Dec. 1, 1931. J. H. DAVIS 1,834,687

MANUFACTURE OF POWDERED METALS

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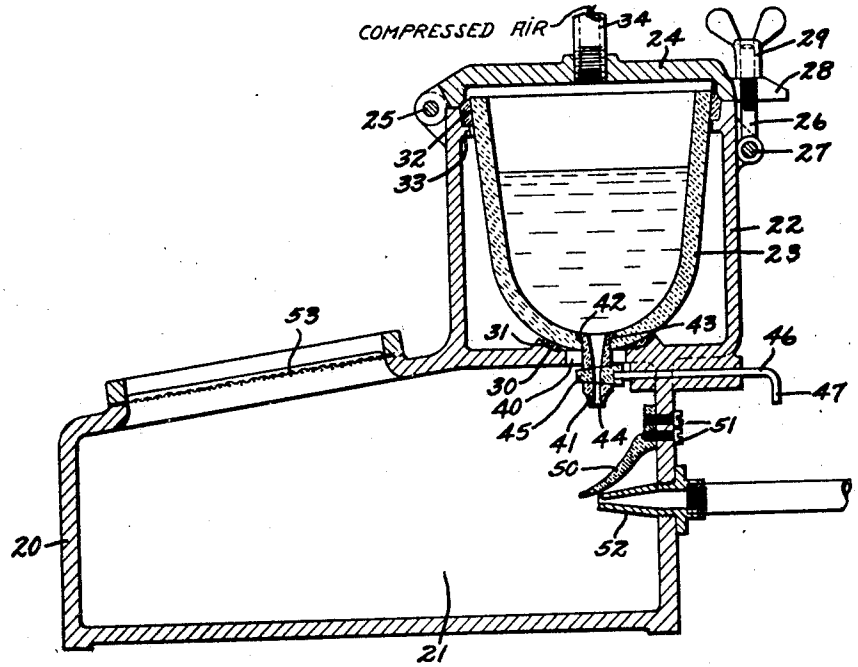


Fig. 1

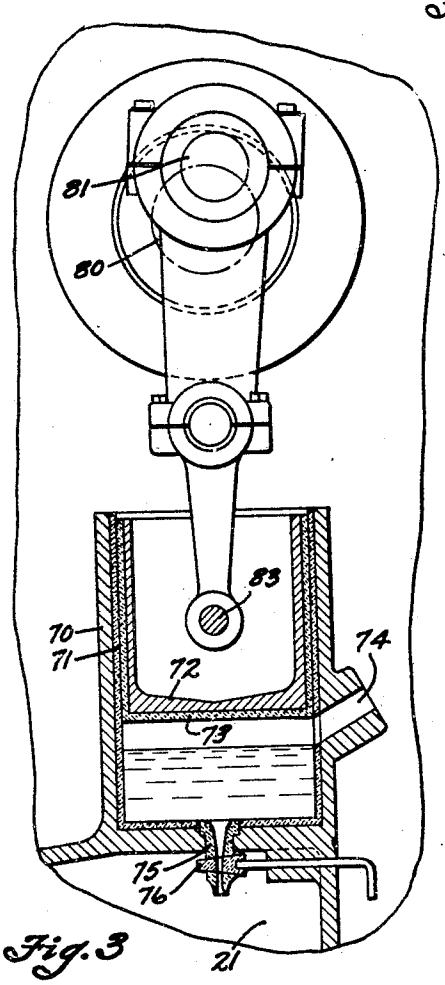


Fig. 3

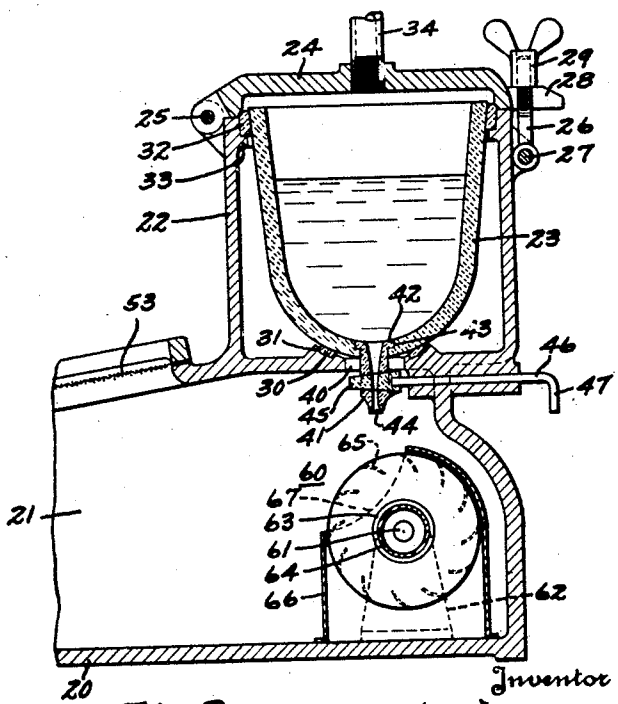


Fig. 2

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UNITED STATES PATENT OFFICE

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MANUFACTURE OF POWDERED METALS

