(No Model.)

M. V. SMITH.

Puddling and Heating Furnace.

No. 230,583. **Patented July 27, 1880.**

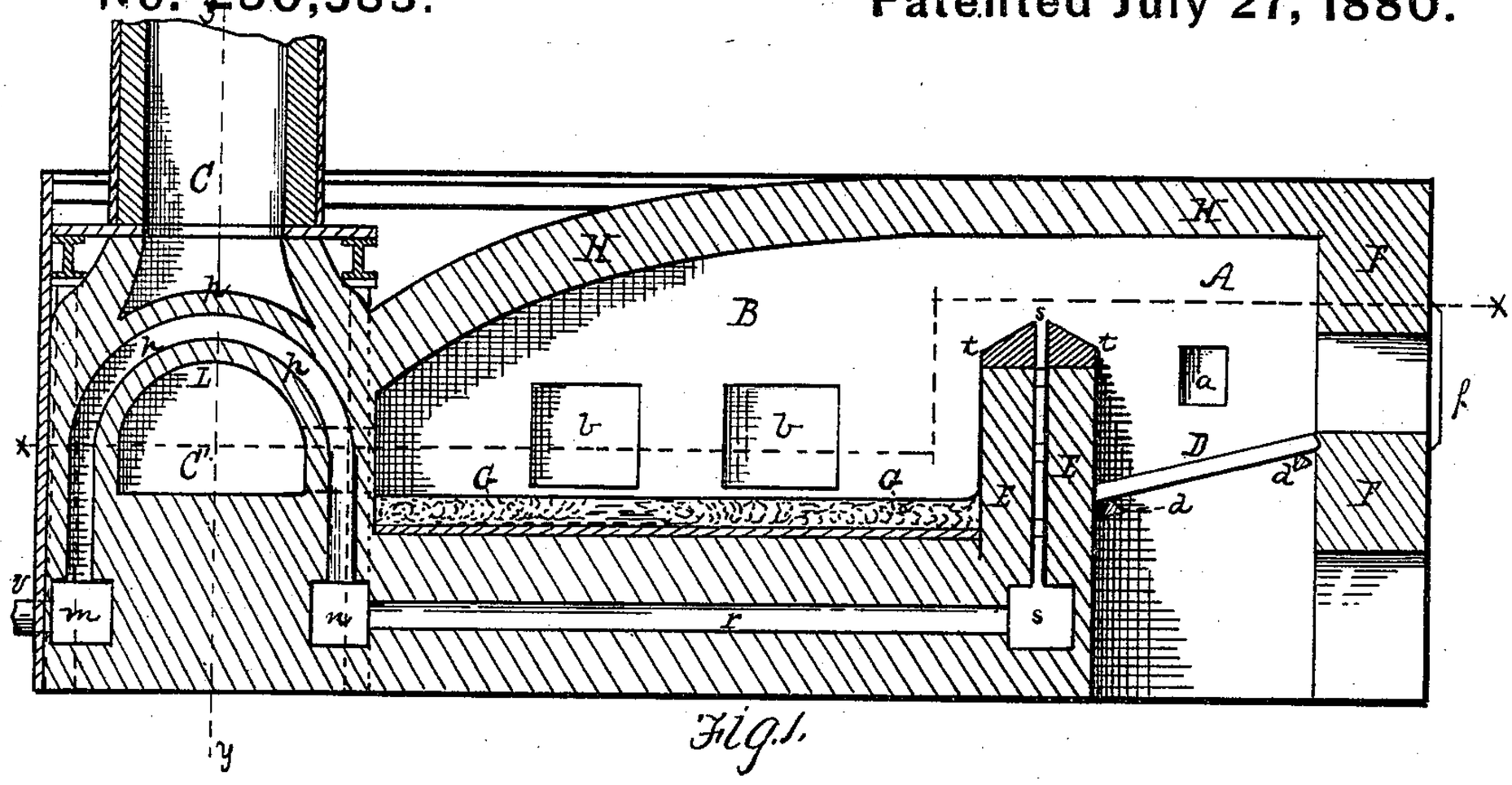

Fig. 1.

