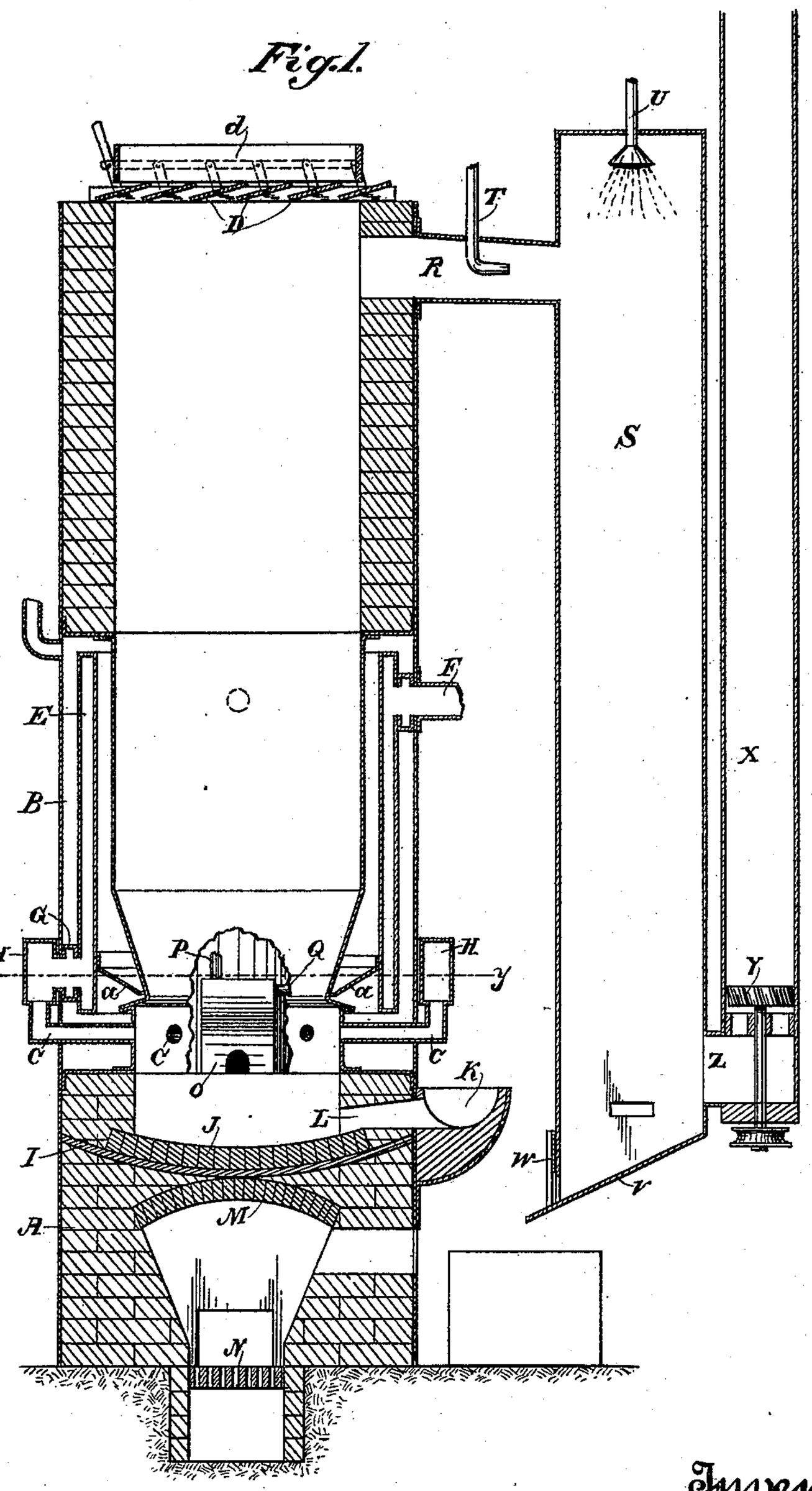
(No Model.) 2 Sheets—Sheet 1.

E. G. SMITH & B. B. BREWER.

SMELTING FURNACE.

No. 496,235. Patented Apr. 25, 1893.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

