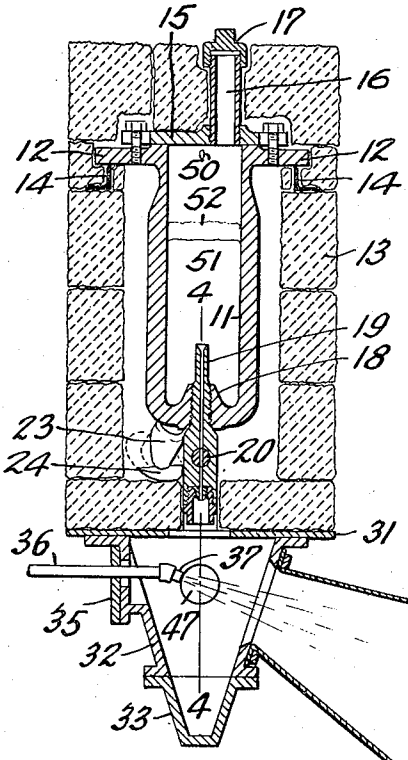
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APPARATUS FOR THE MANUFACTURE OF MAGNESIUM POWDER.

APPLICATION FILED JULY 23, 1917.

1,356,780. Patented Oct. 26, 1920.



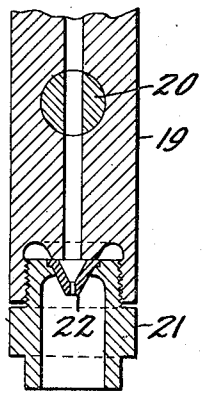


FIG. 2.

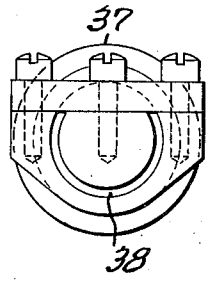


FIG. 3.

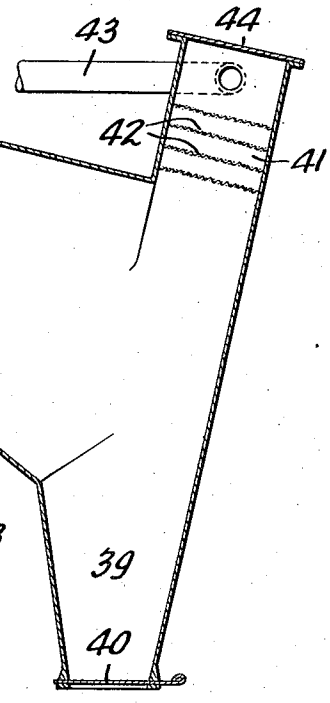


FIG. 1.

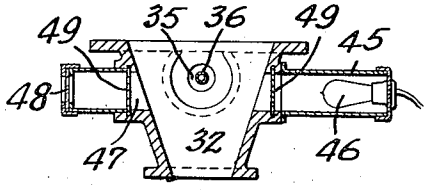


FIG. 4.

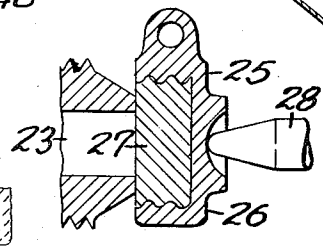


FIG. 6.

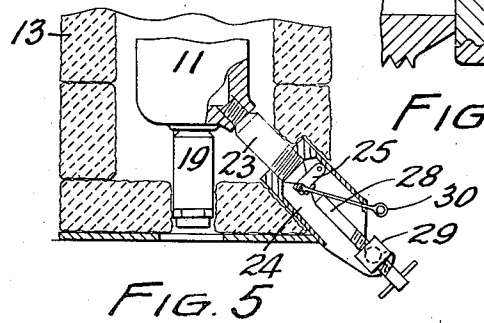


FIG. 5.

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UNITED STATES PATENT OFFICE.

DAVID S. NICOL, OF MONTREAL, QUEBEC, CANADA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN MAGNESIUM CORPORATION, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF NEW YORK.

APPARATUS FOR THE MANUFACTURE OF MAGNESIUM POWDER.

1,356,780. Specification of Letters Patent. Patented Oct. 26, 1920.

Application filed July 23, 1917. Serial No. 182,266.

To all whom it may concern:

Be it known that I, DAVID S. NICOL, a subject of the King of Great Britain, and resident of the city of Montreal, in the Province of Quebec and Dominion of Canada, have invented certain new and useful Improvements in Apparatus for the Manufacture of Magnesium Powder, of which the following is a full, clear, and exact description.

This invention relates to improvements in apparatus for producing magnesium powder, and the object of the invention is to provide a simple, durable and efficient apparatus for the purpose named.

A further object is to provide an apparatus which will produce powder having the individual grains thereof smooth-surfaced, and of substantially uniform size.

A still further object is to provide a device which will produce a large quantity of powder per unit of time and labor employed, and which will be economical in operation.

This apparatus is designed for use in carrying out the process disclosed in my copending U. S. application, Serial Number 182,265, filed July 23rd, 1917.