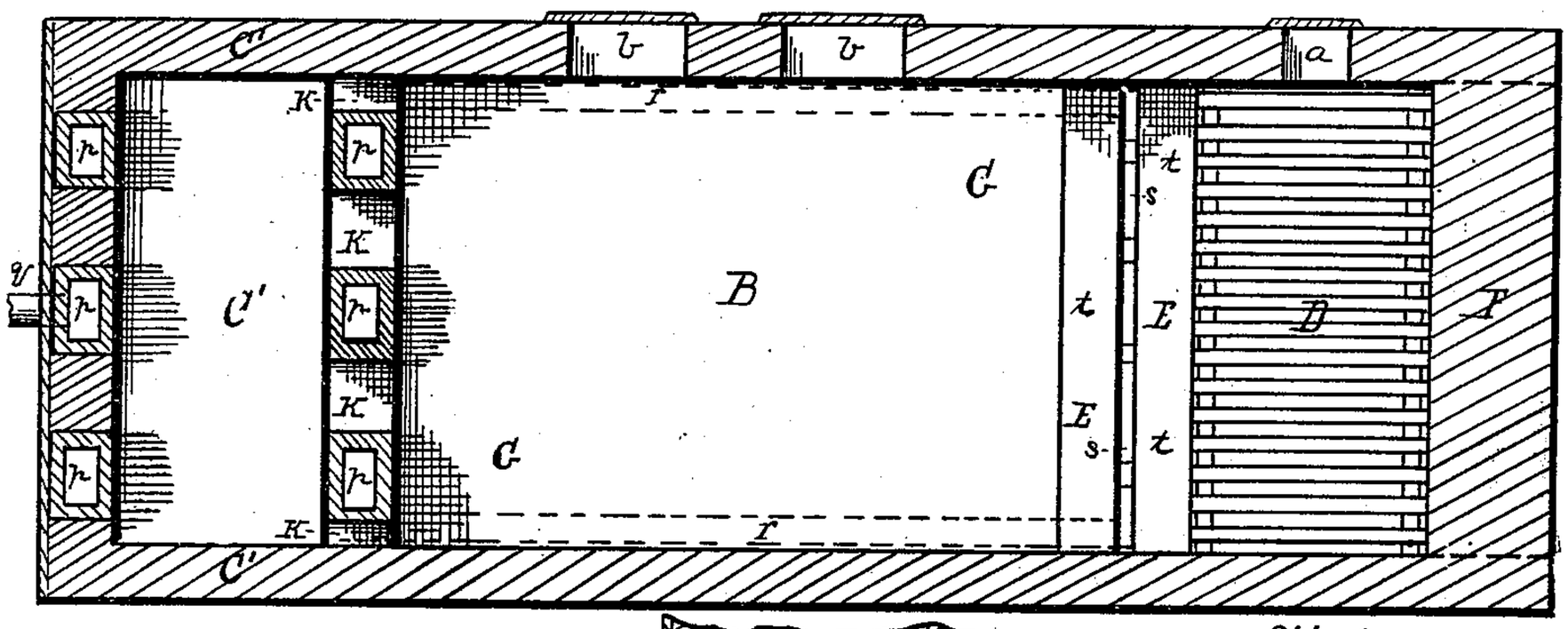

Fig. 2.

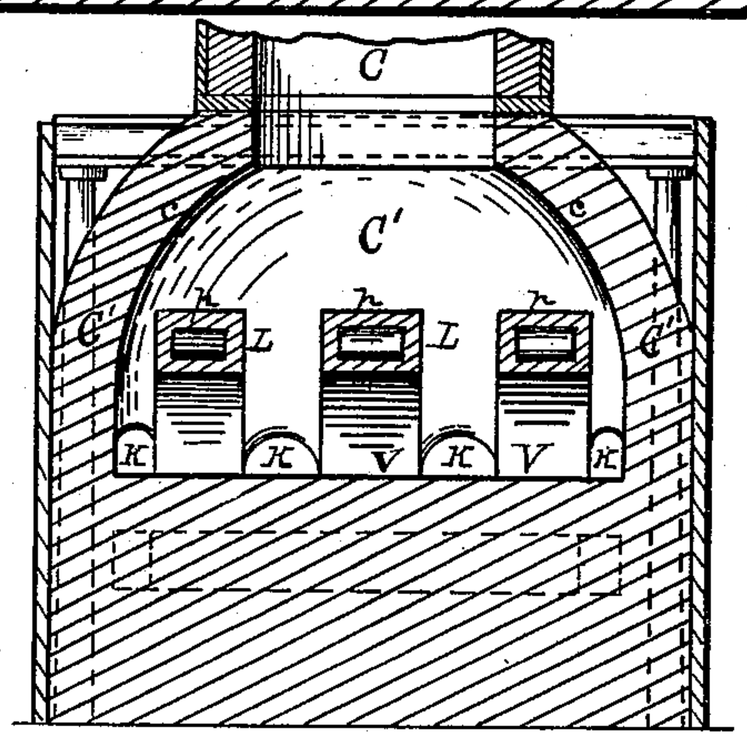

Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

MARTIN V. SMITH, OF McKEESPORT, PENNSYLVANIA.

