

C. D. HOLLEY.
PROCESS OF AND APPARATUS FOR COMMUNUTING LEAD.
APPLICATION FILED APR. 8, 1912.

1,156,079.

Patented Oct. 12, 1915.

2 SHEETS—SHEET 1.

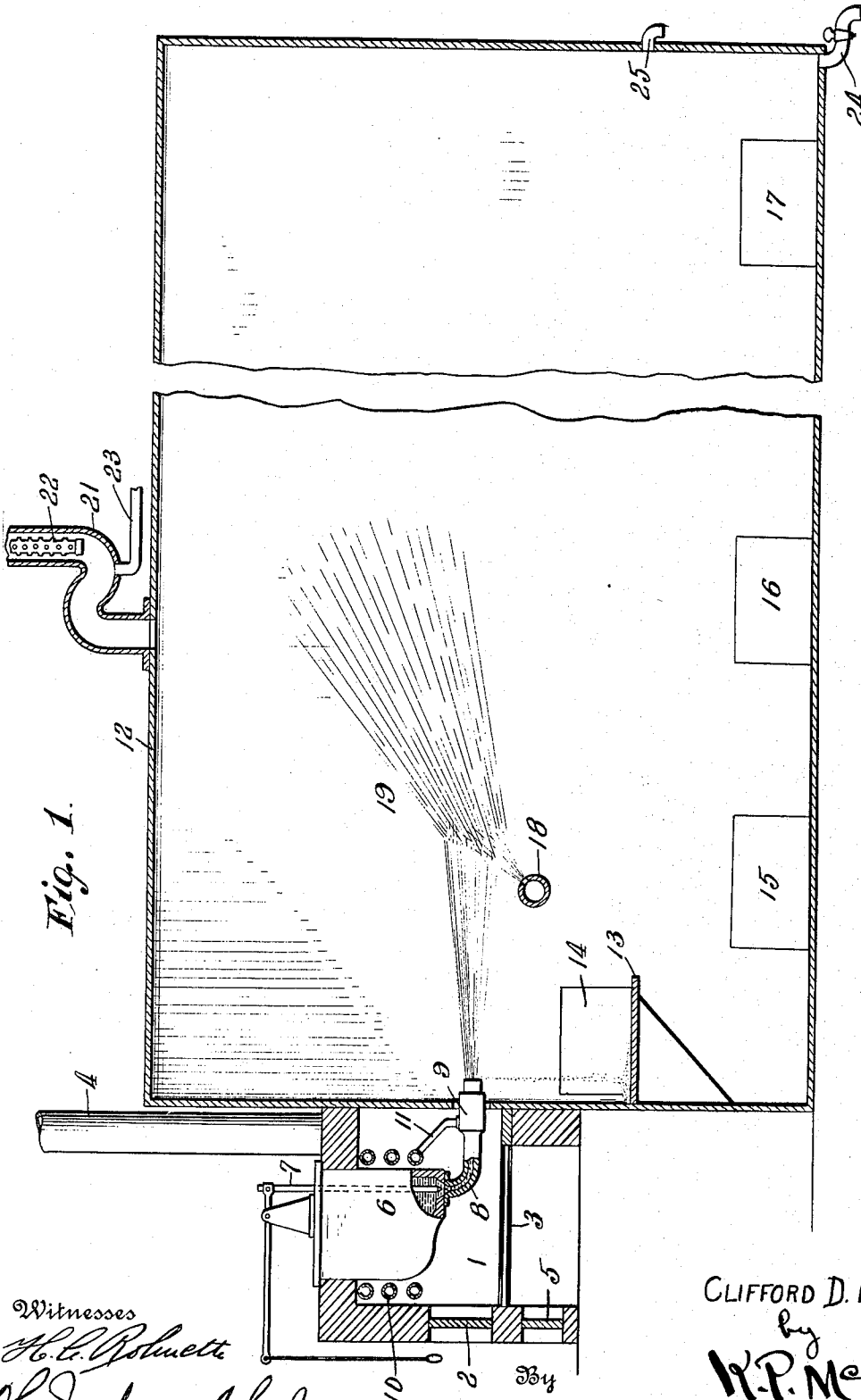


Fig. 1.

