Jan. 31, 1933. E. H. BUNCE ET AL 1,895,878

METALLURGICAL FURNACE

Filed Nov. 15, 1927

Fig. 1,

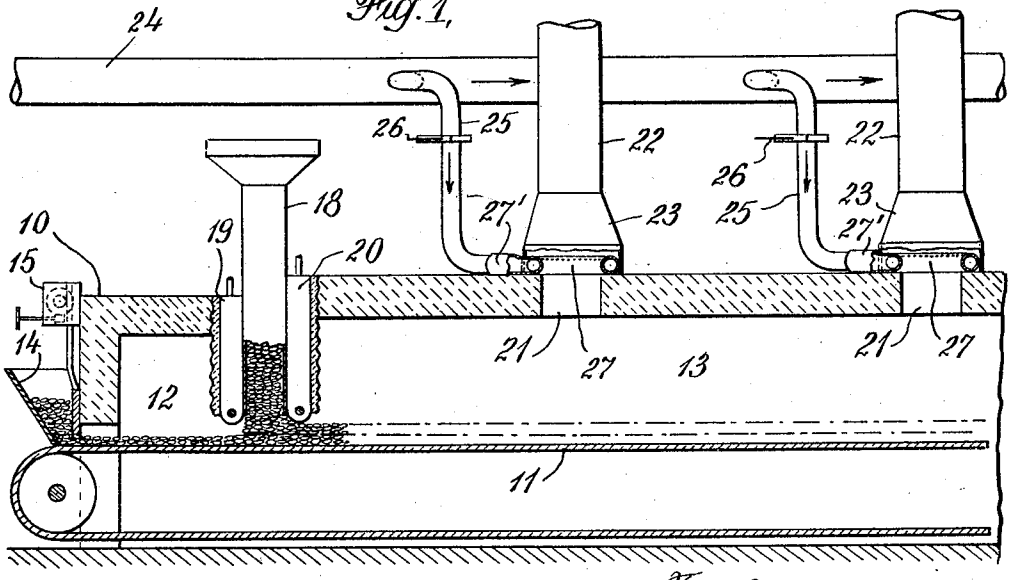


Fig. 2,

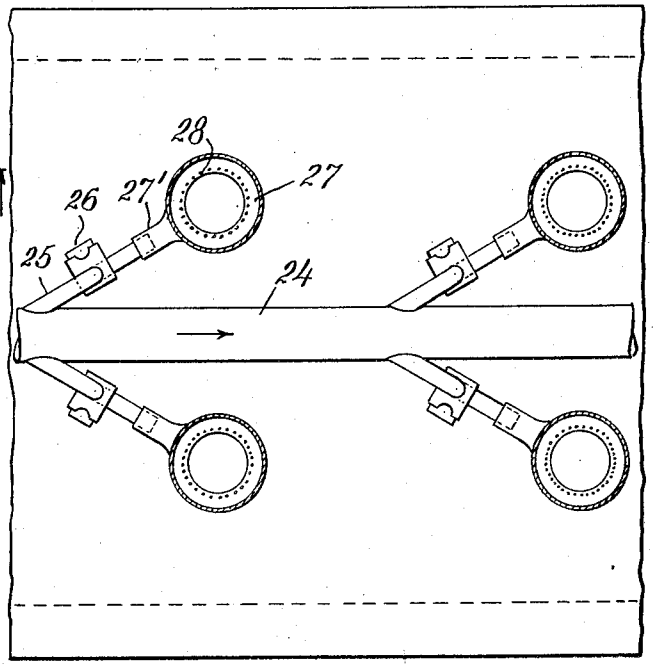


Fig. 3,

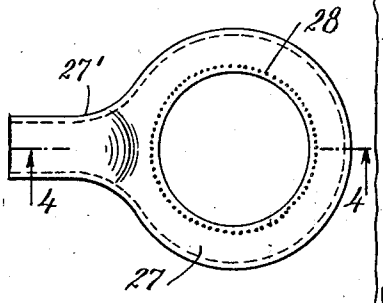
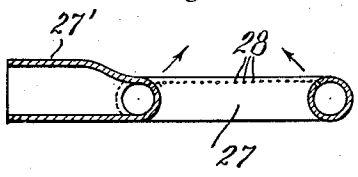


