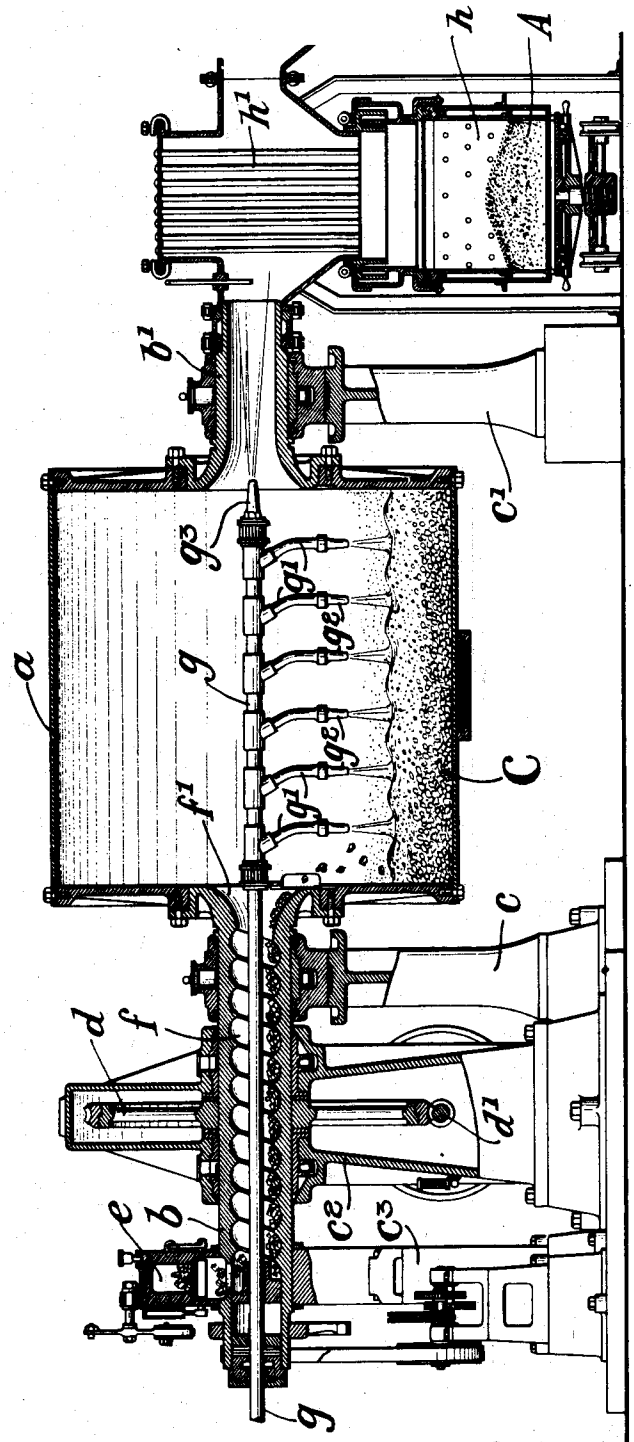
Jan. 31, 1933. G. SHIMADZU 1,896,020

APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Original Filed April 27, 1926 2 Sheets-Sheet 1

Fig. 1.