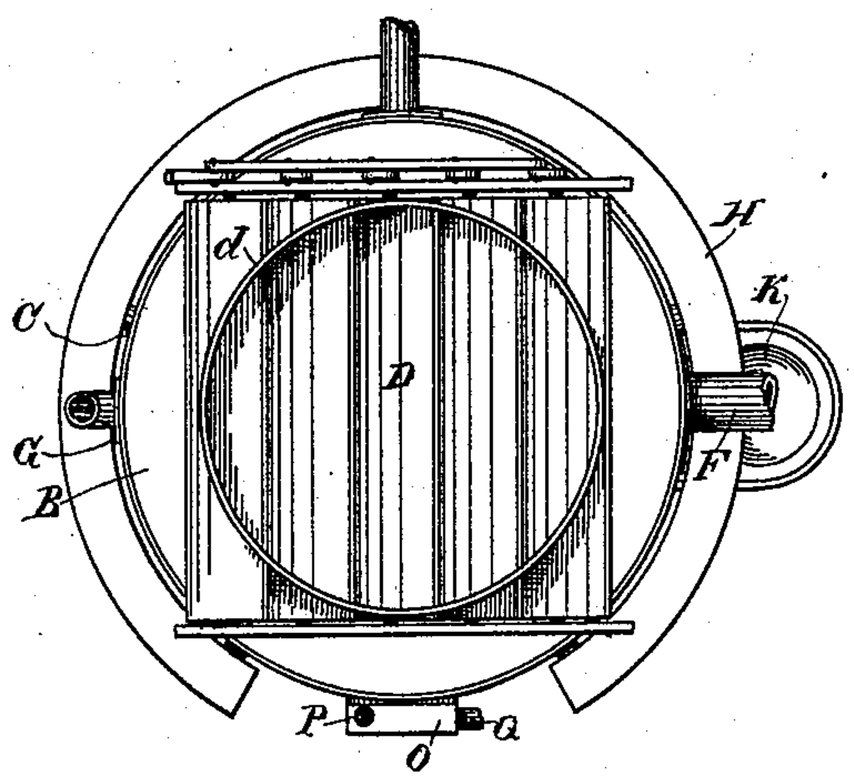
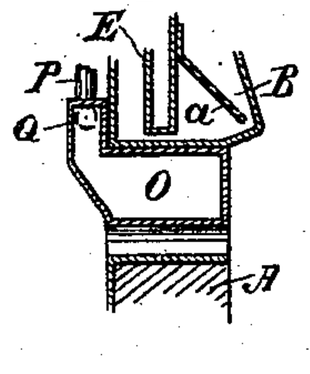


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

EDWIN G. SMITH AND BENJAMIN B. BREWER, OF SAN FRANCISCO, CALIFORNIA.

SMELTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 496,235, dated April 25, 1893.

Application filed December 16, 1892. Serial No. 455,370. (No model.)

To all whom it may concern:

Be it known that we, EDWIN G. SMITH and BENJAMIN B. BREWER, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Smelting-Furnaces; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to that class of furnaces used for smelting and reduction of ores and metals, and it consists in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section taken through the furnace and connections. Fig. 2 is a plan view of the furnace only. Fig. 3 is a horizontal section taken through the line *y*—*y* of Fig. 1. Fig. 4 is a vertical longitudinal cross section through the breast.

The object of our invention is to provide certain improvements in this class of furnaces whereby the air which is used as a blast is heated in a peculiar manner before being discharged into the furnace through the tuyeres; an improvement is made in the bottom of the furnace whereby there is less loss of heat, and the furnace can be easily and quickly cleaned and overhauled without pulling it down, and the gases and products of combustion are condensed and saved after leaving the furnace.

A is the base of the furnace which may be built of brick or other suitable material, and surrounded by a hoop of iron or steel. Upon this rests the water-jacket B made of metal having the lower portion of the boshes contracted so as to overhang the lower vertical portion of the bottom of the water-jacket through which the tuyeres C open into the furnace. This overhang prevents the material which is passing down through the furnace from crowding into and clogging the tuyeres, and leaves an air space around beneath the overhang so that the air circulates freely as it enters from the tuyeres, and is thus more effectively delivered into the mass of ore.

The upper part of the furnace is built in the usual manner above the water-jacket, and is provided with a suitable or desirable means for delivering the charges of ore and fuel into it from time to time.

In the present case we have shown a cover formed of hinged shutters D having suitable connecting rods and handle by which they may be opened and closed simultaneously, and a hoop *d* corresponding with the shape of the interior of the furnace is adjusted with relation to these shutters so that charges of ore and fuel which are delivered within this hoop rest upon the shutters while the latter are closed. When the shutters are opened, the charge drops into the furnace, after which the shutters may be again closed so that there will be no escape of products of combustion in this direction.

The water-jacket B contains within it the annular shell E which extends from near the top to near the bottom of the water-jacket. This shell is connected with the source of air supply by means of the pipe F, and air is delivered into the upper part of the shell through this pipe and passes down thence to the discharge pipe or passage G through which it passes into the surrounding wind-box H. From this box the tuyeres C open into the furnace as previously described.

Instead of a box, such as shown, we may employ a coil or other arrangement of air pipes within the water-jacket, through which the air is passed, the result being the same. By this construction the air which often reaches the furnace at a very low temperature, especially in high and cold localities, is heated to a temperature about equal to that of the water in the jacket, and is thus delivered into the furnace so that it does not unduly reduce the temperature of the ore and metal. At the same time the air entering this chamber retards the heating of the water in the surrounding jacket, and thus prevents a too high temperature of the latter, and a too rapid circulation of water through the jacket which is desirable when the supply of water for this purpose is limited.

a a is a plate or flange attached to the lower end of the wind-box, and extending into the recess which forms the overhang above the tuyeres, and is called a circulating plate. The

water flowing around this plate washes the surface, and prevents any sedimentary deposit from forming upon the inner surface of the water-jacket, and thereby prevents a possibility of melting the said projections over the tuyeres. The bottom of the crucible, into which the metal falls, is made of any suitable metal and concaved as shown at I, and this has a lining of fire-brick J upon which the molten metal is received.