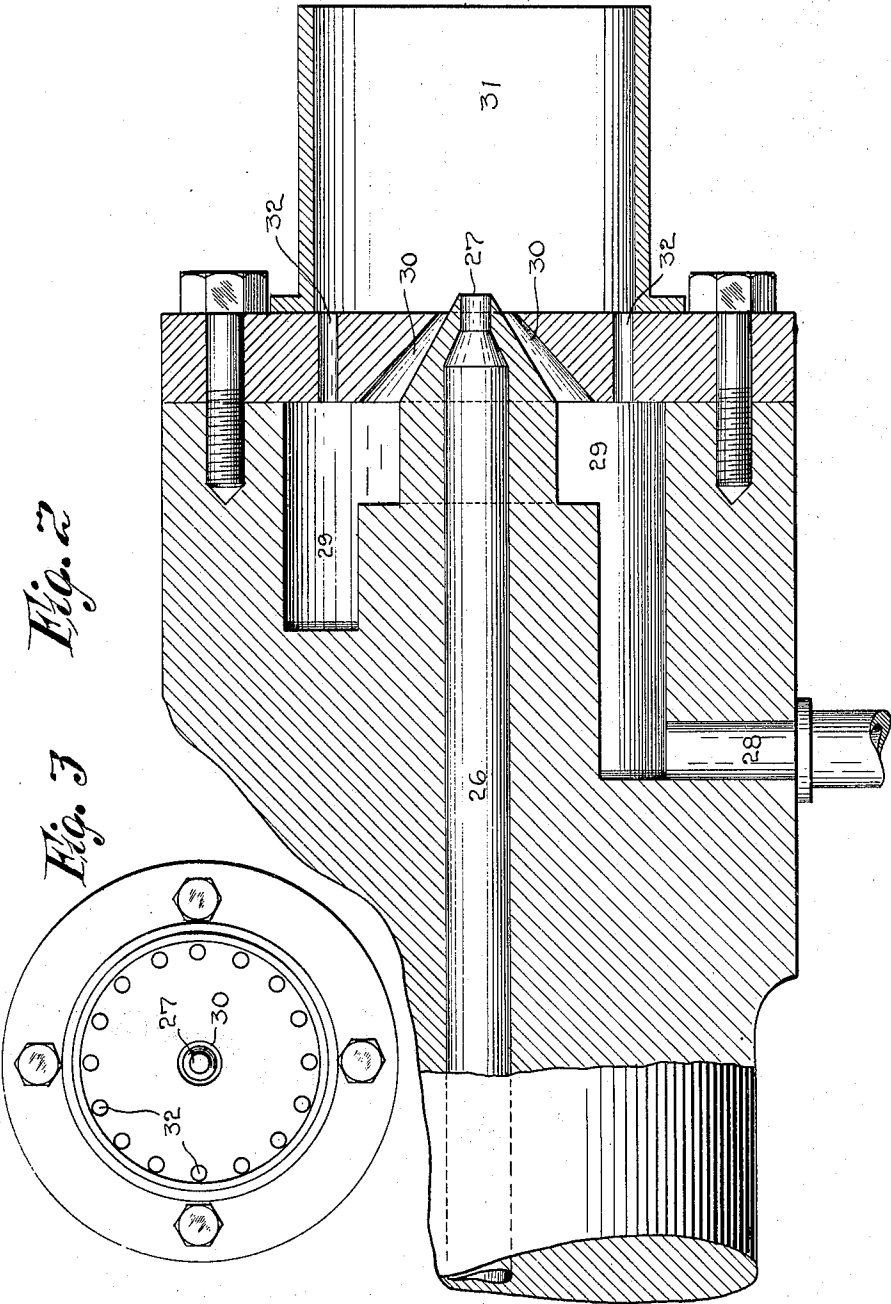
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UNITED STATES PATENT OFFICE.

CLIFFORD D. HOLLEY, OF DETROIT, MICHIGAN, ASSIGNOR TO ACME WHITE LEAD AND COLOR WORKS, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

PROCESS OF AND APPARATUS FOR COMMINUING LEAD.

1,156,079.

Specification of Letters Patent.

Patented Oct. 12, 1915.

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To all whom it may concern:

Be it known that I, CLIFFORD D. HOLLEY, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Processes of and Apparatus for Communiting Lead, of which the following is a specification.