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Inventor

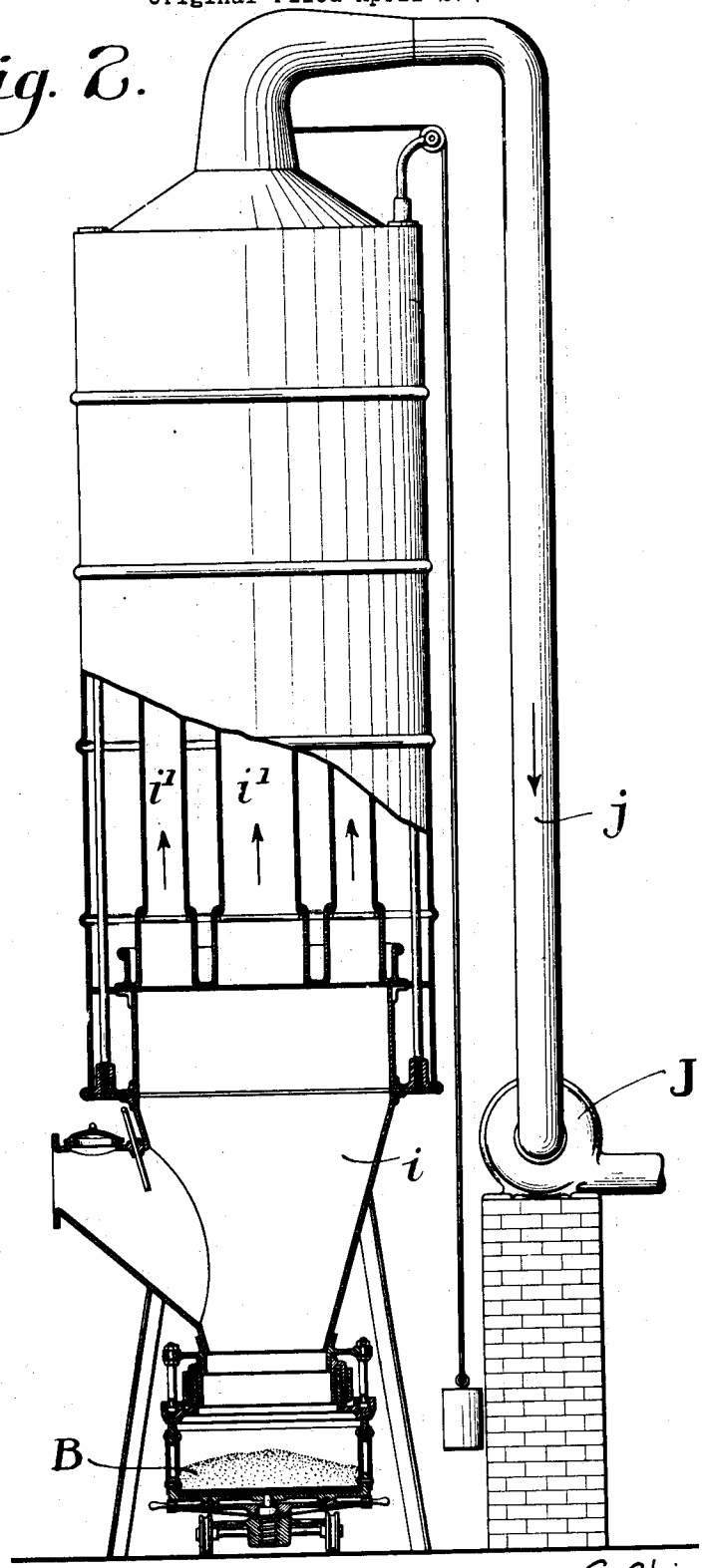
By: Marks & Clerk
Attys

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APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Original Filed April 27, 1926 2 Sheets-Sheet 2

Fig. 2.



G. Shimadzu inventor

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Patented Jan. 31, 1933 1,896,020

UNITED STATES PATENT OFFICE

GENZO SHIMADZU, OF KIOTO, JAPAN

APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Application filed April 27, 1926, Serial No. 104,999. Renewed June 21, 1929.

This invention relates to an apparatus for the continuous production of lead oxides, the object of the invention being to obtain such oxides in the form of extremely fine powders and in a dry state.

The invention involves the subjection of pieces of metallic lead maintained in a state of agitation to artificially supplied atmospheric air or other oxidizing gas whereby a film or coating of oxide will be formed on the pieces, the formation of the film or coating being augmented without fusion of the metal by the heat generated in the principal reaction between metallic lead and the oxidizing gas and by the frictional heat created through rubbing of the pieces one against the other, this rubbing action causing also a brading off as a fine powder of the oxide thus produced, and the oxidizing gas or a part thereof being also utilized to carry off the powder for collection and further treatment if needs be.

