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APPARATUS FOR MAKING POWDERED METALS

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Fig. 1.

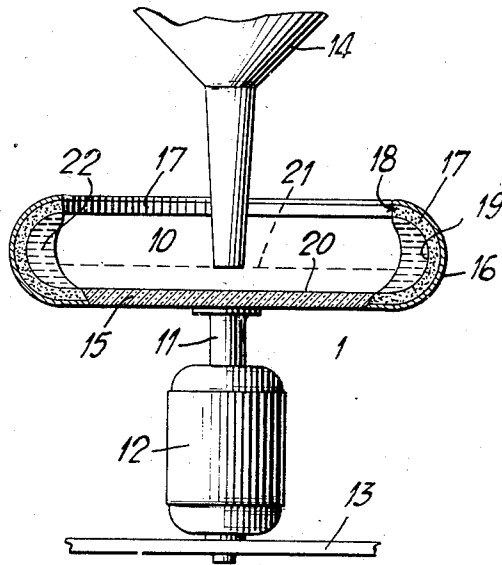
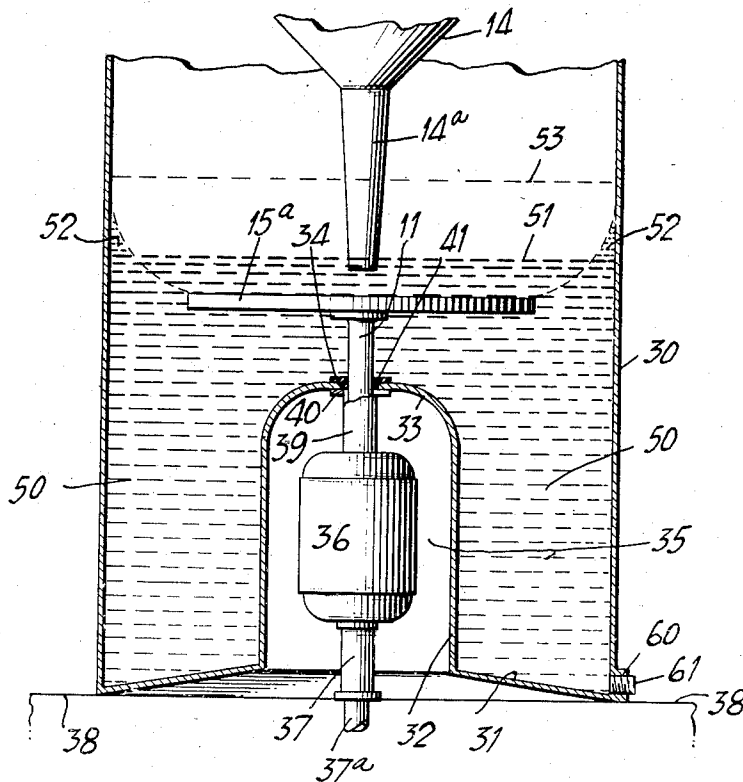


Fig. 2.



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APPARATUS FOR MAKING POWDERED METALS

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5 Claims. (Cl. 83—91)

This invention relates to improvements in powdered metals, and more particularly to an improved method and apparatus for making same.

With the advent of present day developments in forming metallic structures directly from the powdered components without the intervention of fusing and casting steps, a simple, efficient and reliable process for the preparation of the powdered metallic components has been sought.

It is an object of this invention to provide an improved process for the preparation of powdered metals.

It is a further object of this invention to provide such an improved process in which molten metals are dissipated and atomized into a body of cooling fluids.

Yet another object of this invention is the provision of such an improved process in which the molten metal is scattered integrally and in droplet form into a body of cooling fluid.

It is also an object of this invention to provide improved apparatus for forming powdered metals.

These and other desirable objects and advantages of the present invention will be described in the accompanying specification and illustrated in the drawing, forming a part thereof, certain apparatus for carrying out the process of the invention being shown by way of illustration only, for, since the underlying principles may be incorporated in other specific mechanical constructions, it is not intended to be limited to the ones here shown, except as such limitations are clearly imposed by the appended claims.

In the drawing, like numerals refer to similar parts throughout the several views, of which

Fig. 1 is a vertical elevation of a centrifugal apparatus, an associated driving motor and pouring funnel or spout being shown in elevation, and

Fig. 2 is a vertical section through an apparatus showing the centrifugal members disposed within a tank of fluid, the pouring funnel or spout and driving motor being shown in elevation.

Referring more specifically to the drawing, the construction shown in Fig. 1 comprises, generally, a reaction chamber or container 10 mounted for rotation on and about the axis 11 of a motor 12 which is suitably secured to and supported upon a supporting member, indicated generally at 13. Any suitable means of securing the motor 12 to the support 13 may be made use of and will not be described further as the specific means contemplated forms no part of the present invention other than in the combination shown. A pouring funnel or spout 14 of any desired shape may serve

to introduce the molten metal into the member 10 during the casting operation.