This invention relates to a process of and apparatus for communiting lead; and it comprises a process wherein a jet of molten lead is passed outwardly through a contracted orifice into an annular encircling and carrying jet of superheated steam of high temperature and pressure, the lead and steam are allowed to pass forward into and through a mixing chamber of comparatively small diameter to allow a limited expansion and to perfect the atomization of the lead and are then transmitted into an atmosphere of hot steam and air contained in a larger collecting chamber provided with means for allowing a limited and regulated access of air, and advantageously with means allowing introduction of air containing ozone or other actively oxidizing substances, the comminuted lead and lead oxid being then collected therein; and it also comprises an apparatus for the described purpose comprising means for melting and feeding lead to a jet nozzle, means for producing superheated steam leading to and feeding an annular steam nozzle encircling said jet nozzle, a mixing chamber of comparatively small diameter into which said nozzles open and which may be heated by supplemental steam jets or otherwise, and a collecting chamber receiving the mixed materials from the mixing chamber, said collecting chamber being provided with means for separately collecting and removing the coarser lead emerging from the mixing chamber, means for collecting and removing the finer lead therebeyond, means for removing a portion of the steam and air from the atmosphere of said chamber, and regulable means for permitting access of a limited amount of air to said chamber or of air containing oxidants; all as more fully hereinafter set forth and as claimed.

In the manufacture of finely divided lead for simultaneous or subsequent oxidation many propositions have been made for

atomizing molten lead by fluid jets and some of these propositions have become commercial to a greater or less extent. But most of them suffer from fundamental defects in that they employ conditions inconsistent with the properties of lead for securing the ends sought. In atomizing molten lead with air, heated or unheated, for example, the lead at once oxidizes superficially and each droplet or thread of lead produced in the initial comminution becomes covered with a coating of infusible oxid of lead which mechanically retards further comminution. In the gas expansion immediately beyond the jet nozzle the temperature drop is sufficient to solidify the molten lead in any event, precluding further comminution for this reason also. The product obtained is therefore coarser than is desired. Where low temperature steam, moistened steam, etc. are employed the product also is usually unduly rich in coarse particles for similar reasons. Boiler steam expanding freely at once drops in temperature to 212° F. and steam carrying moisture and so expanding of course cannot be above that temperature. As lead fuses only at a much higher temperature (610° F.) and as its specific heat is rather low as compared with steam and water, solidification of the lead sets in at once. When molten lead is atomized with air, the product is of course, as stated, oxidized. Steam and water do not have this specific oxidizing action upon lead and when comminuted metallic lead is desired, atomization by steam should be into a chamber from which the air is, so far as possible, excluded.

In the present invention I have revised the conditions by atomizing with superheated steam into a small chamber permitting a limited expansion and therebeyond introducing the steam and lead into a larger chamber containing a hot mixture of steam with a limited and regulated amount of air, thus postponing the drop in temperature due to free expansion until after the comminution of the lead is perfected in the small chamber beyond the jet nozzle used for atomizing. The quantity of air in the mixture in the large chamber is so regulated as to produce any desired amount of oxidation of the very fine particles of metal produced

in the described way. Advantageously, where lead oxid or oxidized lead is desired, the air may contain ozone or nitrogen oxids to accelerate its oxidizing power. Gases
5 from an arc furnace producing nitrogen oxids may be used with, or in lieu of, air. The product may be formed in a suitable chamber which may contain water at the base, this water being advantageously hot
10 so as not to produce too much condensation in the chamber and for other reasons. From the chamber the product may be removed by hand or any suitable conveyer means. There may be means just beyond
15 the device delivering atomized lead allowing the coarser particles, which will drop first, to be separately removed. Other means for removing finer but still coarse lead and lead oxid may operate in the space between this
20 and the fine-lead exit. Entrained lead particles carried away by emerging steam may be collected by a condensing spray located outside the chamber.