Broadly the apparatus of the invention comprises a vessel adapted to be rotated, means for feeding pieces of metallic lead thereto while the vessel is rotating, and means for artificially supplying atmospheric air or other oxidizing gas to the interior of the vessel in such a manner as to contact with the surfaces of the pieces of lead to oxidize the same and to take up and convey the formed oxide powder as it is abraded by the rubbing action of the pieces against each other to a collector and/or filter device.

In the appended drawings, I have shown an advantageous form of apparatus in which Figure 1 (horizontal section) represents an oxidizing chamber and Figure 2 (elevation with parts broken away), a dust catching tower.

Referring more particularly to Figure 1 of the drawings, a denotes a drum which for the purpose of permitting rotation is provided with trunnions b, b' supported by bearings c, c'. The trunnion b is also journalled in a bearing c^2 which is so designed as to form a casing for a worm-wheel d fast on the trunnion b, said worm-wheel being in mesh with a worm d' coupled to a suitable source of power.

The trunnion b is hollow and its interior is provided with helical grooves f which as the trunnion rotates function as a screw conveyor f which is supplied with pieces of lead by an automatic feeder e. Trunnion f conveys the pieces C′ to the drum a into which they fall at f'.

Arranged axially in the hollow trunnion b is a stationary pipe g which extends into the drum a and is provided with downwardly directed branch pipes g' which may be provided at their ends, with nozzles g^2. The pipe g serves to supply atmospheric air or other oxidizing gas under relatively high pressure from a suitable source to the interior of the drum whilst the latter is rotating. The air or gas issuing from the nozzles g^2 impinges upon the lead pieces in the drum and acts primarily to cause a coating or film of oxide to be formed thereon. The trunnion b' is also hollow and the inner end of the supply pipe g is provided with a nozzle g^3 so arranged with respect to the interior of the trunnion b' as to form an ejector or exhauster for the drum a.

The oxide which in fact is a sub-oxide is formed on the pieces principally by the action of the oxidizing gas thereon as has been explained, the gas acting continuously on the surface of the pieces which are maintained in a state of agitation owing to the rotation of the drum so that all the pieces are properly subjected to the oxidizing action. This oxidation is aided by the heat generated by the reaction itself and also by the friction set up owing to the rubbing of the pieces one against the other. The oxide film or coating is of a comparatively brittle nature and the continual rubbing of the pieces together due to the rotational motion of the drum a causes this film or coating to be abraded off as a suboxide powder, thus exposing fresh surfaces of metallic lead to the action of the oxidizing gas and the other conditions which augment the formation of the oxide film. This abrading off or removal of the suboxide coating from the pieces of metallic lead is also caused in part by the impinging of the air from jets g^2 on the surfaces of the pieces of metallic lead. The air which is fed through pipe

g to the nozzles g^2 at relatively high pressure leaves the nozzles at a velocity sufficiently high to blow any oxide from those pieces of lead on which the air impinges. The combined rubbing action of the pieces and action of the jets of air upon the pieces of metallic lead provides a very efficacious means of reducing the oxide to a remarkably fine powder, so fine in fact that from tests made it has been proved that the weight of a given volume of the powder is only from one third to one tenth of the weight of the same volume of metallic lead, or less of the weight of the same volume of water. As a further proof of its fineness it is found that the sub-oxide powder will readily convert to litharge in the presence of an oxidizing agent by spontaneous oxidation after the application of initial heat. That is to say, if the heat of a match for example be applied momentarily to a quantity of the powder, the combustion will proceed of its own accord until all the powder has been converted to litharge.