Fig. 4,



INVENTOR
Earl H. Bunce
Harry M. Haslam
BY
Prunie, Davis, Marvin & Edmonds
ATTORNEYS

Patented Jan. 31, 1933 1,895,878

UNITED STATES PATENT OFFICE

EARL H. BUNCE AND HARRY M. HASLAM, OF PALMERTON, PENNSYLVANIA, ASSIGNORS TO THE NEW JERSEY ZINC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY

METALLURGICAL FURNACE

Application filed November 15, 1927. Serial No. 233,352.

This invention relates to metallurgical furnaces and has for its object the provision, in a metallurgical furnace, of an improved device for blasting or blowing metallic vapor issuing from the furnace.

United States Patent No. 1,594,000 describes an improved metallurgical furnace provided with a blasting device for intensifying the oxidation of metallic vapor issuing from the furnace. The blasting device described in this patent comprises a blow box from which relatively cool oxidizing gas, such as air, under pressure, escapes through an annular slot in the form of a circumferential blast that completely involves the stream of metal vapor issuing from the furnace. This type of blasting device, while entirely satisfactory with streams of metallic vapor such as derived from the volatilization of metal, does not operate with complete satisfaction upon vapor streams of relatively large sectional area such as derived from the smelting of ore. The stream of vapor derived from the volatilization of metal is highly concentrated and hence is usually of relatively small sectional area. On the other hand, when the metallic vapor is derived from the smelting of ore, it is diluted, usually with carbon monoxide gas, and furthermore the furnacing conditions usually preclude the building up within the furnace of any substantial gas pressure. Hence, the gas outlets must be relatively large in sectional area, as compared with the gas outlets in a metal volatilizing furnace. The circumferential sheet of blasting gas, such as produced by the device specifically described in the aforementioned patent, when directed against a vapor stream of relatively large sectional area tends to develop into a swirling, rising shell of oxidizing gas which envelops, but does not always promptly and completely penetrate, the stream of vapors issuing from the furnace.

The present invention aims to provide an improved blasting device particularly adapted for use with a metallurgical furnace in which the metallic vapor is derived from the smelting of ore. The invention is particularly applicable to zinc oxide furnaces of the Wetherill grate type, whether of the stationary or traveling grate forms. While the invention may be applied with advantage wherever it is desired to blast or blow a stream of metallic vapor, it is peculiarly applicable for the production of zinc oxide in furnaces of the Wetherill type.

The improved blasting device of the invention, in its preferred form, comprises a tubular gas compartment, conveniently of circular section, adapted to rest upon the top or roof of the furnace and to surround the stream of vapors issuing from the gas outlet in the furnace roof. The inside wall of the tubular gas compartment is provided with a multiplicity of perforations or small openings adapted to direct, at an appropriate angle, a substantially continuous but individually separated series of gas jets against the stream of vapors issuing from the furnace.

The novel features of the improved blasting device of the invention will be best understood from the following description, taken in conjunction with the accompanying drawing, in which

Fig. 1 is a side elevation, partly in section, of a metallurgical furnace of the Wetherill grate type embodying the improvements of the invention.

Fig. 2 is a top plan, partly in section, of the furnace of Fig. 1.

Fig. 3 is an enlarged plan of the blasting elements shown in Figs. 1 and 2; and

Fig. 4 is a sectional elevation taken on the section line 4—4 of Fig. 3.

The furance 10 illustrated in the drawing is a Wetherill furnace of the traveling grate type, particularly adapted for the production of zinc oxide direct from ore. The furnace has a moving perforated grate 11, of the endless conveyor type, adapted to advance the charge supported thereby through a coal ignition chamber 12 and then through a reducing and volatilizing chamber 13. A hopper 14 at the charging end of the furnace delivers fuel briquettes onto the traveling grate and these briquettes are spread to an appropriate depth by an adjustable leveling device 15.

A hopper 18 is provided adjacent the coal ignition chamber between bulk heads or par-

titions 19 and 20 for the introduction of the metalliferous charge upon the ignited bed of fuel briquettes. This charge is preferably in the form of briquettes, such for example as a briquetted mixture of zinciferous and carbonaceous materials.