PUDDLING AND HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 230,583, dated July 27, 1880.

Application filed April 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, MARTIN V. SMITH, of McKeesport, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Puddling and Heating Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a longitudinal vertical section of my improved furnace. Fig. 2 is a horizontal section on the line *x x*, Fig. 1; and Fig. 3 is a cross-section through the stack, looking toward the furnace-chamber.

Like letters of reference indicate like parts in each.

My invention relates to reverberatory furnaces for puddling and heating iron, steel, and other metals in their manufacture for merchantable purposes.

Its principal object is to obtain a more perfect combustion of the gases used as fuel or generated from the coal in the heating-chamber above the bed supporting the metal, which will create so high and even heat in the chamber that a much larger heating-chamber can be used, and the capacity of the furnace thus greatly increased.

Heretofore different constructions of furnaces have been used for this purpose, among others furnaces in which the air to aid in the combustion of the gases is heated in a stove or series of pipes located at the base of the stack, and is discharged at or near the throat or mouth of the heating-chamber.

My invention consists, first, in providing the furnace with an air-blast heating-stove, located at the base of the stack, formed of a series of arched and transverse flues, and suitable flues for conducting and discharging the air-blast through a discharge-flue in the bridge-wall; second, in forming a series of piers between the heating-chamber and stack, dividing the opening between them into a series of ports; third, in forming these piers hollow for the passage of air; and, finally, in details of construction hereinafter set forth.

To enable others skilled in the art to make and use my invention, I will describe its construction and operation.

The furnace shown is a reheating reverberatory furnace provided with the fire-chamber A, heating-chamber B, and stack C. The fire-chamber A has the usual stoking-hole *a* and a series of grate-bars, D, supported on transverse bars *d*. The grate D is formed inclining toward the bridge-wall E, so that a large mass of incandescent fuel is held near the bridge-wall. The furnace is provided with one or more doors, *f*, in the rear wall, F, through which the grate-bars are drawn.

The bed G of the heating-chamber B extends from the bridge-wall E to the base of the stack, and is formed of suitable bed-plates supporting the bottom or bed of sand or "fix."

The roof H is formed horizontal over the fire-chamber A, but is curved gradually downward over the heating-chamber to the base of the stack, forming the dome in the heating-chamber, by which the heat is deflected or reverberated down upon the metal.

The heating-chamber B is formed longer than usual in reverberatory furnaces, occupying the space of the heating-chamber and furnace-neck, and extending, as before stated, to the base of the stack.

I have found that a working-bed nine feet in length and seven in width, giving sixty-three feet of working-surface, can be easily heated for either puddling or reheating purposes in my improved furnace. It is of the same width throughout, and communicates with the base of the stack through a series of ports, K, separated by suitable piers V, the ports at the sides being formed against the side wall of the furnace.

The heating-chamber is provided with two working-doors, *b*, to enable the workman to reach any part of the enlarged working-bed.

The stack C is supported on pillars in the usual way, and extends up to any desired height. The base of the stack C′ is formed the same width as the heating-chamber, so that the ports K pass directly into this enlarged base, which is drawn in above to the internal width of the stack. At the base of the stack is formed the heating-stove L, for heating the air-blast, the said heating stove being located in the enlarged base C′. This heating-stove is preferably formed of two transverse flues, *m n*, extending across the furnace, connected

by a series of hollow arches or arched flues, *p*, which extend up into the chimney. The flue *m* is arranged at the base of the outer wall of the stack, and the blast-pipe *q* passes through said wall into the flue. The flue *n* is located under the wall between the heating-chamber and stack.

I find a series of three hollow arches or arched flues, *p*, extending up from the transverse flues into the stack gives the best results, as the air can pass from the blast-pipe into the transverse flue *m*, and circulating therein pass through the arched flues *p* into the transverse flue *n*. At either end of the transverse flue *n* are the longitudinal flues *r*, which extend under the bed-plate to the base of the bridge-wall E, where they connect with the transverse flue *s* in the bridge-wall. The base of this flue is made large, so that the air can circulate through it, and it is then drawn into a width of about two inches, and extends up through the bridge-wall to the top thereof, the flue preferably opening out along the entire top of the wall. The wall is keyed together with brick extending across the flue at different points, and the top is made sloping on either side from the mouth of the flue *s* to shed any slag or particles of coal, and prevent their falling into the flue, as well as to form the top of the bridge nozzle-shaped, so that the gases passing over the sloping bridge come in contact with the blast close to the exit of the flue, and a more perfect commingling of the air and gases is obtained.