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This invention relates to a method of and apparatus for manufacturing metal powders.

The principal object of the invention is to devise an improved method of making metal powder from metal scrap or other forms of metal, and to provide an improved form of apparatus for carrying out the method, so as to reduce the cost of manufacture and improve the product formed.

In the formation of machine bearings from powdered materials according to the method set forth in the patent to H. M. Williams, 1,642,347, a mixture of various materials is used, the principal ingredient being powdered copper. It is of primary importance in the manufacture of bearings of the type described in the Williams patent to obtain the copper powder as cheaply as possible, and one of the more specific objects of this invention is to devise a method of and apparatus for the manufacture of copper powder from scrap copper, although the invention is in no way limited to the production of any particular metal in powdered form.

With the above objects in view, a feature of the invention resides in the method of manufacturing metal powder which consists in forcing molten metal through a small orifice into an atmosphere of lower temperature than the metal, directing the metal against a baffle and blowing a blast of air through the spray of atomized metal before or after contact with the baffle, to further break up the metal.

A further feature of the invention resides in the provision of a suitable apparatus for carrying out the above method.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a longitudinal section of a preferred form of apparatus for carrying out the invention.

Fig. 2 is a similar view of a modified form of apparatus in which the molten metal is forced against a movable baffle.

Fig. 3 is a fragmentary sectional view of a modified form of apparatus for carrying out the invention.

Referring to Fig. 1 of the drawings, the reference numeral 20 designates a casing forming a chamber 21 which constitutes a receptacle for the powdered metal. Integral with and projecting upwardly from the casing 20 is another casing 22, in which is received a vessel 23, which is adapted to contain molten metal. The casing 22 is provided with a lid 24 hinged at 25 which may be opened to fill the vessel 23. A latch bolt 26, pivoted at 27, is adapted to engage between lugs 28 projecting from the lid and a set screw 29 may be adjusted to hold the latch in latching position.

The vessel 23 when in the casing 22 rests on a washer 30 of asbestos packing or other suitable material, positioned in a groove 31, formed in the bottom of the casing 22 and the upper edge of the vessel engages a similar packing washer 32, positioned around the interior of the casing 22 at the top thereof. The lower edge of the washer engages a shoulder 33, projecting inwardly from the wall of casing 22 and the top of the washer projects above the edge of casing 22 in position to be engaged by lid 24, when the latter is closed to form a tight joint. A pipe 34 leads to a source of compressed air.

A hole 40 is provided at the center of the bottom wall of the casing 22 and projecting through said hole into the chamber 21 is a nozzle 41. The nozzle is provided with a flange 42 engaging in a corresponding recess 43 in the bottom of vessel 23, and a passage 44 in the nozzle allows metal to flow from the vessel 23 into chamber 21 when a plug valve 45 controlling the passage is open. The valve is provided with a stem 46 extending through a boss on the wall of casing 20 to the outside of such casing where it is provided with a handle 47 for manual operation of the valve.

Situated in chamber 21, immediately below the nozzle 41, is a baffle 50 against which material issuing from the nozzle 41 will impinge. This baffle is in the form of a curved plate projecting from the casing 20 at an angle to the axis of the nozzle, and is secured

to the casing by screws 51. An air blast nozzle 52 is screwed into the casing 20 below the baffle and the tip of the nozzle projects within the casing 21 to a point immediately below the end of the baffle 50. This nozzle is adapted to be connected to a pipe extending to a compressed air supply and the nozzle is so positioned that the blast of compressed air from the nozzle will be directed against the lower end of the baffle and through material discharged from the nozzle 41 just as such material leaves the surface of the baffle 50.

A fine screen 53 is positioned in the top wall of casing 20 which permits escape of air from the chamber 21 but prevents the passage of any of the metal powder. This screen may be made of any material having a fine enough mesh to prevent the passage of the metal particles.