K is the receiver exterior to the furnace, into which the metal overflows from the crucible, from the passage L, and from which it may be dipped out from time to time as desired.

Beneath the concaved bottom I is an arch M, and beneath this is the fire-place and the grate N upon which a fire may be built, and thus the temperature of the bottom of the crucible may be kept at any desired degree. This is important because the weather is often intensely cold where such furnaces are erected and it is difficult to keep the metal within the crucible at the proper temperature until it can be withdrawn.

Upon the side of the crucible is what is termed the breast O. This is a hollow metal chamber which fits into a corresponding opening in the side of the crucible, so that it may be easily slipped in or out, and when removed it allows easy access to the interior and lower part of the furnace and crucible. When it is in place it is suitably luted to make a tight joint. The interior of this piece is hollow and it has a feed pipe P through which water is admitted, and an overflow pipe Q through which the water is allowed to pass out, thus keeping a circulation within the piece which keeps it cool enough to prevent its being melted by the heat.

R is a passage opening out from the side of the furnace, near the top, and S is a vertical chamber into which this passage opens.

T is a pipe through which a jet of steam is delivered into the passage R to make a sufficient draft to cause the products of combustion to flow readily into the chamber S. The steam also saturates the said products with moisture and is condensed when it comes in contact with the cold spray in the chamber.

U is a spray nozzle, through which water passes into the upper part of the chamber S, and serves to condense and precipitate any particles which come over from the furnace, and this precipitate and water fall upon an inclined bottom V of the chamber, and are drawn off from time to time through a slide door shown at W.

X is the chimney, and Y is a propeller or fan-wheel rotating in the lower part of the chimney, acting as a draft-wheel which draws all gases and vapors remaining uncondensed in the chamber S through the opening Z into the lower part of the chimney whence it is discharged by the draft caused by the wheel Y.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a water-jacketed smelting furnace, an air conveying device submerged within the water-jacket for the purpose of heating the air before entering the furnace, and pipes by which the air is conveyed from the chamber to the tuyeres, and thence to the furnace, substantially as herein described.

2. A furnace having a water-jacket surrounding the lower part, said jacket having the upper and lower portions made cylindrical and the intermediate portion forming the boshes made conical and contracted from its junction with the upper cylindrical portion so as to have a smaller diameter at the bottom than the lower cylindrical portion whereby an overhang is formed, substantially as herein described.

3. A furnace having the hollow water-jacket made with cylindrical upper and lower sections and the intermediate conical portion of smaller diameter at its lower end, and forming an off-set or shoulder above the lower cylindrical portion, an annular chamber fixed within the water-jacket, pipes whereby the air is admitted to said annular chamber at the top and delivered therefrom into the wind-box and tuyeres at the lower end, an inclined diaphragm fixed in the water space between the wind-box and the interior lower angle of the conical portion of the water-jacket and pipes by which water is admitted to the water-jacket and discharged therefrom whereby a circulation of water takes place around the interior air chamber and the inclined diaphragm, substantially as herein described.

4. A furnace having a hollow metallic water-jacket with air heating chamber submerged within it, wind-box and tuyeres, a crucible into which the molten metal is received, and a removable hollow box fitting into an opening made through one side of the lower part of the water-jacket, said box having water supply and discharge pipes whereby an independent circulation is maintained within it, substantially as herein described.

5. A furnace having a water-jacket, air supply and heating chambers submerged within it and tuyeres, a crucible situated below the furnace having the concave arched metallic bottom and the correspondingly shaped fire-proof lining J, and an arch and fire-grate situated below said bottom whereby heat may be applied thereto independently of the furnace, substantially as herein described.

6. A furnace having the water-jacket, the air heating chamber submerged within the water-jacket for the purpose of heating the air prior to entering the furnace, and the tuyeres and crucible as shown, in combination with the vertical condensing chamber, the water spray pipe introduced into the upper part of the chamber, a discharge pipe con-

necting the upper part of the furnace with said chamber a steam jet pipe entering a passage opening out from the side of the furnace near the top whereby the draft is produced from the furnace to the chamber an inclined bottom at the lower end of the condensing chamber with overflow and a discharge door, the chimney, the lower part of which connects with the lower part of the condensing chamber and a rotary draft wheel or propeller fitted within the chimney, substantially as herein described.

In witness whereof we have hereunto set our hands.

EDWIN G. SMITH.
BENJAMIN B. BREWER.

Witnesses:
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J. A. BAYLESS.