A. DONALDSON.

METALLURGICAL APPARATUS.

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1,432,842.

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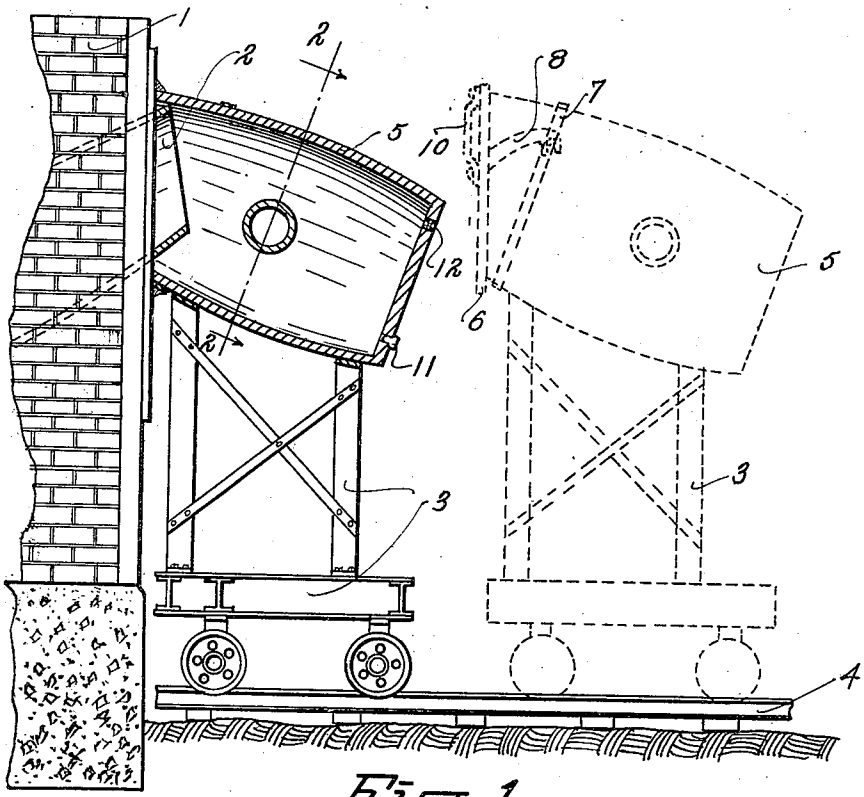



Fig. 1

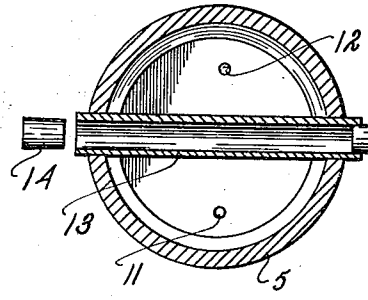



Fig. 2

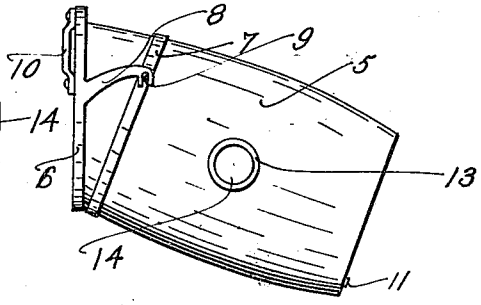



Fig. 3

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# UNITED STATES PATENT OFFICE.

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## METALLURGICAL APPARATUS.

Application filed March 19, 1921. Serial No. 453,624.

*To all whom it may concern:*

Be it known that I, ARCHIBALD DONALDSON, a citizen of Canada, residing at Kellogg, in Shoshone County, and State of Idaho, have invented certain new and useful Improvements in Metallurgical Apparatus, of which the following is a specification.

My present invention relates to improvements in metallurgical apparatus for use in connection with the heating furnaces, and particularly to fume arresters or condensers used with zinc retorts or containers of the furnace.

In the common practice of treating charges of raw material for the production of zinc, a bottle shaped retort is charged with a proper quantity of ore and placed in the furnace in such position as to permit the neck of the retort to protrude through an opening in the furnace. A condenser is then moved to position to cover the mouth of the retort, and the connection sealed in an air tight manner, and when heat is applied to the charge the latter is fused, the zinc content vaporized, and the vapor passed off to the external fume arrester or condenser where it is precipitated and formed in a molten mass.

After the retort is charged and heat applied thereto, a considerable time is required to raise the temperature sufficiently to wholly and freely vaporize the zinc, but during this period of time some of the zinc vapor is conveyed to the fume arrester or condenser. Because of the difference of temperature between the retort and arrester, the latter has not reached the melting point of zinc, hence the incoming vapor, as it contacts with the walls of the arrester or condenser, is precipitated and formed into small particles or drops which refuse to unite one with another. This lack of unity between the particles I ascribe to the fact that the particles become coated with a film, because of lack of heat, that prevents amalgamation, even after the temperature has subsequently been elevated to the melting point in the condenser. This lack of amalgamation results in an undesirable product, usually termed blue powder.

To overcome this defect in the initial part of the process of treating the charge of zinc ore, I provide means for preheating the condenser or arrester, to the proper melting point, say 680° C., and then regulate and control the temperature of the interior of the condenser to maintain it at the proper intensity.

