Dec. 18, 1923. 1,478,347

J. L. MITCHELL

APPARATUS FOR CALCINING LITHOPONE

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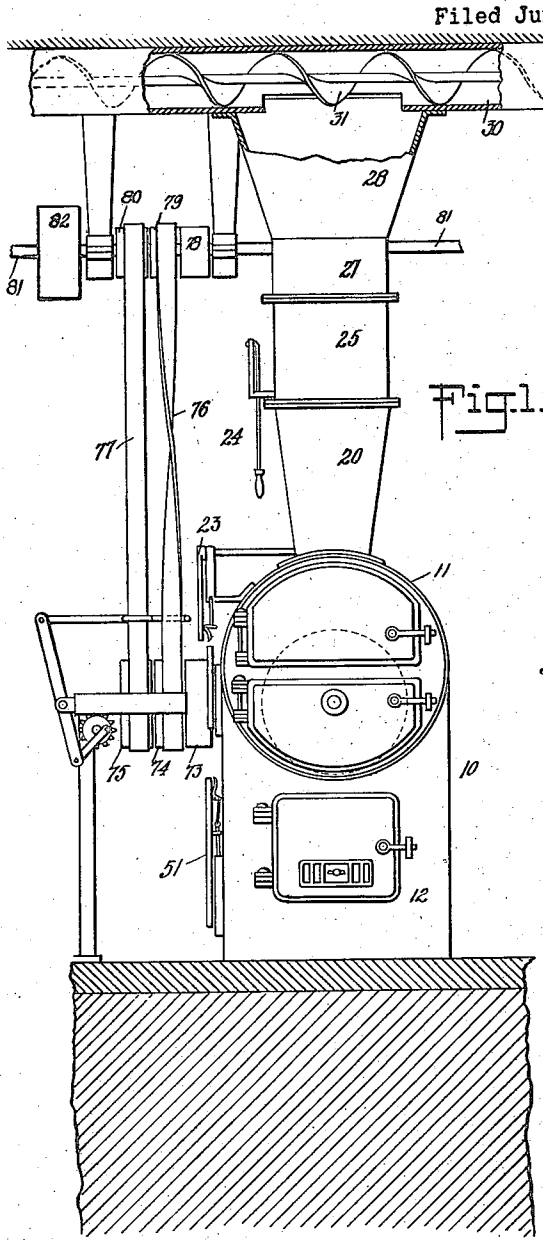


Fig. 1.

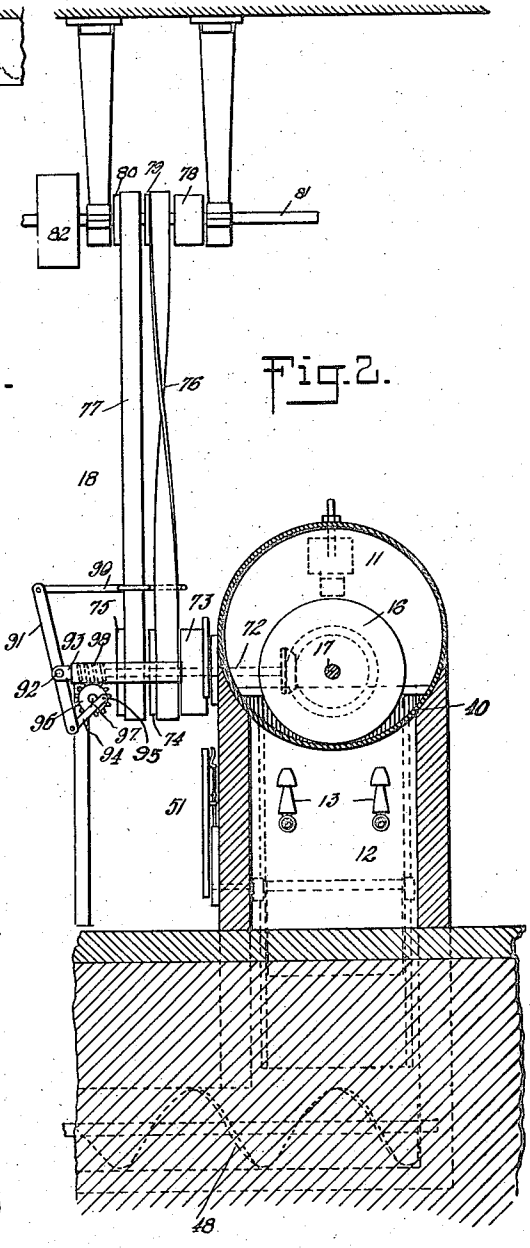


Fig. 2.

