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METHOD AND APPARATUS FOR REDUCING METAL TO A FINELY DIVIDED CONDITION.

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1,306,060.

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Fig. 1.

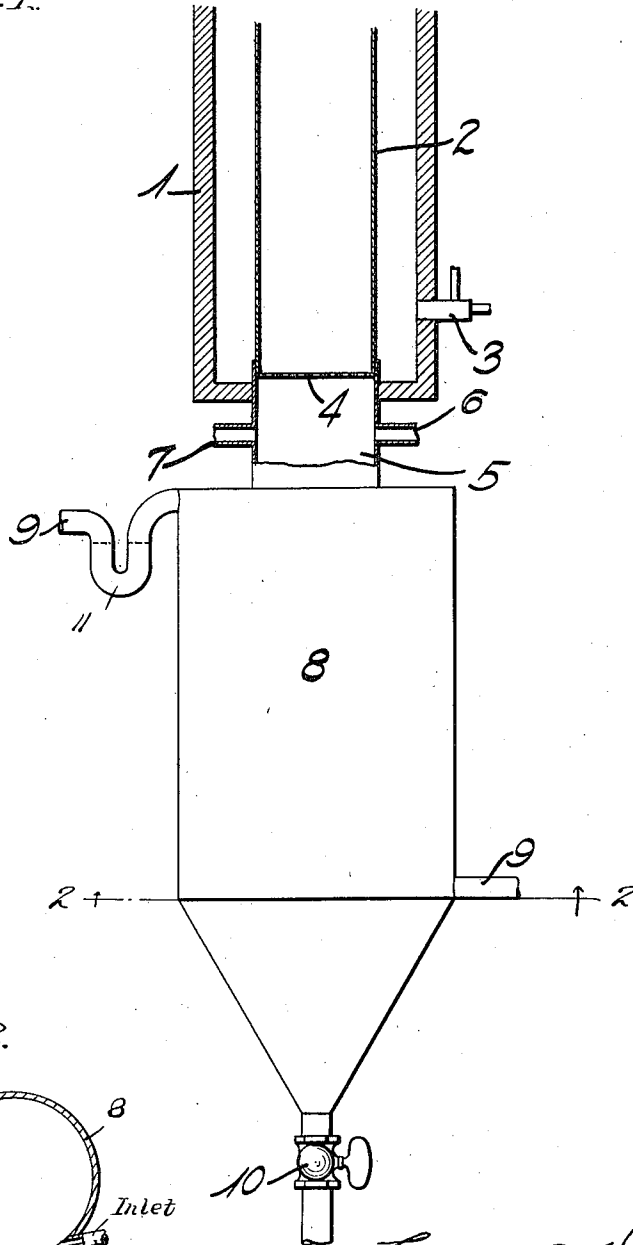
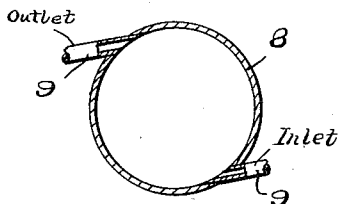


Fig. 2.



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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR REDUCING METAL TO A FINELY-DIVIDED CONDITION.

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Specification of Letters Patent.

Patented June 10, 1919.

Application filed August 28, 1916. Serial No. 117,162.

To all whom it may concern:

Be it known that I, EVERETT J. HALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Reducing Metal to a Finely-Divided Condition, of which the following is a specification.

10 This invention relates to a method and apparatus for reducing metals to a finely divided or powdered condition such as is required for certain technical purposes.

15 One of the objects of the invention is to accomplish the result stated above in a substantially continuous operation, and without danger of oxidation, combustion or explosion of the metal under treatment, and with desirable uniformity of product.

20 Other objects and aims of the invention will be in part obvious and in part specifically referred to in the course of the following description of the elements, combinations, arrangements of parts, and applications of principles constituting the invention; and the scope of protection contemplated will appear from the claims.

25 In the accompanying drawings, which are to be taken as a part of this specification, and in which I have shown a form of embodiment of apparatus well adapted for use in the carrying out of my new process, Figure 1 is a sectional view, with parts in elevation, and Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, looking in the direction of the arrows.

30 Referring to the numerals on the drawings, there is shown at 1 a furnace of suitable construction, within which is supported a crucible 2. The inlet for flame or combustible gases for the heating of metal within the crucible is indicated at 3. The bottom of the crucible is distinguished by the numeral 4, and it is intended that molten metal within the crucible shall drop through the perforations in the bottom 4 in the form of globules, or in fine streams; and of course the perforations will have to be properly spaced so that the globules or streams will not run or fuse together after passing through the perforations, while the size of the perforations will determine somewhat the size of the globules or streams.

