. Immediately above and over the bridge C, I provide a cold-air flue *g*, having one end closed and the other end provided with a valve or damper, by means of which it can be kept partially or wholly open to the atmosphere or outside air. Within the flue *g* a number of openings or apertures are made through the furnace-top, through which the air admitted to the flue *g* is carried into the furnace at the flame-point immediately over the bridge C.

Connected with the hot-air flue E is the cross-flue K, through which the air from the flue E is carried or distributed to all parts of the bridge E. The flues E are provided with suitable slide-valves or cut-offs of any ordinary

construction, by means of which the quantity or volume of air admitted can be controlled.

In operating a furnace provided with my improvements, the fire having been started in the fuel-chamber A, the doors of the fuel-chamber A and the air-chamber D are tightly closed, and a jet of steam is turned into the nozzles of the air-pipes *e* by means of a valve in the steam-pipes *f*. The force of the steam from the pipes *f* entering the nozzles of the air-pipes *e* creates a draft and causes a current of cold air to enter said pipes, which is at once intermixed with the steam carried to the air-chamber D, passes up through the burning fuel to the fuel-chamber A, and comes in contact with the cold air admitted to the furnace through the flue *g*, and the hot air from the bridge C, which contact under the uniform pressure of the steam, results in a perfect combustion and produces the greatest possible uniformity and intensity of the heat produced.

The advantages gained by the apparatus described are a great saving in the amount of fuel consumed, a greater intensity and uniformity in the heat produced, and a great saving in the wear and tear of the furnace structure, especially of the grate-bars, as well as a great diminution in the smoke and dirt produced in operating the furnace. After firing the furnace in the first instance the doors of the fuel-chamber A and the air-chamber D are tightly closed, and are opened only for the purpose of removing the ashes and clinkers from the grate-bars, the fuel being thrown into the furnace in the usual manner through the "stoking-hole" *r;* or the furnace may be provided with a fuel-hopper arranged to work automatically or by means of a lever under the control of the furnace-man.

In the drawings, *s* is the opening to the heating-chamber of the furnace, through which the iron is put into and taken from the furnace.

Having thus described my invention, what I claim is—

In combination with a furnace having a fuel-chamber A and a heating or melting chamber B with an intermediate bridge, a steam-coil arranged to receive its heat from the furnace and provided with a pipe *f*, arranged to discharge steam into the open end of the pipe *e*, a closed box under the fire-grate, with which the pipe *e* communicates, a hollow space or flue in the bridge, and an air-passage leading thereto under the heating-chamber, with openings in the top of the bridge from the hollow interior thereof, and an air-passage *g* over the bridge, having openings into the interior of the furnace and provided with a regulating-valve for admitting a regulated amount of cold air, as described.

In testimony whereof I affix my signature in presence of two witnesses.

JACOB JAMES.

Witnesses:
A. W. WILLIAMS,
P. A. HIGGS.