WITNESSES

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Fig. 3.

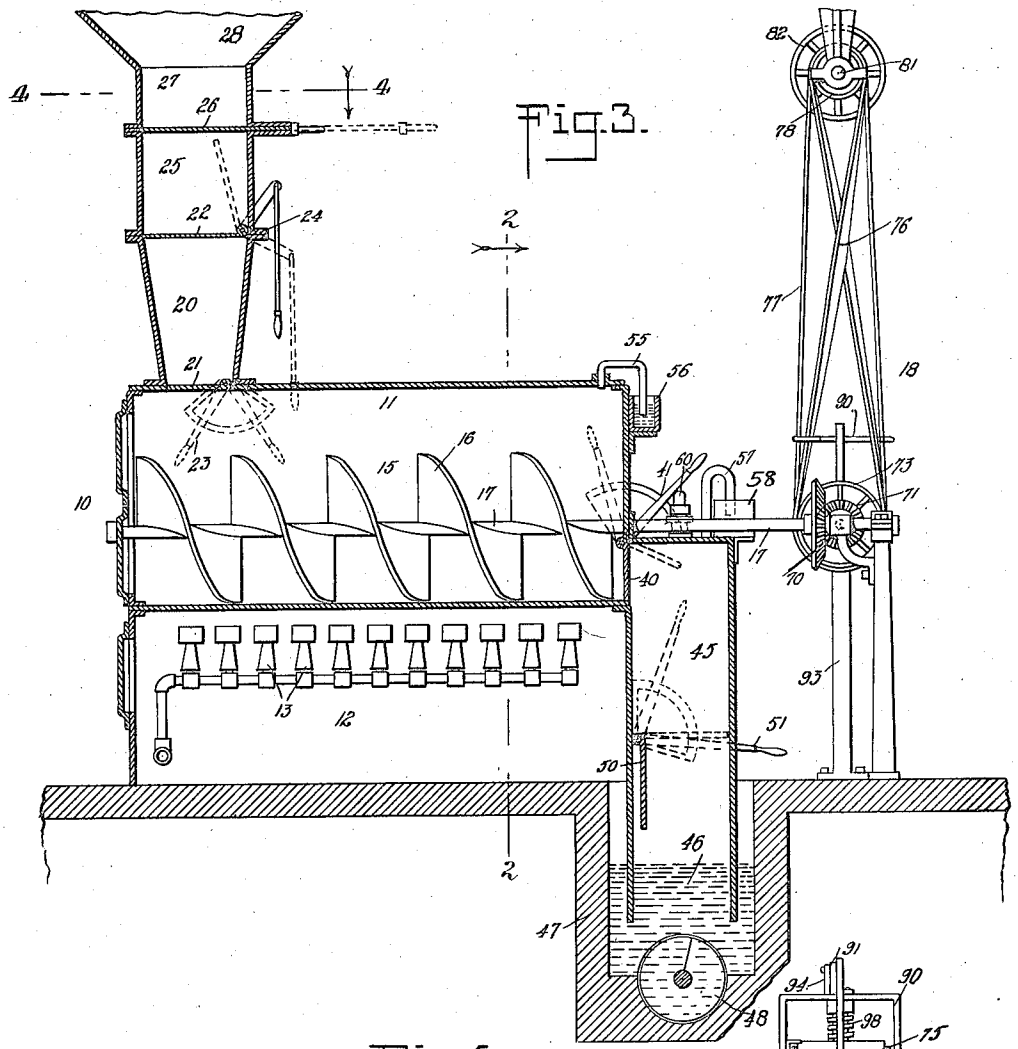
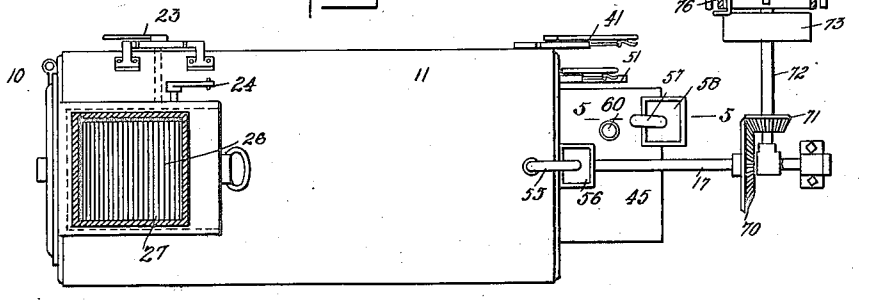


Fig. 4.