In an apparatus embodiment of the present invention, a fire heated kettle or the like
25 for melting lead may communicate with a jet nozzle into which superheated steam is supplied. This steam may be superheated by the same heating means used for melting
30 the lead. The jet nozzle however which receives the steam and lead instead of communicating directly with a comparatively large collecting chamber in which free expansion, with concomitant drop in temperature, may at once occur, is best connected
35 to a releasing or mixing chamber of comparatively small diameter. This mixing chamber may be heated externally if desired. Or, and very advantageously, supplemental jets may be arranged to direct hot
40 steam along the inner walls of the mixing chamber to form an envelop of superheated steam surrounding the jet of mingled lead and steam. In this chamber a limited expansion occurs, allowing a disruptive
45 comminution of the mixture of superheated steam and molten lead without giving too much drop in temperature, thus much enhancing the perfection of the comminution.
50 As the expansion is in a non-oxidizing atmosphere, good atomization is obtained. To obtain the best effects, the admixture of steam and lead at the jet nozzle should be as perfect as possible. While the steam jet
55 may be surrounded by the lead jet, I find it is better to have the steam jet encircle the lead jet and to have the nozzle so shaped that the steam shall be directed annularly into the lead jet. The object is to produce
60 a comminution at the nozzle and perfect this comminution in the mixing or expansion chamber without oxidation and without at once permitting such an expansion as to chill the lead to the solidifying temperature.

The steam may be superheated in tubing surrounding the lead melting kettle, or in a separate superheater. The bottom of the kettle may communicate with the nozzle
70 through a short tube. Where the delivery into the collecting chamber is to be horizontal, the jet nozzle may connect with the bottom of the kettle through a tube with a cast-iron bend. The bottom of the kettle
75 and the end of the bend should be faced very carefully and directly drawn together with tap screws as any gasket that may be used is short-lived. With a heavy cast-iron bend so attached to the kettle, the other end, carrying the nozzle and attached parts,
80 should be free to move to allow for expansion and contraction. The feed of molten lead into the bend may be controlled by a simple cone-ended rod as valve means.

In the main expansion chamber beyond
85 the chamber for limited expansion just described, the comminuted lead will be carried forward by the force of the jet. In this chamber it may, or may not, undergo oxidation. If oxidation be not desired,
90 then the atmosphere of the chamber will be provided altogether by the steam of the atomizing jet. Where oxidation is desired, as is usually the case, means for introducing
95 air may be provided. To accelerate the action of this air, it may be ozonized or may be admixed with oxids of nitrogen which operate in the manner familiar in sulfuric acid practice. Where oxids of nitrogen are
100 used, the usual towers and other means may be provided beyond the lead chamber for condensing and recovering such oxids. This collecting chamber should be preferably
105 rather large and long and should be provided with doors or other means for removing lead or lead oxid at various points along its length. As the lead passes forward
110 through this chamber, the heavier particles deposit first so there is a gradation in fineness along its length. The collecting means may therefore remove lead of any desired degree of fineness. It is useful to provide a
115 special shelf just beyond the limited-expansion-chamber to collect the coarse or unatomized lead. Where air is introduced into the chamber for oxidation, it is desirable to
120 introduce it from nozzles or perforated pipes with the outlets so placed as to discharge upwardly against the horizontally passing and expanding jet of lead and steam, thereby supporting the latter somewhat, causing the lead to deposit freely on
125 the walls of the chamber forming an easily friable, porous mass which undergoes oxidation very rapidly. These masses may be dislodged at suitable intervals by beating the walls and new masses allowed to accumulate and oxidize.

In the accompanying illustration I have shown, more or less diagrammatically, an
130

apparatus embodiment of the present invention suitable for use in the described process.

In this showing, Figure 1 is a longitudinal vertical section of a complete installation, certain parts being shown in elevation; and Fig. 2 is a similar view on an enlarged scale of the lead comminuting device.

In Fig. 1, 1 is a lead-melting furnace provided with fire door 2, grate 3, stack 4, ash door 5, and carrying a lead melting retort or kettle 6. At its base this kettle is provided with an orifice valved by rod 7. A short heavy bend 8 of cast iron or other suitable material is flanged directly on the bottom of the kettle. At its other end it carries the atomizing device indicated as a whole by 9.

Around the kettle in the fire chamber is a superheating coil 10 communicating with the steam inlet of the atomizing device through 11. The atomizing device is movably mounted in an orifice of the casing 12. This casing which may be of any suitable size or shape is provided with a shelf 13 for coarse lead and is also provided with a door 14 for removing such lead. Other doors 15, 16, 17 are provided along the length of the chamber for removing various grades of lead. Jet means 18 provide for the introduction of air, ozonized air, etc., and as shown are set to direct jets upwardly against horizontal lead jet 19.

