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PROCESS OF PREPARING ZINC DUST AND APPARATUS THEREFOR

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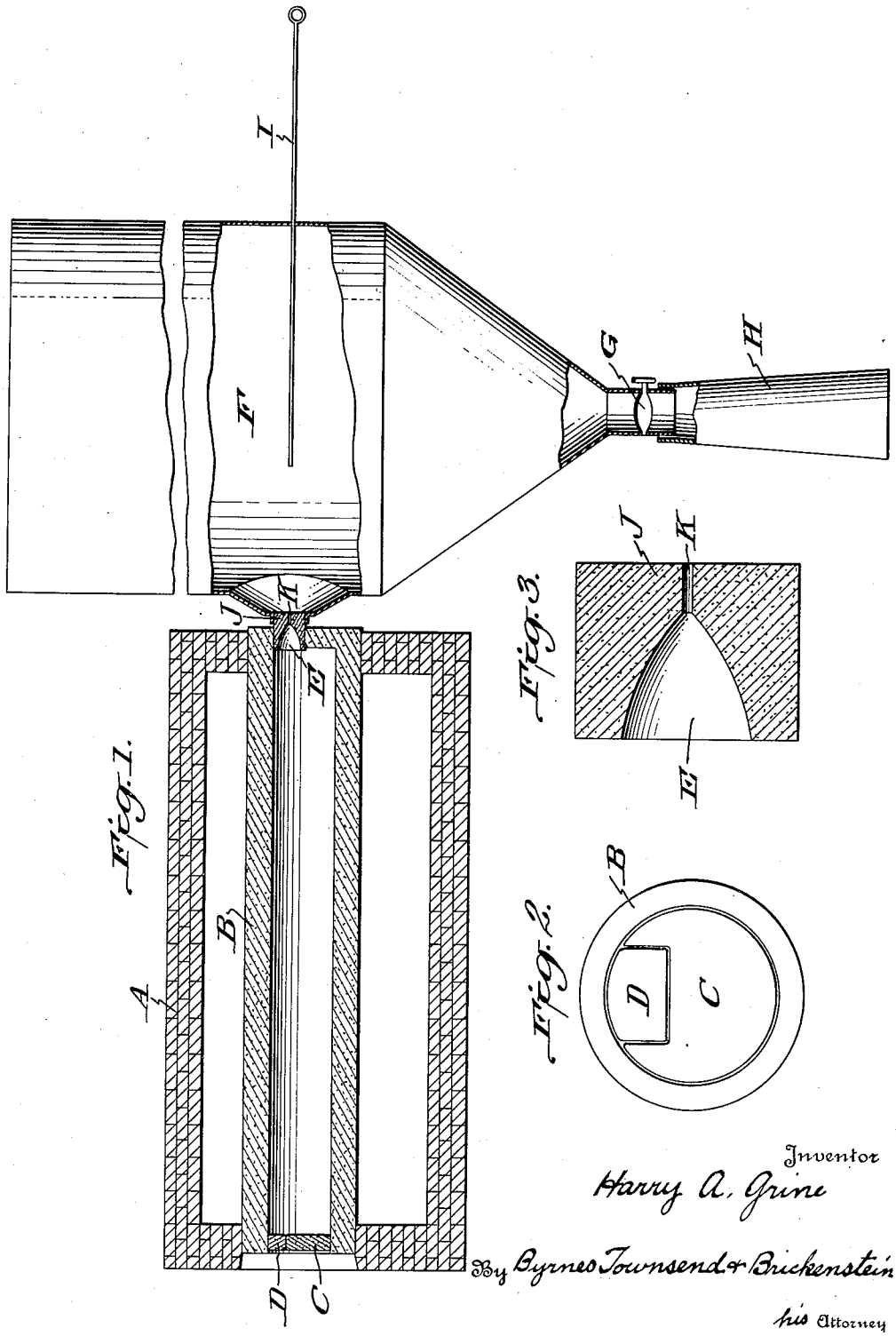


Fig. 1.

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE

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PROCESS OF PREPARING ZINC DUST AND APPARATUS THEREFOR

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This invention relates to a process of preparing zinc dust by the distillation of zinc from dross or other zinc-bearing materials, and apparatus therefor.