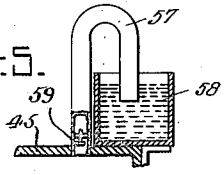


WITNESSES

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Fig. 5.



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1,478,347

UNITED STATES PATENT OFFICE.

JOHN L. MITCHELL, OF GREENWICH, CONNECTICUT.

APPARATUS FOR CALCINING LITHOPONE.

Application filed June 2, 1920. Serial No. 385,991.

To all whom it may concern:

Be it known that I, JOHN L. MITCHELL, a citizen of the United States, and a resident of Greenwich, in the county of Fairfield and State of Connecticut, have invented a new and Improved Apparatus for Calcining Lithopone, of which the following is a full, clear, and exact description.

The invention relates to the manufacture of lithopone such, for instance, as shown and described in the application for Letters Patent of the United States, Serial No 250,708, filed by me on August 20, 1918.

An object of the invention is to provide certain new and useful improvements in the manufacture of lithopone whereby a thorough calcination of the product takes place and the desired density and opacity is obtained with a corresponding increase in the quality of the lithopone.

Another object is to eliminate or control the formation of zinc oxide as desired.

Heretofore lithopone has been produced by a precipitation of barium sulphide and zinc sulphate. This product was subsequently washed, dried, and calcined in a muffle furnace at a temperature generally of from 500° C. to 700° C., and then the product was quenched in cold water, dried and ground in a pulverizing mill to form a marketable lithopone.

It has been proposed in the process of the above kind to calcine the zinc sulphide and barium sulphate at a temperature of about 850° C. to 900° C., the product having been first dried at a temperature of 100° C., as far as possible with the exclusion of air. It has further been proposed to heat a mixture of barium sulphate and zinc sulphide in a vessel from which the heated mixture is delivered into water, the whole process being carried out with the exclusion of air from the apparatus.

Lithopone made as above described is not thoroughly calcined owing to the lumpy condition of the material which prevents the heat from permeating the entire mass, and loss of density and opacity is the result of this imperfect calcination.

In my process, however, the precipitate formed of barium sulphate and zinc sulphide is first dried and then thoroughly pulverized by grinding or other means before calcination and is then placed in an airtight muffle furnace and calcined at a temperature of from 700° C. to 950° C.

With these and other objects in view, the invention consists of certain novel features of construction as hereinafter shown and described and then specifically pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a rear end elevation of the improved apparatus for calcining lithopone;

Figure 2 is a cross section of the same on the line 2—2 of Figure 3;

Figure 3 is a longitudinal central section of the same;

Figure 4 is a plan view of the same, with part in section, on the line 4—4 of Figure 3; and

Figure 5 is an enlarged sectional side elevation of the water sealed outlet for the vapors arising in the delivering chamber, the section being on the line 5—5 of Figure 4.

In the manufacture of lithopone as heretofore practiced it has been customary to fill pans with the dry precipitate of barium sulphate and zinc sulphide and then to place the filled pans in a muffle furnace for a predetermined time to calcine the precipitate, after which the pans are withdrawn and the calcined product is quenched in cold water. During the removal of the pans, with the calcined product therein, through an open door of the furnace, the hot contents of the pans are subjected to atmospheric air, and a considerable amount of the zinc sulphide is changed into zinc oxide, which latter is very objectionable as an ingredient of lithopone as it tends to reduce the density of the lithopone. With the improved apparatus presently described in detail the precipitate is thoroughly calcined and quenched under exclusion of air thus insuring the formation of lithopone having a desired density and opacity and a corresponding increase in the quality.

The improved apparatus for calcining lithopone is provided with a muffle furnace 10 having a normally closed calcining chamber 11 and a heating chamber 12 containing a suitable heating means such as gas burners 13 or the like. Within the calcining chamber 11 is arranged an agitating device 15 for thoroughly agitating the dry precipitate of barium sulphate and zinc

sulphide by moving the said precipitate forward and backward a number of times in the calcining chamber 11 while the latter is subjected to the heat from the burners 13. The agitating means 15 is preferably in the form of spiral blades 16 attached to a shaft 17 journaled in the ends of the calcining chamber 11 and having one outer end connected with a driving and reversing mechanism 18 for alternately rotating the shaft 17 in opposite directions, as hereinafter more fully explained.