While the vaporizing point in the retort is approximately 1900°, the temperature in the condenser must be maintained at a correspondingly lower point, say 680°, the melting point of zinc, or the zinc will not condense as rapidly as it is received in the arrester. A too rapid ingress of vapor to the condenser will produce an excessive pressure in the latter and may result in dislocating the arrester which would allow the escape of the vapor.

To overcome this contingency, I also provide means for maintaining the proper temperature in the condenser and for increasing or decreasing the area of condensation therein during the operation. These ends are attained by the utilization of means in connection with the condenser for varying the condensing area of the interior of the fume arrester, and controlling, regulating, and maintaining the temperature of the interior of the condenser.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention wherein the parts are combined with a condenser in the best mode I have thus far devised for the practical application of the principles of my invention. While I have herein illustrated a zinc furnace, and shall hereinafter refer to the invention as applied to the production of zinc vapor or fumes, it will readily be understood that the invention may be adapted for use in connection with the condensation of other fumes or vapors, and I therefore do not limit myself to the invention as described herein.

Figure 1 is a view showing a portion of a zinc furnace and mouth of the container or retort therein, combined with an external condenser forming a receiving chamber or fume arrester according to my invention.

Figure 2 is a vertical sectional view of the condenser at line 2—2 of Figure 1.

Figure 3 is a side view of the condenser having a closure applied thereto to prevent escape of the fumes after withdrawal of the condenser from the retort.

I have illustrated my invention in connection with a well known type of zinc furnace 1 in which the retort or charge container is heated, and from which the mouth of the retort protrudes, as indicated at 2 in Figure 1.

A carriage 3 and track 4 are utilized for supporting and moving the condenser 5, which is moved to position in full lines Figure 1 over the mouth of the retort, as an external chamber for receiving fumes or vaporized zinc produced in the retort. The condenser is made up of suitable refractory material, somewhat in the form of a barrel with a closed bottom and open top, and is located in position as indicated in Figure 1 of the drawings. In full lines the condenser is positioned to receive the fumes from the retort, while in dotted lines the condenser is shown withdrawn from the furnace, and when so withdrawn is equipped with a closure 6 over the open end of the receptacle to prevent escape of heat therefrom. A steel band 7 may be attached to the condenser, around its exterior for fastening the closure thereon by means of hooks 8 and pins 9, the latter diametrically disposed on the band, and a handle 10 may be affixed to the closure for convenience in manipulation.

In the bottom of the condenser a usual form of tap hole for drawing off the molten metal is provided and normally closed by a plug 11, and a peep hole or window 12 is also provided in the bottom of the condenser for affording a view of the interior of the condenser.

At approximately the longitudinal center of the condenser, and extending transversely therethrough and through the walls thereof I locate a tube 13, also of refractory material, and preferably with its open ends projecting beyond the periphery of the condenser. These open ends may be closed or partially closed, by plugs 14 adapted to be inserted therein when desired. It will be understood that the fumes arising from the retort pass into the condenser, and therein are condensed and form molten metal that may be drawn off from the tap hole when the plug 11 is removed. While I have shown but one tube in the condenser, others may be added if desired or necessary.

By the condition of the tube, the condensing area of the fume arrester and the temperature of the interior of the condenser are controlled. Thus, with the tube open at both ends, as may be assumed in Figures 1 and 3, the area of condensation of the arrester is increased to its maximum and the zinc vapor is formed into a molten mass in the condenser. To decrease the area of condensation, one or both of the plugs 14 may be inserted in the ends of the tube.

The tube may be utilized to increase the temperature of the interior of the condenser by applying heat to the interior of the tube within the condenser, and this may be accomplished by placing charcoal in the tube and firing it in order that the tube may become a radiator of heat, or a hot blast may be blown into the tube for the purpose of heating it to perform the functions of a heat radiator. The heat within the radiator thus formed by the tube may be governed or controlled by opening one or both of the ends of the tube as required. Should the temperature in the condenser reach an excessive degree, with the plugs removed a spray or jets of air may be introduced into the tube for cooling the latter, thus drawing off the heat as required from the interior of the condenser.

Thus the interior of the condenser may be preheated at the beginning of the operation, and maintained at the required point during the operation, and as the operation is nearing completion resulting in decrease in volume of vapor and consequent reduction in temperature in the condenser, the radiator may be utilized to maintain the required heat to the end of the operation. In this manner a regulated and uniform temperature is maintained in the condenser throughout the operation to insure a uniformity in the formation of the molten metal in the condenser.

From the above description taken in connection with my drawings it is evident that I have provided means for performing the functions and attaining the results set forth to be accomplished by my invention, and it will be understood that changes and alterations are contemplated and may be made within the spirit of my invention without departing from the scope of the appended claims.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is—

1. In a zinc furnace the combination with a retort of an external portable fume condenser and means therein for varying the area of condensation therein.

2. In a zinc furnace, the combination with a retort, of an external portable fume condenser, a tubular element in said condenser forming a heat radiator, and means for varying the heat of said radiator to vary the area of condensation within the condenser.

3. In a zinc furnace the combination with a retort of an external portable fume condenser, a transversely arranged tube in said condenser having its ends opening outside the condenser, and means for closing said ends, for the purpose described.

4. A fume condenser comprising an open end receptacle, and means for closing said end, a transversely arranged tube in said receptacle having its open ends projecting beyond the periphery of the receptacle, and means for closing said ends.

In testimony whereof, I affix my signature.

ARCHIBALD DONALDSON.