One object of this invention is to produce a much finer dust than can be obtained by known processes. Another object is to provide means whereby a much higher conversion of zinc vapors into finished dust may be accomplished than in current practice.

Zinc dust is usually prepared by distilling zinc from zinc-bearing materials and condensing the zinc vapors so formed in large metal condensers. In current methods a connector of comparatively large diameter, usually six to eight inches, is used between the distillation retort and the condenser. At the junction of this connector with the condenser there is a zone, partly within the discharge end of the connector and partly immediately in front of the discharge end of the connector in the condenser, where the vapors begin to condense before being expanded, thus forming metal particles too coarse to screen out as finished fine sized dust. These particles will cohere and gradually form larger pieces of metal termed scrap. This zone results from excessive heat radiation from the large discharge end of the connector causing a cooling of the connector end and heating within the condenser near it. All of the oversize material must be screened out and reworked with some loss of zinc and extra cost. With the large connector the velocity of the vapors, through the discharge end of the connector, is low, permitting time for cooling and condensing part of the vapors there. In some current practice partial oxidation is practiced to secure fineness of dust particles.

I have now found that if the zinc vapors are evolved under slightly increased pressure over atmospheric and discharged into a condenser through a considerably restricted orifice, the zinc dust obtained is much finer and considerably lesser amounts of coarse zinc particles are formed.

A practical means of accomplishing this is to pass the zinc vapors evolved in the retort through a connector having a dam carrying a small discharge orifice located in the discharge end of the connector between the volatilizing retort and condenser. This eliminates the excess radiation at this point, makes it possible to maintain the vapors at a temperature which prevents condensation in the connector and prevents overheating of the condenser, by radiation, in the zone into which the vapors are projected on leaving the orifice. The connector is surrounded by heat and kept at a temperature above the condensing temperature of zinc so that the zinc comes to the orifice in hot vapor form, passes through the short orifice with considerable velocity, is projected well out into the condenser and quickly expanded and cooled. The jet action secured by the small orifice is very beneficial in projecting the vapors well out into the body of the condenser for more rapid expansion and cooling.

The invention will be described in connection with the accompanying drawings, which illustrate one form of an apparatus embodying my invention and suitable for carrying out the process thereof.

Fig. 1 is a diagrammatical vertical section of the apparatus.

Fig. 2 is an enlarged view of the front charging end of the retort B.

Fig. 3 is an enlarged sectional view of the connector E.

In Fig. 1, A is the wall of a conventional gas or otherwise fired furnace surrounding the cylindrical retort B which is made of refractory materials, such as fire clay, graphite, or silicon carbide. At the front end of the retort is a clay disc C permanently luted to the retort walls. The disc C is provided in its upper portion with an opening into which the refractory piece D fits and is tightly luted during the distillation process. The piece D is removable for charging or cleaning out the retort when residuum, from the zinc-bearing materials used, is removed.

The retort is closed at its rear end save for a circular opening in the upper portion into which the refractory connector E is tightly luted. The connector E is approximately five inches inside diameter on the end next to the retort but is closed by the circular dam J except for the orifice K on the dis-

charge end. The connector extends slightly beyond the wall of the furnace to receive the condenser F, F is a sheet-iron condenser which may be of any convenient form. The condenser shown in the drawing is a vertical cylinder with a conical bottom but obviously it may be of any other suitable form, for example, a horizontal cylinder. The condenser is so constructed that the connector, between it and the retort, fits tightly into it and the orifice K communicates directly with the full space of the condenser. There is a butterfly valve G which closes the outlet from the lower end of the condenser when dust receiving can H is removed. H is a receiver for the zinc dust and is a sheet-iron can tapered at the top to fit snugly over the bottom of the butterfly valve housing. The condenser F may be provided with an opening through which a tight fitting rod I passes. This rod carries on its inner end a flat scraper for removing, to the condenser outlet, any dust collecting on the surface of the condenser which does not drain by gravity to the outlet. The discharge orifice in connector E may also be cleaned, when necessary, through this rod opening. In operating the apparatus, zinc dross or other metallic zinc-bearing material is charged into the retort B and heat applied. When the distillation of zinc begins and vapors are evolved, a slight but substantial pressure is created within the retort by reason of the restricted outlet orifice of the connector, the zinc vapors pass through the connector E and with considerable velocity through the orifice K into the condenser F. Owing to the velocity given to the vapors in the small orifice the vapors are projected into the condenser and expand rapidly. The projection of the vapor into the body of the condenser, and the sudden expansion of the vapor quickly reduces its temperature so that it condenses to a very fine dust which settles to the discharge end of the condenser and in the can H where it is removed periodically by closing the valve G and changing dust can H.