On the top of the calcining chamber 11 and preferably adjacent the rear end thereof is mounted a charging member 20 provided at the bottom with a door 21 which when opened allows the dry precipitate to drop from the charging chamber 20 into the calcining chamber 11. The upper end of the charging chamber 20 is normally closed by a door 22 to prevent air from passing into the calcining furnace together with the charge at the time the door 21 is opened. The doors 21 and 22 are provided with suitable manipulating means 23 and 24 under the control of an operator. On top of the chamber 20 is arranged a chamber 25 provided with a slidable gate 26 under the control of the operator and which closes the lower end 27 of a hopper 28 connected with a horizontally disposed tubular conveyer casing 30 in which is mounted a conveyer 31, preferably of barrel type, for filling the hopper 28 with the dry precipitate of barium sulphate and zinc sulphide. It is understood that the conveying means, in practice, supply a number of apparatus for calcining lithopone with the precipitate.

The right-hand end of the calcining chamber 11 is provided with a door 40 under the control of an operator by the use of a suitable handle 41 to permit of swinging the normally closed door 40 outward and upward into open position within a delivering chamber 45 closed at the top and terminating at its lower open end in cold running water 46 contained in trough 47 provided in its bottom with a conveyer 48 of spiral or other type for carrying off the quenched and calcined product, as hereinafter more fully explained. In the delivering chamber 45 between the level of the water 46 and the door 40 is arranged a normally closed door 50 under the control of an operator manipulating a suitable handle 51 to open the door temporarily for dropping the calcined material into the running water. After the precipitate has been calcined within the calcining chamber 11 then the door 40 is opened to allow the conveyer 16 to push the calcined product through the open door 40 into the delivering chamber 45, and when this has been done the door 40 is closed and the door 50 is now opened to allow the calcined product to drop into the water 46 to be quenched by the latter and conveyed under water to a place of discharge to be finally dried and made ready for the market. It is understood that after a batch has been calcined and discharged from the calcining chamber 11 the door 40 is closed and a new charge contained in the charging chamber 20 is allowed to drop into the calcining chamber 11 by the operator opening the door 21, after which this door 21 is again closed.

The calcining chamber 11 is provided with an escape or vent 55 for the gases or vapors arising during the calcining operation, and this vent is preferably in the form of a U-shaped tube having its outer end extending into a water seal 56 to allow the gases to escape from the calcining chamber 11 without danger of atmospheric air passing by way of the vent into the calcining chamber. A valved outlet 57 is arranged on the top of the delivering chamber 45 and this vent is in the form of a U-shaped tube provided with a low pressure valve 59 (see Figure 5) and having its outer end engaging a water seal 58 to allow the vapors arising from the quenched calcined product to escape from the chamber 45 without danger of air passing into the chamber by way of the vent 57. The top of the delivering chamber 45 is also provided with a relief or safety valve 60 of any approved construction to allow escape of the vapor in case it reaches a high pressure.

The driving mechanism for the agitating means 15 is constructed as follows: On the outer end of the shaft 17 is secured a bevel gear wheel 70 in mesh with a bevel gear wheel 71 secured on a transversely extending shaft 72 provided with three pulleys 73, 74 and 75 adapted to be driven by two belts 76 and 77, of which the belt 76 is the cross belt (see Figures 1, 2 and 3). The belts 76 and 77 are adapted to be engaged with pulleys 78, 79 and 80 mounted on an overhead countershaft 81 carrying a driving pulley 82 connected with other machinery for imparting a rotary motion to the shaft 81. The pulleys 74, 79 are loose pulleys while the pulleys 73, 78 and 75, 80 are fast pulleys. The belts 76, 77 are engaged by a belt shifter 90 pivotally connected with the upper end of a lever 91 fulcrumed at 92 on the framework 93 in which the shaft 72 is journaled. The lower end of the lever 91 is pivotally connected by a connecting rod 94 with a wrist pin 95 held on one face of a worm wheel 96 secured on a shaft 97 journaled on the framework 93. The worm wheel 96 is in mesh with a worm 98 secured on the shaft 72 to periodically actuate the belt shifter 90 with a view to shift the cross belt 76 alternately from the loose pulleys 74, 79 onto the fast pulleys 73, 78, and the belt 77 from the fast pulleys 75, 80

onto the loose pulleys 74, 79 thus periodically reversing the rotary motion of the shaft 72 and consequently that of the shaft 17 of the conveyer 15. It is understood that the conveyer 15 is reversed on each complete revolution of the worm wheel 96.