The reducing and volatilizing chamber 13 is provided with gas outlets 21, in the roof of the furnace structure, for the escape of the gaseous products of the smelting or reducing operation. Down-legs 22, usually equipped with peep-holes at their lower ends, rest upon stand-pipe castings 23 located over the outlets 21. While the furnace shown in the accompanying drawing has a separate and independent down-leg 22 for each gas outlet 21, all of the gas outlets 21, particularly in a furnace of the traveling grate type, may open into a common hood or manifold having a single down-leg.

The improved blasting device of the invention is mounted on the roof of the furnace above each of the gas outlets 21. As illustrated in the drawing, the blasting device comprises a hollow tubular member 27 having a lateral hollow extension 27′ adapted to be connected to the air or other oxidizing gas main 24 through a pipe 25 provided with a damper or valve 26. The gas main 24 is preferably sufficiently elevated, or spaced, from the furnace proper, as shown in the drawing, so that air passing therethrough is substantially not preheated. The pipe 25 preferably extends downwardly from the gas main 24 in such a way, as shown, that it will be exposed to a minimum of heat coming from the furnace walls. It is aimed to permit the passage of air through the gas main 24 and the pipe 25 without preheating. The tubular member 27 with its lateral extension 27′ may conveniently be an integral metal casting, such as an iron casting. The inner wall of the tubular member is provided with a multiplicity of perforations or small holes 28 through which gas escapes from the gas compartment provided by the hollow interior of the tubular member.

The holes 28 are preferably drilled through the wall of the tubular member 27. These holes are arranged as a continuous series in the form of a circle. Adjacent holes are sufficiently spaced from one another so that the streams or jets of gas issuing from each hole are substantially separate and independent, although these separate gas jets taken in their entirety completely envelope the stream of vapors issing from the outlets 21. To this end the wall thickness of the tubular member 27 is sufficient to impart independence of direction to each jet or stream of gas discharged through the holes 28. The holes 28 are moreover arranged to direct the enveloping gas jets against the vapor stream at an appropriate angle, while each hole is directed towards the center axis of the tubular member.

Merely by way of example, we will describe the construction and dimensions of a particular blasting device of the invention with which excellent results have been obtained in actual practice. The tubular member was of cast iron and had an inside diameter of eighteen inches and an outside diameter of twenty-eight inches. The wall thickness of the member was one-half inch, so that the circular section of the hollow interior of the member was four inches in diameter. The holes 28 were three-eighths inch in diameter and were spaced five-eighths inch from center to center, thereby providing approximately 100 holes in circular alignment. The holes were drilled at an angle of about 45° with respect to a horizontal plane. It will, of course, be understood that the dimensions of the blasting device, including the number of perforations or holes, their size and angle of inclination will depend upon the pressure and volume of the issuing stream of vapors, the dimensions and suction draft of the down-legs and the pressure and quantity of blasting gas to be employed. Simple investigations will serve to adequately determine the optimum dimensions for any particular furnacing operation.

The operation of the apparatus hereinbefore described while producing zinc oxide from a briquetted charge is as follows:

Suitable fuel briquettes are fed into the hopper 14. As the traveling grate 11 conveys a layer of these briquettes through the ignition chamber 12, the briquettes are ignited. A layer of briquetted zinciferous and carbonaceous materials is deposited from the hopper 18 onto the ignited fuel briquettes. Combustion and smelting of the briquettes are aided by a blast of air passing up through the perforated grate 11.

As the highly heated briquetted charge passes through the chamber 13, the zinc compounds are reduced and the resulting metallic zinc is volatilized. The furnace is closed as tightly as practicable to exclude the admission of undesirable air. The amount of air introduced through the perforated grate is kept low enough to insure and maintain a reducing atmosphere under the furnace arch in conjunction with the carbonaceous reducing material in the fuel and ore-fuel briquettes. The zinc vapors and gases within the chamber 13 flow from the furnace through the outlets 21, and are subjected to the blasting action of the relatively cool oxidizing gas discharged from the blasting device.