Preferably the zinc-bearing material is charged molten at regular intervals so as to maintain a uniform evolution of vapors. Charging in discontinued several hours prior to time for cleaning residue material from the distillation retort in order to get zinc worked out before cleaning out the residue. Completion of the charge is indicated by the condenser becoming cold when vapors are no longer passing into it. The zinc-bearing material may be charged in solid form after cleaning out the retort but this produces considerable thermal shock on the hot retort and more interruption to the dust-making while the metal is being brought to the distillation temperature.

Instead of metallic zinc-bearing material, it is also possible to introduce into the retort a zinc ore, such as roasted zinc ore with a reducing agent, in which case, of course, cleaning of the retort after each charge is completed is necessary.

In the production of zinc dust by the condensation, in large metal condensers, of zinc vapor, care must be taken that the zinc vapor does not come in contact with any considerable amount of air as it forms an explosive mixture with air or is oxidized, forming zinc oxide which is undesirable in the product. For this reason the butterfly valve G or other valve is provided to prevent admission of air to the condenser when the dust can H is removed for dumping dust. Normally valve G is open allowing dust to drain into the can H until full.

The size of the orifice K in the discharge end of the connector E may vary slightly with the size of volatilizing retort used and amount of production required, that is, the rate at which zinc vapors are produced. Preferably it is of such size that the free passage of zinc vapors through it is restricted to such an extent that the pressure in the retort is sufficiently above atmospheric to give considerable velocity to the vapors passing through the orifice. This pressure may vary ordinarily between a few inches water pressure to one pound pressure. The size of the orifice should also be sufficiently small to prevent excess radiation of heat from the connector into the condenser. For standard retorts used for commercial production of zinc dust, the orifice opening is preferably one inch or less in diameter. In current practices, that is to say with a comparatively large discharge opening at the end of the connector entering the condenser, as contrasted with the greatly restricted opening of this invention, it is usual to have 25 to 30 percent of oversize material, which must be reworked, whereas by the process and apparatus of this invention, over 95 percent of the zinc vapor is condensed as finished dust leaving only about 5 percent to be reworked. The crude dust contains little intermediate zinc material between 100 and 300 mesh and can, therefore, be screened on a coarser screen than is required in current practice.

A further important feature of this invention lies in the fact that the connector between the vaporizing retort and condenser is kept at a temperature above the condensing temperature of zinc vapors so that the zinc is in vapor form on one side of the orifice, passes rapidly through the short orifice without time for condensing, and is instantly projected into the large condenser for expansion and cooling. In this manner no condensation takes place until after the vapors are expanded and no condensation takes place in the connector to form globules of oversize metal or scrap. A saving in gas or other fuel for heating the volatilizing retort is also effected by preventing loss of heat

by radiation into the condenser. The only heat carried into the condenser is the sensible heat of the zinc vapors, and this prevents overheating of the condenser by radiation and gives better cooling efficiency in the condenser.

I claim:

1. Process for the production of zinc dust by distillation of metallic zinc bearing material which consists in volatilizing zinc in a closed chamber, passing the zinc vapors to an expansion device consisting of a restricted opening while maintaining the temperature of the vapors in said expansion device above the condensing temperature of zinc and quickly expanding and cooling the vapors in a condenser at a pressure below that obtaining in said closed chamber and in the absence of air to form zinc dust, said restricted opening being sufficiently small to produce a jet action projecting the zinc vapors with considerable velocity well out into the body of the condenser.

2. Process as claimed in claim 1 wherein the pressure in the closed chamber is between about a few inches water pressure to about one pound pressure above the pressure in the condenser.

In testimony whereof, I affix my signature.

HARRY A. GRINE.