Above the casing is an outlet 21 leading to a suitable suction fan (not shown) and provided with spray condensing means 22 for recovering fine lead entrained with the escaping steam. Means 23 remove condensed water and entrained lead. Drain 24 may be used to remove condensed water from the chamber. In case it is desired to maintain a body of water in the chamber, overflow 25 may be used.

In Fig. 2 the structure of the atomizing device (9) is shown in more detail. Duct 26 leads from the lead kettle to contracted orifice 27. Duct 28 supplies superheated steam (from 11) to annular chamber 29, and annular nozzle 30 feeds the superheated steam into proximity to the lead jet and around the same. Immediately beyond the jet nozzle is an expansion chamber 31 into which may lead supplemental steam jets 32 best arranged to discharge close to the chamber walls. Instead of leading in these supplemental steam jets parallel to the axis of the expansion chamber as shown, they may make any desired angle therewith. Where the jets are thus angularly disposed a swirling flow of steam along the walls of the expansion chamber is produced which is distinctly advantageous under certain conditions.

The operation of the foregoing structure is obvious. Lead melted in kettle 6 is allowed to flow by 7 through duct 26 and out-

let 27. Steam superheated in 10 passes by 11 to chamber 29, and thence escapes through 30 in proximity to an atomizing lead jet from 27, and through 32 along the walls of chamber 31. A limited expansion in 31 is permitted without sufficient expansion to cause undue cooling, the envelop of steam from the supplemental steam jets along the chamber walls being especially effective in preventing temperature drop during such expansion. During this first expansion it is desirable not to let the temperature drop enough to solidify the lead. In this chamber 31 the atomization is perfected, the compound jet of lead and superheated steam coming from 27 and 30 expanding disruptively. The comminuted lead and the steam pass through 31 into the collecting chamber. The coarser particles of lead, which are inevitably formed, drop on 13 and are removed from time to time through 14. Ordinarily the amount of coarse particles formed in the present process is relatively small, requiring comparatively infrequent removal. The finer lead passes onward with the steam jet and settles more slowly. As superheated steam is being led into the chamber and there is no cooling in the chamber, the atmosphere in the chamber is heated. In order to permit controlled oxidation when desired a regulable amount of air or air containing oxidants is fed in through 18. The excess of steam and air passes off through 21, while 22 gives sufficient condensation to remove and recover entrained lead.

By introducing the air from 18 as shown at a lifting angle to lead jet 19, the finer grades of atomized lead and lead oxid will collect in part on the walls and roof, whence they may be dislodged and removed from time to time. Where desired, depending walls or baffles may be used to increase the amount of lead so collected. The chamber may contain a body of hot water into which the rest of the lead drops. If not and the fallen material cakes, a water spray may be turned on it occasionally.

Unless air be excluded from the chamber, as when the object is to make finely divided lead, the very fine material produced by atomization in the way described, oxidizes very rapidly when kept just moist; and particularly in the presence of ozone or air containing nitrous gases.

What I claim is:—

1. In the comminution of lead, the process which comprises atomizing a jet of molten lead with a jet of superheated steam, allowing a regulated expansion in a mixing chamber, delivering the steam and lead into a collecting chamber and collecting the atomized lead.

2. In the comminution of lead, the process which comprises atomizing a jet of molten lead with a jet of superheated steam, al-

lowing a regulated expansion in a mixing chamber, delivering the steam and lead into a collecting chamber in the presence of a regulated amount of air and collecting the atomized lead.

3. In the comminution of lead, the process which comprises atomizing a jet of molten lead with a jet of superheated steam, allowing a regulated expansion in a mixing chamber, delivering the steam and lead into a collecting chamber in the presence of a regulated amount of air containing active oxidants and collecting the atomized lead.

4. In the treatment of lead the process which comprises producing a jet of atomized lead in an atmosphere of steam by means of a current of superheated steam and delivering limited and regulated amounts of air to said jet subsequent to its formation.

5. In the comminution of lead, the process which comprises atomizing lead by superheated steam and oxidizing by a regulated amount of air containing active oxidants in an atmosphere of steam.

6. In the comminution of lead, the process which comprises forming concentric jets of molten lead and superheated steam, contacting the same to permit atomization, delivering the mixture into a chamber of limited diameter to permit a regulated expansion and delivering the expanded and atomized mixture into a collecting chamber.

7. In the comminution of lead, the process which comprises atomizing lead into a collecting chamber through an inlet and separately collecting the coarser lead near said inlet and the finer lead at a point removed therefrom.