The operation is as follows:

Presuming that the calcining chamber 11 is charged with a dry precipitate of barium sulphate and zinc sulphide, and that the shaft 17 is running, with the doors 21 and 40 in closed position: it will be noticed that the agitating device 15 moves the precipitate alternately lengthwise from the left to the right and from the right to the left by the action of the conveyer blade 16 whereby the precipitate is thoroughly agitated while subjected to a temperature from 700° C. to 950° C. to insure a thorough calcining of the material. This calcining operation is kept up for about half an hour and then the door 40 is opened at the time the conveyer blade 16 moves the material from the left to the right so that the material is discharged through the open door 40 into the upper portion of the delivering chamber 45 in which the lower door 50 is closed at the time. After the material is discharged from the calcining chamber 11, the door 40 is closed and the door 21 is opened to allow a charge of the precipitate contained in the charging chamber 20 to drop in to the left-hand of the empty calcining chamber 11, after which the door 21 is again closed. The door 22 and the gate 26 are next opened to allow the precipitate in the hopper 28 to drop into the charging chamber 20, to fill the latter, after which the gate 26 is closed and then the door 22. In the meantime the calcined material in the upper portion of the delivering chamber 45 is allowed to drop into the water 46 on opening the gate 50 so that the calcined material is quenched in the cold water 46 of the trough 47 and the quenched material is moved to a suitable place of discharge by the conveyer 48 to be subsequently dried and made ready for the market.

From the foregoing it will be seen that the precipitate of barium sulphate and zinc sulphide is not subjected to the action of air either prior to or after the calcining process, and the calcined product is quickly quenched under the exclusion of air to insure the formation of lithopone having the desired density and opacity and a corresponding increase in quality. It will also be noticed that by the arrangement described, the formation of zinc oxide is practically eliminated, but, if desired, air may be admitted to form zinc oxide in a desired proportion.

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

1. An apparatus for the calcining of lithopone, comprising a muffle furnace, agitating means within said muffle furnace, a charging chamber connected to said muffle furnace, a delivering chamber connected with the discharge end of said furnace to receive the calcined product from said furnace, a door between said delivering chamber and said furnace, a trough containing water, the lower end of the delivering chamber extending down into and below the surface of the water, a submerged conveyor in said trough to carry off the quenched calcined product, and a door disposed intermediate the length of the delivering chamber above the lower end thereof to receive and temporarily retain the charge thereof when the charge is discharged from the furnace, said last mentioned door also discharging material into the water, the door, after it has discharged material into the water being elevated to close off the upper end of the delivering chamber from the fumes due to the quenching.

2. An apparatus for calcining lithopone comprising a muffle furnace having agitating means for calcining the material under the exclusion of air, means rotating the said agitating means alternately in opposite directions, a charging chamber connected with the top of the said muffle furnace at one end thereof, the said charging chamber having doors for delivering the material to the said muffle furnace under exclusion of air, a delivering chamber connected with the other end of the muffle furnace at the bottom thereof and having doors for receiving the calcined product from the muffle furnace and temporarily retaining it, and a trough containing a conveyer and adapted to be filled with water, the lower end of the said delivering chamber opening under water into the trough.

3. An apparatus for calcining lithopone comprising a muffle furnace having agitating means for calcining the material under exclusion of air, means rotating the said agitating means alternately in opposite directions, a charging chamber connected with the top of the said muffle furnace at one end thereof, the said charging chamber having doors for delivering the material to the said muffle furnace under exclusion of air, a delivering chamber connected with the other end of the muffle furnace at the bottom thereof and having doors for receiving the calcined product from the muffle furnace and temporarily retaining it, a trough containing a conveyer and adapted to be filled with water, the lower end of the said delivering chamber opening under water into the trough, and water-sealed gas and vapor outlets for the said furnace and the said delivering chamber.

4. An apparatus for the calcination of lithopone which includes a calcining chamber, a delivery chamber connected to the dis-

charge end of the calcining chamber, a water trough connected to one end of the delivery chamber, and manually operable doors disposed between the calcining chamber and the delivery chamber, and between the delivery chamber and the water trough whereby the material may be discharged into the delivery chamber and held temporarily therein before being dropped into the trough until the door leading to the calcining chamber has been closed, whereby the calcining chamber may be closed from the delivery chamber before the material is allowed to drop into the water trough.

JOHN L. MITCHELL.