35 Below the bottom 4 there is a chamber 5, into which there is an inlet 6 for a protect-

ing gas, such as chlorin, and from which chamber there is an outlet 7 for such protecting gas. Obviously, the particles of metal dropping from the bottom 4 of the crucible will pass through the protecting gas in the chamber 5, and the gas should be continuously changed to avoid overheating and to accomplish the preliminary cooling of the metal particles; this cooling of the particles is effected without access of air, and consequently without danger of oxidation, combustion, or explosion.

Below the chamber 5 there is a closed receptacle 8, into which the chamber 5 opens, and this receptacle 8 has a tangential inlet and a tangential outlet 9 for some protecting liquid such as kerosene. Preferably the inlet is toward the bottom of the receptacle and the outlet near the top, so that particles dropping from the perforated bottom 4, through chamber 5 and into receptacle 8 are gradually cooled as they pass to the bottom of receptacle 8, since of course the liquid in the receptacle 8 will be hot at the top and cool at the bottom, relatively. The tangential inlet and outlet give a rapid whirling circulation of the protecting liquid within the receptacle, and the liquid is preferably under sufficient pressure so that this rapid whirling assists in the disintegration of the metal, partially accomplished by the dropping of the particles into and through the relatively cool fluids in chamber 5 and receptacle 8. The protecting and cooling medium or liquid in receptacle 8 must certainly be supplied in sufficient volume to prevent it reaching boiling or decomposition temperature, and it is preferred to keep the temperature well below such point for the sake of greater cooling effect. Preferably the receptacle with its inlet and outlet are in a closed circuit including a pump, or other forcing means, and in the outlet there may be a liquid seal in the form of an ordinary trap 11, to prevent the escape of any of the gas from chamber 5. Numeral 10 indicates a draw-off valve or outlet from which the disintegrated metal in the liquid seal receptacle 8 may be at intervals or continuously removed, passing thence to a screen or separator in order that the accompanying protecting liquid may be recovered and returned to the protecting liquid circulating system. The disintegrated metal may now be reduced to a still more finely divided condition by

grinding it under oil or some other oxidation-preventing liquid or fluid, after which the powdered metal is separated from the protecting liquid or fluid and properly dried.

- 5 Inasmuch as many changes could be made in the above construction, and many apparently widely different embodiments of my invention could be made without departing from the scope thereof, it is intended that
10 all matters contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might
15 be said to fall therebetween.

I claim:

1. The method which consists in continuously passing particles of molten metal through a body of protecting gas and thence
25 into and through a body of protecting liquid, said bodies of gas and liquid being continuously renewed.

2. The method which consists in passing particles of molten metal through a body of
30 protecting gas and thence into and through a body of protecting liquid, and maintaining said protecting liquid below a predetermined temperature.

3. The method which consists in passing
35 particles of molten metal through a body of protecting gas and thence into and through a rapidly whirling body of protecting liquid.

4. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber
40 for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, a gas inlet to the chamber, and a liquid inlet to the liquid receptacle.

- 45 5. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, gas inlets and outlets for the chamber, and liquid inlets and outlets for the liquid receptacle, the liquid outlet of said liquid receptacle having a liquid seal therein.

6. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber
55 for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, a gas inlet to the chamber, and a liquid inlet to the liquid receptacle, said liquid inlet being disposed tangentially to the adjacent wall of the receptacle.

7. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber
60 for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, a gas inlet to the chamber, and a liquid inlet to the liquid receptacle, said liquid receptacle having also a valve controlled outlet at its bottom.

8. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber
65 for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, gas inlets and outlets for the chamber, and liquid inlets and outlets for the liquid receptacle, the liquid outlet of said liquid receptacle having a liquid seal therein.

9. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber
70 for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, gas inlets and outlets for the chamber, and liquid inlets and outlets for the liquid receptacle, said liquid inlet being at the lower portion of the liquid receptacle, and the liquid outlet being at the top thereof.

10. The combination of a receptacle for holding a supply of molten metal, a perforated bottom for said receptacle, a chamber for which said perforated bottom constitutes the top, a liquid receptacle into which said chamber opens, gas inlets and outlets for the chamber, and liquid inlets and outlets for the liquid receptacle, the liquid outlet of said liquid receptacle having a liquid seal therein.

In testimony whereof I affix my signature.

EVERETT J. HALL.