8. In the comminution of lead, the process which comprises delivering comminuted lead into an atmosphere of steam by superheated steam and simultaneously feeding a limited and regulated amount of air into said atmosphere.

9. In the comminution of lead, the process which comprises delivering comminuted lead into an atmosphere of steam by superheated steam and simultaneously feeding a limited and regulated amount of air containing active oxidants into said atmosphere.

10. In the comminution of lead, the process which comprises atomizing a jet of molten lead by a jet of superheated steam, and maintaining an envelop of superheated steam around the said jets during the completion of such atomization.

11. In the oxidation of lead, the process which comprises forming a jet of atomized lead and directing thereagainst a gaseous current containing oxygen in a highly reactive condition.

12. In the oxidation of lead, the process which comprises atomizing lead with a horizontal jet of superheated steam, delivering

the combined jet into a collecting chamber and delivering a lifting jet of air beneath said combined jet.

13. In the oxidation of lead, the process which comprises atomizing lead with a horizontal jet of superheated steam, delivering the combined jet into a collecting chamber and delivering a lifting jet containing active oxidants beneath said combined jet.

14. In a lead treating device, means for atomizing lead, means for supplying molten lead thereto, means for supplying superheated steam thereto, means beyond the atomizing device for permitting a limited expansion of the jets from the atomizing means and collecting means in communication with said regulated expansion means.

15. In a lead treating device, a jet nozzle, means for supplying molten lead thereto, means for supplying superheated steam thereto, an expansion chamber of small diameter beyond the jet nozzle and a collecting chamber beyond the expansion chamber.

16. In a lead treating device, a furnace, a lead kettle in said furnace, means for superheating steam, a lead-atomizing nozzle suitably connected to said lead kettle and to said superheating means, an expansion chamber of small diameter extending beyond said nozzle, and auxiliary means for heating said expansion chamber.

17. In an apparatus for comminuting lead, a receptacle to contain molten lead, a collecting chamber adapted to receive comminuted lead, a lead-atomizing means connecting said receptacle and said chamber, said atomizing means being rigidly attached to said receptacle but being free to move relative to said chamber.

18. In an apparatus for comminuting lead, a container for molten lead, a collecting chamber adapted to receive comminuted lead, means for spraying molten lead into said collecting chamber, means for removing finely comminuted lead from said chamber, and means in said chamber for separately collecting coarsely comminuted lead.

19. In an apparatus for comminuting lead, a melting kettle, a collecting chamber for receiving comminuted lead, means for atomizing lead suitably connected to said melting kettle and discharging into said collecting chamber, means for controlled admission of air to said chamber, and lead-entrapping means for withdrawing air and vapor from said chamber.

20. In an apparatus for comminuting lead, a melting kettle, a lead-atomizing nozzle, a conduit supplying molten lead from said kettle to said nozzle, means for supplying superheated steam to said nozzle, a collecting chamber to receive comminuted lead discharged from said nozzle, means for removing lead and water from said chamber, a vapor exit leading from said cham-

ber, and condensing lead-entrapping means disposed in said exit.

21. In an apparatus for comminuting lead, a melting kettle, a lead-atomizing nozzle, a conduit supplying molten lead from said kettle to said nozzle, means for supplying superheated steam to said nozzle, a collecting chamber to receive comminuted lead discharged from said nozzle, means for removing lead and water from said chamber, a vapor exit leading from said chamber, and means in said exit to prevent the escape of fine particles of lead entrained in the vapors leaving said chamber.

22. In an apparatus for comminuting lead, a lead-atomizing device comprising a nozzle having separate channels for molten lead and for superheated steam, an expansion chamber of restricted diameter extending beyond said nozzle to permit limited

ed expansion of steam, and means for maintaining the walls of said expansion chamber at substantially the temperature of superheated steam.

23. In an apparatus for comminuting lead, a lead-atomizing device comprising a nozzle having separate channels for molten lead and for superheated steam, an expansion chamber of restricted diameter extending beyond said nozzle to permit limited expansion of steam, and means for maintaining a layer of superheated steam close to the walls of said expansion chamber.

In testimony whereof, I affix my signature in the presence of two subscribing witnesses.

CLIFFORD D. HOLLEY.

Witnesses:

J. H. PEPIN,

C. A. PROTIVA.