The suboxide which is formed in my machine in the above described manner is a very unstable fine powder. It is essential that it be removed from the mill in which it is formed immediately after it has been ground or blown from the lumps of lead. Otherwise if it is permitted to remain within the mill for any appreciable length of time it will go over to litharge inasmuch as the temperature within the mill is sufficiently high and there is a plentiful supply of air present. In the arrangement shown the powder is removed substantially instantaneously after formation by the currents of air issuing from jets g^2 which penetrate the entire mass of lead and which leave the mill through trunnion b' carrying with it the formed powder. As will be noted the interior of trunnion b is flared from the drum to form a nozzle which, combined with the action of the air issuing from jet g^3, functions as an ejector to aid in the rapid removal of said powder. A chamber h is connected near its upper end to the hollow trunnion b' and acts to collect the powdered oxide or a portion of it issuing from the trunnion. This chamber h is provided with a plurality of vertical bars h' which act as a screen or sieve to break down the conveying action of the ejector by impingement of the particles thereagainst so that the particles will fall into the bottom of the chamber and accumulate therein as indicated at A. The sub-oxide powder may be removed as such from the chamber h at convenient intervals.

Frequently it is desirable that the product be in the form of litharge rather than suboxide. With the construction shown, the suboxide powder may be readily converted to litharge before removal from the container h. The advantage of converting the powder to litharge in this manner is that the conversion will be complete and the product will be uniform throughout due to the fact that the air within the chamber h is in heated condition and while so heated it has ready access to the powder as it falls on the pile a. Were the suboxide powder first permitted to accumulate in a pile and then oxidized it would be found that the product would not be uniform but that a large portion on the inside of the pile to which the air does not have ready access would remain in the suboxide state. To start the oxidation it is necessary to apply external heat to the product but once started the heat generated by the reaction will be sufficient to oxidize all of the powder which is thereafter formed in the mill and delivered to the chamber h. Any powder intermingled with gas that passes through the screen h' is transferred to a bag room or filter tower i where it is finally separated from the gas. This tower is provided with filter bags of suitable material such as silk which are subjected externally to a rarefied atmosphere or vacuum created in the upper part of the tower by means of the exhauster J. By this means the gas is drawn through the bags leaving the powder on the interior surface thereof from whence it falls and is collected at the bottom of the tower as indicated at B. Here again the sub-oxide powder may be removed as such at convenient intervals or first converted into litharge.

It will be appreciated that if found desirable a plurality of filter towers may be provided in series whereby the extracted gas may be subjected to further filtration to ensure complete separation of powder. It will also be appreciated that the provision of an initial separator h followed by a filter or filters is not essential to the carrying out of the invention. In some cases it might be found that the separator h could be dispensed with in which case the filter stage could be coupled direct to the drum. Again, the separator might in some instances be used without a filtration stage. I reserve to myself the right to such modification and others that are obvious in the construction and assembly of the apparatus.

I claim:

1. Apparatus for the production of lead oxides in the dry state, comprising a vessel adapted to be rotated, hollow trunnions supporting said vessel, a screw conveyer disposed in one of said hollow trunnions to introduce material into said vessel, an air pipe passing through said hollow trunnions and terminating in the other of said hollow trunnions whereby air passing through said pipe acts to expel dry material from said vessel through said other hollow trunnion.

2. Apparatus for the production of lead oxides in the dry state, comprising a vessel adapted to be rotated, hollow trunnions supporting said vessel, a screw conveyer dis-

posed in one of said hollow trunnions to introduce material into said vessel, an air pipe passing through said hollow trunnions and terminating in the other of said hollow trunnions whereby air passing through said pipe acts to expel dry material from said vessel through said other hollow trunnion, said air pipe having branches thereon provided with nozzles whereby air is also introduced into the interior of the drum.

3. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for supplying oxidizing gas to the interior of the vessel, an outlet for said gas, and means comprising an injector for increasing the velocity of said gas as it passes through said outlet.

4. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for feeding lumps of metallic lead to said vessel, a pipe for feeding air under pressure to said vessel a plurality of jets extending from said pipe to impinge upon said metallic lead pieces within said vessel whereby the surfaces thereof are oxidized, means for rotating said vessel to abrade said oxide from said surfaces by mutual attrition, and means for removing said oxide from said vessel substantially instantaneously upon formation.

5. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to contain pieces of metallic lead, means for feeding lead to said vessel, a pipe for feeding air under pressure to said vessel, a plurality of jets extending from said pipe to impinge upon the surfaces of said metallic lead pieces within said vessel, whereby the surfaces of said lead pieces are oxidized, means for rotating said vessel to cause said oxide to be abraded from said pieces by mutual attrition, said vessel having an outlet and means at the end of said pipe extending into said outlet for causing said air to pass through said outlet at a sufficiently high velocity to carry said abraded oxide from said vessel.

6. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for feeding pieces of metallic lead to said vessel, a pipe for feeding air under pressure to said vessel a plurality of jets extending from said pipe to impinge against the surfaces of said lead pieces whereby said surfaces are oxidized and said oxide is blown from said pieces, and an ejector for removing said gas and said oxide from said vessel.

7. Apparatus for the continuous production of lead oxides in the dry state comprising a drum, means for feeding pieces of metallic lead to said drum, a conduit extending into said drum and connected to said source of supply of air under pressure, a plurality of nozzles connected to said conduit for causing said air to impinge upon said metallic lead pieces within said vessel whereby the surfaces of said pieces are oxidized, means for rotating said drum to grind said oxide from said metallic lead pieces, an ejector for removing said air and said oxide from said drum, means interposed in the path of travel of said air and powder for separating a portion of said powder from said air, and a collector for removing the remainder of said powder from said air.

8. Apparatus for the continuous production of lead oxides in the dry state comprising a drum, a conduit connected to a source of supply of air under pressure and extending into said drum, a plurality of nozzles connected to said conduit for causing said air to impinge upon said metallic lead pieces within said drum, means for rotating said drum, an outlet for said drum, an ejector for blowing said product from said drum through said outlet and a collector connected to said last named means for supplying said product from said air.

9. Apparatus for the continuous production of a product including litharge in a dry state comprising a vessel rotatable on axes and means extending through an axis for feeding pieces of metallic lead to said vessel, a conduit for feeding an oxidizing gas under pressure to the lower part of said rotatable vessel, said vessel having an outlet above the zone of impact between the oxidizing gas and the lead pieces in the vessel, whereby said oxidizing gas oxidizes the surface of the lead pieces and then blows the powdered lead oxides upwardly and outwardly from said surfaces, means for rotating said vessel, a chamber having a conduit communicating with said rotatable vessel, said chamber having vertically extending fabric filters in its upper portion and a lower portion below said filters into which said oxides may slide off and fall from the filters to be further oxidized to litharge and a conduit from the filters to conduct away the oxidizing gas separated by the filters from said oxides.

10. Apparatus for the continuous production of a product including litharge in a dry state comprising an apparatus including a vessel in the form of a drum, means for feeding pieces of lead into the drum, means for rotating the drum to cause frictional movement between said pieces, means for supplying under pressure an oxidizing gas to the interior of the drum so as to act on said pieces to form a coating of lead suboxide thereon and to remove from the pieces the powder formed by the abrading action of the pieces against one another, and means associated with said apparatus in which said lead suboxide may be converted into litharge while still in its dry state.

11. Apparatus for the continuous produc-

tion of litharge in a dry state comprising an apparatus including a vessel in the form of a drum, means for feeding pieces of lead into the drum, means for rotating the drum to cause frictional movement between said pieces, means for supplying under pressure atmospheric air to the interior of the drum in suchawise as to act on said pieces to form a coating of lead suboxide thereon and to take up and remove from the pieces the powder formed by the abrading action of the pieces against one another, and means associated with said apparatus whereby said lead suboxide is converted into litharge, and means for receiving the product collected from said apparatus

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.