The strength and volume of the blast is in part controlled by the dampers 26. It is of course preferred that the fan (not shown) supplying the air to the main feeder pipe be operated at a predetermined speed so that

a substantially uniform supply of air may be passed to the blasting elements.

The air forced into the member 27 circulates within the hollow compartment thereof and is made to issue through the multiplicity of holes 28. This air is supplied under sufficient pressure to make individual streamlets of air pass through the holes. As the stream of zinc vapor issues from the outlet 21, it is met by these numerous streamlets of air. Each streamlet of air tends to penetrate the moving stream of zinc vapor to its very center. Since the whole stream of zinc vapor is promptly and directly penetrated with these numerous streamlets of air, the vapor is very promptly oxidized to zinc oxide.

The volume and draft of air is sufficient to almost instantaneously cool down the zinc oxide particles before they have a chance to coalesce. In this manner particle growth due to heat is substantially inhibited. This means that all of the zinc vapors are quickly contacted with air to form zinc oxide particles, which are almost instantaneously cooled. This results in a zinc oxide pigment of exceedingly fine and uniform particle size.

While the foregoing represents an illustrative working example of the present invention, it is to be understood that the principles of the invention may be readily practiced in other ways. Any stream of zinc or other metallic vapors, no matter how obtained, may be oxidized by the method and apparatus contemplated. For example, the stream of metallic vapors may be obtained directly from the smelting of ores, or from the melting and volatilization of metal. Moreover, the stream of metallic vapors may be circular, oval, square, or rectangular in section, and blasting elements of appropriate size and shape may be provided to operate in connection with such streams of vapors.

The improved blasting device of the invention is readily and conveniently mounted in position on the furnace. The angle of inclination of the perforations is easily controlled to give the optimum angle of blasting against the issuing stream of metallic vapor. Moreover, the construction and arrangement of the blasting device is such that the walls of the outlets 21 are not subjected to undesirable cooling with the consequent formation of troublesome accretions, and such accretions as do form about the blasting element are removed from time to time without difficulty and at slight labor expense.

We claim:—

1. A metallurgical furnace comprising a zinc reduction chamber, a vapor conduit communicating with said reduction chamber, an air discharging device operatively associated with and surrounding the exit end of said conduit, said air discharging device comprising a hollow member having its wall perforated with a multiplicity of holes adapted to direct a multiplicity of streams of air towards zinc vapor issuing from said conduit.

2. A zinc metallurgical furnace comprising a reduction chamber, a vapor conduit communicating with said reduction chamber, an air discharging device operatively associated with said conduit, an air supply conduit communicating with said air discharging device, said air supply conduit being spaced away from the normally hot furnace walls so that air passed therethrough will not be materially preheated in transit, said air discharging device comprising a hollow member having its wall perforated with a multiplicity of holes adapted to direct a multiplicity of streams of air directly into zinc vapor issuing from said vapor conduit.

3. A zinc metallurgical furnace of the Wetherill grate type for the manufacture of zinc oxide comprising a reduction chamber defined by a perforated grate adapted to support a charge of zinciferous material and carbonaceous reducing agent and surrounding furnace walls sealed against undue admission of outside air and furnace arch, a zinc vapor-gas discharge conduit communicating with said reduction chamber through the arch thereof, an air-discharging device operatively associated with said conduit, said air discharging device comprising a hollow member having its wall perforated with a multiplicity of holes adapted to direct a multiplicity of jets of air directly into zinc vapor issuing from said conduit.

4. A zinc metallurgical furnace according to the preceding claim, in which an air supply conduit connects with said air discharging device, the air supply conduit being spaced away from the normally hot furnace walls so that air passed therethrough will not be materially heated in transit.

5. The combination with a zinc metallurgical furnace of the Wetherill grate type for the manufacture of zinc oxide, of an air-discharging device above the furnace arch, and operatively associated with a conduit opening provided therethrough, said air-discharging device comprising a hollow member having its wall perforated with a multiplicity of closely spaced holes adapted to direct a multiplicity of jets of air directly into zinc vapor issuing from said conduit opening in the furnace arch.

In testimony whereof we affix our signatures.

EARL H. BUNCE.
HARRY M. HASLAM.