The member 10 comprises, generally, a bottom or base plate 15, of any suitable heat resisting composition, and of any desired thickness and shape. To this base is secured, in any desired manner, a rim member 16, generally of semi-circular configuration. The member 15, as already indicated, may be made of any suitable heat resisting material, such as magnesite, and is secured to the shaft 11 in a suitable manner and centrally thereof. The rim 16 may be made of thin metal and is preferably provided with an interior facing of heat resisting material 17 which may be of magnesite or any other such material rammed in place and thereafter baked.

The rim 16 with its associated heat resisting liner 17 is curved inwardly at its free edge, indicated generally at 18, to provide a trough 19 which serves as a retaining member for material forced therein upon rotation of the member 15 about its axis. A body of water, 20, may be introduced into the bottom of the chamber 10 and when the member 10 is in a state of rest will fill the bottom thereof to a desired height, indicated generally at 21. Upon rotation of the member 10 the water 20 will be thrown outwardly into the channel 19 and will form a ring of cooling fluid 22 coextensive with the retaining channel members and configured thereto.

In operation the metal, alloy, or other composition to be powdered is projected upon the rotating plate 15, at the axis thereof, by means of the spout or nozzle of the pouring device 14. The particles of the molten material impinge upon plate 15, at the axis thereof, and are flattened and simultaneously projected outwardly because of the centrifugal effect of the whirling disc 15. In this operation the material is effectively broken up into minute particles, which upon striking the body of the liquid 22 in the channel 19, are immediately cooled. By varying the distance from the outlet end of the nozzle or pouring spout 14 to the plate 15, and by varying the pressure with which the molten metallic material is projected therethrough, any desired particle size may be imparted to the molten material, as it will be readily apparent that with a slow flow of molten material with a low hydrostatic head, larger particles will be formed than will be the case where a stream of material under a relatively greater hydrostatic head is projected against the plate through a greater distance. This very desirable variation in particle size may be of particular advantage in the treatment of

different metallic compositions where the reactions may be dependent upon the particle size, and differential reactions may be controlled by suitably controlling the particle size of the materials used.

With the use of water for a cooling fluid, readily oxidizable metals, such as iron and the like, will be formed in particles having a protective oxidized coat of the oxide formed on the surface thereof. Owing to the speed of cooling from the molten to the solid particulate state, the oxide coating formed will be of substantially infinite thinness and can later be readily removed by heating to low red heat in the presence of an atmosphere of hydrogen, hydrocarbon gases and/or any other suitable and desirable reducing material.

While water has been disclosed as a preferred cooling fluid, it will, of course, be appreciated that a fluid having reducing qualities, in and of itself, may be used. Thus, for example, the fluids used may comprise a mixture of alcohol and water which will serve to reduce any oxide coating formed and which is particularly suited for use with certain of the non-ferrous metals and for alloys such as nickel, copper and the like.

The invention also comprehends the use of cooling fluids made up of emulsions or suspensions of reducing materials in water, to minimize any tendency of the atomized metals, alloys, and metallic compounds generally used to become oxidized. In addition, the chamber or space formed by the member 10 may be protected by a suitable inert or non-reactive atmosphere, such as nitrogen and the like, and the tendency to form undesired coatings on the atomized metal particles thereby minimized or avoided.

Upon completion of the run, the powdered metal will be removed from the basket 10 and purified, if found necessary, in any desired manner, and thereafter used as desired, and more particularly in the processes set forth and described in my prior application, Serial No. 593,883, filed February 8, 1932.

The apparatus just described may be used for general work and the basket or revolving container 10 may be constructed in any desired size, according to the quantity of material to be treated. The motor and associated apparatus will be suitably varied to take care of the container and the quantity of material to be handled therein.

Where any great quantity of powdered metallic material is to be made use of, an apparatus of the type shown in Fig. 2 may be found to give desirable results and meet the requirements for bulk operation. This device comprises generally a retaining tank or member having side walls 30 of any suitable configuration and an outwardly sloping bottom 31 terminating inwardly in a central upstanding tubular member 32 whose top is peened over to form a dome 33 having a central aperture 34. In the well or chamber 35 formed by the member 32 a motor 36 is disposed and is mounted on a bushing or bearing 37, the latter in turn being mounted on a support 38 which also serves as a support for the tank 30. The motor is provided with the usual shaft 11 upon which is axially mounted a plate 15a of any suitable dimensions. A bushing 39 having a flange 40 is disposed over the shaft 11 and abutted against the rim 34 of the dome 33, a gland or washer 41 being fitted thereagainst from the other side of the dome and being so configured and arranged as to hold the shaft 11 rigidly against the inner periphery 34 of the dome. A

suitable pouring device having a spout 14a aligned with the axis of the rotatable plate 15a is provided.