The above described apparatus operates as follows:

The vessel 23 may be filled with scrap copper or whatever metal it is desired to convert to powdered form. The lid 24 may then be closed and the vessel 23 heated to melt the metal therein. The heating means may be of any desired form and, since the heating means forms no part of the invention, no particular form of heating means is disclosed. Instead of melting the metal in vessel 23, such metal may be melted elsewhere and poured into the vessel while in a molten state.

When the vessel 23 is filled with molten metal, compressed air is admitted through pipe 34 and the valve 45 is opened to allow flow through the nozzle 41. The molten metal is discharged at high velocity into the air in chamber 21, which is at considerably lower temperature than the molten metal. As the molten metal is sprayed from the nozzle it is broken up into relatively small particles. The particles of molten metal strike against the baffle 50, the impact acting to break up the metal into smaller particles than it is possible to obtain by the atomizing action of the nozzle alone. In addition to the action of the baffle the stream of air at high pressure which is directed by the nozzle 52 against the particles as they leave the baffle 50, effects a still further breaking up of the metal powders.

The metal which issues from the nozzle is atomized and more or less in the form of a spray of molten metal particles. These particles are still in a molten state when they strike the baffle 50, and while the baffle might be unheated and the air entering the nozzle 52 might be cold, it is possible that the particles of molten copper would stick to the baffle to some extent at the beginning of the operation until the baffle was heated by the copper itself sufficiently to prevent this action. It is accordingly preferable to heat the baffle sufficiently to prevent the molten copper particles sticking thereto at any time and better results are obtained when heated air is admitted through nozzle 52. The baffle may be heated by any suitable heating means, as for instance an electric heater, or the baffle may be heated by the air admitted through nozzle 52 when hot air is employed. The air passing through the nozzle is directed against the lower end of the baffle and will heat the baffle sufficiently to prevent the molten metal sticking thereto. While other heating means might be employed, the specific means for heating the baffle forms no part of this invention and no heating means other than nozzle 52, which may be connected to a source of hot air, is disclosed.

The nozzle 41 must also be heated to prevent the molten metal chilling within the nozzle and stopping the passage therethrough. The nozzle may be heated by any suitable means such as an electric heater, or if hot air is admitted through the nozzle 52, such air will heat the nozzle sufficiently to prevent stoppage. Moreover, the nozzle is heated to a considerable degree by contact with the crucible.

Because of the high temperature of molten copper it is necessary that the vessel 23 be a crucible of some suitable refractory material such as graphite or other refractories, while other parts which are in engagement with the metal, such as the nozzle 41, valve 45 and baffle 50, must be of refractory material also.

The modified form of apparatus shown in Fig. 2 is exactly the same as that disclosed in Fig. 1 with one exception. The baffle 50 and air blast nozzle 52 have been eliminated in the modified structure and a different device for assisting in the atomization of the molten metal has been provided. In the modified apparatus a blower indicated in its entirety by the reference numeral 60 is rotatably mounted immediately below the nozzle 45. The blower is in the form of a hollow drum, one end of which is secured to a shaft 61 journalled in an upright standard 62 fixed on the bottom wall of the casing 20. The opposite end of the drum is provided with projecting flanges 63 surrounding a central opening into which projects a pipe 64 which extends through one of the side walls of the casing 20, the pipe being secured in said wall by any suitable means. This pipe serves the double purpose of admitting air from outside of the casing to the interior of drum 60, and providing a support on which one end of the drum rotates. The periphery of the drum is provided with fan blades 65 which draw air from outside the casing through pipe 64 and force such air outwardly between the blades as the drum is rotated. A casing 66 entirely surrounds the drum except where the drum projects through a cut-away portion 67 of such casing. The casing 66 permits the blow-

er to force air into chamber 21 only through the cut-away portion of the casing, the cut-away portion of said casing being so located with respect to the nozzle 45 that the blower forces air through the spray of molten metal issuing from the nozzle. The blower may be driven by an electric motor connected to the shaft 61, or by any other suitable means.

The nozzle 41 and the blower must be heated sufficiently to prevent chilling of the metal particles, on contact therewith, enough to cause the metal to stick to the nozzle or the blades of the blower. The nozzle and blower may be heated by any suitable means and the admission of heated air through pipe 64 will heat these elements sufficiently to effect the desired result. The pipe 64 may be connected to any convenient source of hot air.