Instead of the long flue *s*, a series of ports leading from a transverse flue at the base of the stack may be employed.

The top of the bridge-wall is capped with incombustible or refractory bricks *t*, such as those formed of asbestus, which will stand the intense heat at the point of contact between the blast and flame.

Doors are formed in the furnace sides for cleaning the transverse flues *m n s*.

The walls of the front of the heating-chamber are built down around the arched flues *p*, the bases of which form the piers V, separating the ports K between the chamber and stack. As all the waste products must pass through these ports, they pass around the base of the arched flues *p*, and in ascending the stack circulate around the arches of the flues and raise the blast passing through them to an exceedingly high heat. The convergent walls *c* of the enlarged stack-base C′ also deflect the heat back upon the arched flues, adding to the heat of the chamber.

The air-blast passing through the arched flues *p* prevents their burning out, so that the heating-stove in the furnace will wear a long time. As the blast passes down through the piers between the ports K it cools them, and prevents their burning out under the intense heat passing between them from the heating-chamber.

The operation of my improved furnace is as follows: When coal is used as fuel it is fed to the fire-chamber A through the stoking-hole *a*, and a sufficient amount of air to support the flame is admitted to the chamber, either through a blast-pipe or an open ash-pit. The carbonic-oxide gas generated from the burning coal passes over the sloping bridge-wall into the heating-chamber. In the meantime the air-blast has been forced from the blast-pipe *q* into the heating-stove L, and thereby raised to a high heat, and then conducted through the flues *r* to the discharge-flue *s*. The heated air is discharged through the flue *s* in the bridge-wall in an upward direction, so as to impinge from underneath against the flame or gases passing over the wall at right angles, and, penetrating them, causes a thorough commingling of the air and gases, and therefore a complete combustion of the fuel and the generation of an exceedingly high heat in the heating-chamber, sufficient for metallurgic purposes all over the enlarged chamber.

The force of the blast carries the mixed air and gas up against the furnace-roof, so that the combustion takes place in the upper part of the heating-chamber, above the metal supported on the bed. The heat generated by this combustion is then deflected or reverberated down upon the metal, causing the rapid heating and melting thereof. As the gas and heated air are not mixed until they enter the heating-chamber, all the heat generated thereby is utilized in the chamber, and practical tests have proven that for this reason the enlarged chamber can be fully heated, and the capacity of the furnace increased fully one-third over the ordinary furnace.

In reheating, as the combustion takes place in the upper part of the furnace, and the heat only is deflected upon the iron, the loss from oxidation is greatly reduced, being only about one-third of the usual furnace, where the flame is thrown down directly on the metal. By regulating the blast either a neutral, reducing, or oxidizing flame can be obtained.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a puddling or heating furnace, the combination of the heating-stove L, located at the base of the stack, formed of the transverse flues *m n* and arched flues *p*, with the longitudinal flues *r* and discharge-flue *s*, located in the bridge-wall, substantially as and for the purposes described.

2. In a puddling or heating furnace, the combination of the bridge-wall E, provided with the upwardly-opening discharge-flue *s*, with the asbestus capping-bricks *t*, substantially as and for the purposes set forth.

3. In a puddling or heating furnace, the bridge-wall E, provided with the sloping or nozzle-shaped top, and the discharge-flue *s*, opening in an upward direction through said nozzle-shaped top, substantially as and for the purposes set forth.

4. In a puddling or heating furnace, the combination, with the heating-chamber B and stack C, of the series of piers V, forming the series

of ports K between the heating-chamber and stack, substantially as and for the purposes set forth.

5. In a puddling or heating furnace, the combination, with the heating-chamber B and stack C, of the series of piers V, formed hollow and separating the ports K between the chamber and stack, substantially as and for the purposes set forth.

6. In a puddling or heating furnace, the heating-stove L, formed of the transverse flues *m n* and arched flues *p*, located at the base of the stack in the line of the waste products from the heating-chamber, substantially as and for the purposes set forth.

In testimony whereof I, the said MARTIN V. SMITH, have hereunto set my hand.

MARTIN V. SMITH.

Witnesses:
J. E. WOOD,
JAMES I. KAY.