A body of cooling fluid 50 is disposed within the tank and preferably in such an amount that its upper level 51 is disposed above the level of the plate 15a.

Upon rotation of the plate 15a the water disposed thereabove will be forced by centrifugal action towards the edges of the tank forming a meniscus 52 whose upper edge attains a height indicated generally by the level 53. To increase the body of the cooling fluid 52 the plate 15a and the motor may be lowered by means of a shaft 37a, controlled by any suitable mechanism, not shown, the glands 41 preventing leakage of liquid past the motor shaft 11. Outlets 60 may be provided about the bottom periphery of the tank, in any desired manner, and may be provided with closures 61 of any desired type. They may be screw members as shown, or they may comprise gate valves of any desired construction.

The cooling fluid 50 may be composed of water, as indicated above, or any water solution, suspension or emulsion. It may also be composed of any non-inflammable reducing liquid, and if a flammable reducing liquid, such as ligroin, kerosene and any other inorganic or organic medium be used, the space above the level of the liquid in the tank or container may be filled with a non-oxidizing, protective inert and/or reducing gas such as nitrogen, carbon dioxide, hydrogen, carbon monoxide and the like.

It will now be appreciated that by the practice of the principles of the present invention, powdered metallic compositions may be made in any quantity by impinging a molten stream of metal upon the axis of a rotating member which is so configured and arranged that the particulate metal scattered therefrom is immediately contacted with a body of a cooling fluid, which may also include reducing elements, or be itself both a cooling fluid and a reducing agent. The apparatus designed for use with the improved process may be of a variety of types, each of which is simple in construction and economical to manufacture and operate, while at the same time providing for the production of desired quantities of powdered metallic compositions simply, efficiently and at very low cost.

The powdered metals so prepared may be subjected to the action of a gaseous or vaporous reducing agent, before being used, in order to reduce any oxide or other coating formed on the surface of the metal particles.

The particle size of the materials formed may be varied by varying any or all of the following factors: The rate of flow of the material onto the rotating disc; the speed of rotation of the disintegrating disc, and the distance between the nozzle of the pouring spout and the facing of the disc. The greater the distance therebetween, the greater the drop of the metal and the finer the particles formed therefrom.

While the foregoing description has been set forth in general and in detail in respect to specific ideas, it will be understood that changes and modifications may be made therein and that such changes and modifications are to be considered within the scope of the invention as defined in the subjoined claims.

What is claimed is:

1. An improved apparatus for use in making powdered metals, comprising, in combination, a container for molten material, a plate upon 75

which the molten material is adapted to be projected, means for rotating the plate, liquid means comprising a body of liquid in contact with the plate and adapted to be whirled thereby and serve as a cooling medium, and peripheral restraining means for the liquid cooperating with said plate to form therewith a liquid meniscus which rises above the level of the said plate when the latter is rotated.

2. In an apparatus of the character described, in combination, a plate of substantial thickness mounted for rotation about an axis, a peripheral channel member of relatively thin material disposed around the said plate and secured thereto, and a liner of heat resistant material formed within the said channel, the thickness of the said liner and channel approximating that of the said plate.

3. An apparatus for forming powdered metal compositions, comprising, in combination, means for supplying molten material, a subjacent container having side walls and an integral bottom, a recessed portion in said bottom forming a well, a motor and associated supports mounted in the well, a shaft in the motor extending through and slidably associated with the well, a plate mounted for rotation on the end of the shaft and disposed within said container, and a body of liquid in the container normally extending above the top of said plate, and a peripheral restraining means for the liquid cooperating with said plate to form therewith a liquid meniscus which is raised above the level of the plate

and is rotated therewith when the plate is rotated.

4. An apparatus for forming powdered metals from a fused mass thereof, which comprises means to project the fused metal upon a rotatable member, means to confine a body of liquid in contact with the rotatable member and having a normal level above the upper surface of the rotatable member, and means to rotate the rotatable member to effect centrifugal displacement of the body of liquid whereby to form a meniscus of the same in contact and rotatable with the said rotatable member and disaggregation of the fused metal into particulate form when projected by the rotating member into the so-formed meniscus.

5. An apparatus for forming powdered metals from a fused mass thereof, comprising, in combination, a container for the fused material, an outlet for the said container, a receptacle subjacent to the container and containing a body of cooling liquid therein, a plate mounted for rotation and disposed within the liquid in the receptacle, means for rotating the plate to thereby whirl the liquid and form a meniscus of the liquid rotatable by and with the rotating plate for quenching the fused material when projected outwardly from the rotating plate; and peripheral restraining means for the liquid cooperating with said plate to form therewith a liquid meniscus which is caused to rise above the level of the plate when the latter is rotated.

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