In the form of the invention disclosed in Fig. 3, a cylinder 70 is formed integral with the casing 20 and projects above said casing 20, occupying the same position relative to the casing 20 as does the part 22 of casing 20 in the form of the invention shown in Fig. 1. The cylinder 70 is lined with refractory material such as graphite or carborundum as indicated at 71 and reciprocating within the cylinder is a metal piston 72 having an outer jacket 73 of refractory material. A passage 74 is provided in one wall of the cylinder to permit filling with molten metal. A nozzle 75, of the same construction as the nozzle 41, and controlled by a valve 76, similar to valve 45, provides means of communication between the cylinder and the chamber 21.

The piston is reciprocated by any desirable means to force the molten metal through the nozzle 75 when the valve is open and a conventional means for operating the piston is shown in Fig. 3. This means comprises a cam shaft 80 having a crank pin 81 which engages a connecting rod which is connected to the piston through the usual wrist pin 83. The cam shaft is adapted to be driven by any suitable source of power. As the piston descends when the valve 76 is open, a spray of molten metal is forced through the nozzle in the manner set forth in the description of the other embodiments of the invention.

Either the baffle 50 and air nozzle 52, or the blower 60 may be employed in this embodiment of the invention.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. The process of disintegrating metal to form metal powder which consists in converting the metal to a molten state, discharging the metal under pressure while molten through a small orifice to effect atomization of the metal, directing the atomized metal issuing from the orifice against a baffle to further disintegrate the metal and forcing a blast of air through the atomized metal to also break up the metal.

2. The process of disintegrating metal to form metal powder which consists in converting the metal to a molten state, discharging the metal while molten through a small orifice to effect atomization of the metal, directing the atomized metal issuing from the orifice against a baffle to further disintegrate the metal and forcing a blast of hot air through the atomized metal to also break up the metal.

3. The process of disintegrating metal to form metal powder which consists in converting the metal to a molten state, discharging the metal while molten through a small orifice to effect atomization of the metal, directing the atomized metal issuing from the orifice against a baffle to further disintegrate the metal and forcing a blast of hot air against the baffle and through the atomized metal, to simultaneously heat the baffle sufficiently to prevent metal particles sticking thereto and to also break up the metal particles.

4. Apparatus for disintegrating metal to form metal powder comprising, a crucible adapted to contain molten metal, a receiving chamber, a discharge orifice connecting the crucible and receiving member, means for applying pressure to the molten metal in said crucible to force the metal through the discharge orifice at sufficient velocity to atomize it, and a plurality of means for further disintegrating the metal after the atomized metal issues from the discharge orifice, said means comprising a baffle against which the atomized metal issuing from the discharge orifice is adapted to strike and means for forcing air under pressure through the atomized metal.

5. Apparatus for disintegrating metal to form metal powder comprising a crucible adapted to contain molten metal, a receiving chamber, a discharge orifice connecting the crucible and receiving chamber, means for applying pressure to the molten metal in said crucible to force the metal through the discharge orifice at sufficient velocity to atomize it, a baffle in said receiving chamber against which the atomized metal is adapted to strike to further disintegrate the metal and means for heating the discharge orifice and baffle to prevent metal particles adhering thereto.

6. Apparatus for disintegrating metal to form metal powder comprising a crucible adapted to contain molten metal, a receiving chamber, a discharge orifice connecting the crucible and receiving chamber, means for applying pressure to the molten metal in said crucible to force the metal through the discharge orifice at sufficient velocity to atomize it, a baffle in said receiving chamber against which the atomized metal is adapted to strike

to further disintegrate the metal, and means for directing hot air under pressure against the baffle and through the atomized metal to heat the baffle, and also break up the metal.

7. Apparatus for disintegrating metal to form metal powder comprising a crucible adapted to contain molten metal, a receiving chamber, a discharge orifice connecting the crucible and receiving chamber, means for forcing the metal through the discharge orifice at sufficient velocity to atomize it, a constantly moving baffle positioned in the path of the metal issuing from the nozzle to further break up the metal, and means directing air under pressure through the atomized metal to also break up said metal.

8. Apparatus for disintegrating metal to form metal powder comprising a crucible adapted to contain molten metal, a receiving chamber, a discharge orifice connecting the crucible and receiving chamber, means for forcing the metal through the discharge orifice at sufficient velocity to atomize it, and a rotary blower in the path of the metal issuing from the discharge orifice, said blower being provided with fan blades against which the atomized metal is adapted to strike, and means for connecting the blower to a source of hot air, whereby the fan blades are heated sufficiently to prevent metal sticking thereto.

In testimony whereof I hereto affix my signature.

JAMES H. DAVIS.