The apparatus at present used for powdering magnesium consists merely of ordinary turning, milling or sawing machines, which are set to take very fine cut. The cuttings constitute the powder desired, but both the product and the method of producing it have great disadvantages. The powder is not uniform in size or shape, and presents a multitude of knife edges which cause the grains to cling together, so that the powder is not mobile. Furthermore, these edges render the powder readily oxidizable, so that it is not stable in nature. The irregularity of shape of the grains and the immobility of the powder render it extremely difficult to classify for size by screening. A disadvantage of the method of producing powder is the large capital investment for plant necessary to produce a comparatively small amount of powder, and also the large labor cost in the production. To this must be added the constant danger of fire and explosion due to the presence of magnesium dust in the air and on all parts of the plant.

According to the present invention, the apparatus used is simple and inexpensive, and will produce a larger amount of powder of better quality than several machines operating by the old method in any given length of time. The apparatus consists of a crucible in which the magnesium is melted under suitable conditions and discharged in a fine stream into a jet of gas of sufficient velocity to tear the stream of molten metal up into minute particles which are almost instantly chilled. These particles are collected and classified according to size, and are the desired powder. Nitrogen is found to be most suitable for the purpose of disintegrating the metal stream, and the apparatus is therefore constructed to collect the nitrogen for re-use, so that only a small loss due to inevitable leakage is experienced.

In the drawings which illustrate the invention:—

Figure 1 is a vertical sectional view of the apparatus as a whole.

Fig. 2 is an enlarged sectional view of the crucible outlet.

Fig. 3 is a front elevation of the gas pipe nozzle for directing the gas jet.

Fig. 4 is a section on the line 4—4, Fig. 1.

Fig. 5 is a fragmentary vertical sectional view, showing the clean-out of the crucible.

Fig. 6 is an enlarged fragmentary sectional detail view of the clean-out.

Referring more particularly to the drawings, 11 designates a crucible of suitable shape and material having lugs 12, by means of which it is suspended in a suitable furnace 13, the lugs resting on metal bearers 14 in the furnace walls. The crucible is provided with a cover 15 carrying a charging chute 16, which projects through the top of the furnace and is provided with a fluid tight cover 17. It is essential that the joints of the crucible be sufficiently tight to hold hydrogen gas under low pressures. At the bottom of the crucible, a central raised portion 18 is provided, into which the outlet pipe 19 is screwed. This outlet pipe projects some distance above the raised portion 18, so that any dross which may collect in the bottom of the crucible will not enter the pipe. The pipe is provided near its lower end with a valve 20, controlling the discharge of molten metal from the crucible. The lower end of the pipe is provided with a hollow nut 21 holding a nozzle 22, preferably of refractory material, such as graphite. It is preferred to use refractory material at this point rather than metal, as the part is quite small and it

is essential to the continued efficiency of the machine that the bore of the nozzle remain constant. Metal would be subject to corrosion and consequent enlargement. It will be noted that the outlet of the crucible is central, so that flux or slag which usually works down the sides will not approach the outlet, and further so as to be out of alinement with the charging chute 16.

A drain or clean-out is provided for the crucible and comprises a pipe 23 of suitably large bore, screwed at its upper end into the lowest part of the crucible, and at its lower end into a casing 24, within which a valve 25 is pivotally mounted. This valve comprises a metal cup 26 containing a plug 27 of refractory material, such as graphite, which bears against the end of the pipe 23. The valve is held closed by a screw 28, operating in a nut 29 removably trunnioned in the casing 24. A handle 30 is provided to hold the valve up out of the path of material flowing through the drain.

The bottom supporting plate 31 of the furnace carries a depending casing 32 which may be termed the spraying or disintegrating chamber. This chamber is in the form of an inverted pyramid having the part 33 toward the apex removable. This part forms a cup for the collection of material not carried out of the chamber. One side of the casing 32 is provided with a large opening giving access to an inclined laterally projecting chamber 34, which may be termed the collecting chamber. Opposite the collecting chamber, a plate 35 is provided carrying a gas pipe 36 having a nozzle 37, shown in detail in Fig. 3. This nozzle has an arcuate orifice 38 sub-tending an angle of 180° or more. It will thus be seen that a jet issuing from this nozzle is trough-shaped. The nozzle is connected to the pipe 36 at such an angle that the jet issuing therefrom follows approximately the longitudinal axis of the collecting chamber 34 or a path slightly above the axis. At the lower end of the collecting chamber, a sump 39 is provided for the collection of metal powder, which may be removed through a slide 40 at the bottom of the sump. At the top of the collecting chamber is a separating chamber 41 containing screens 42 adapted to separate fine metal dust from the gas used. Above the screens a pipe 43 is provided through which the gas may be drawn off for re-use. A cover 44 is provided for the separating chamber to permit cleaning of the screens 41.

The collecting chamber and the gas pipe occupy opposite sides of the pyramidal casing 32, and the remaining sides are occupied one by a housing 45 containing a suitable illuminating element 46 and the other by a suitable peep-hole 47. The peep-hole is preferably provided with a transparent panel 48 carried a sufficient distance from the chamber to prevent it from becoming clouded. The open ends of the housing 45 and the mounting of the transparent panel 48 are provided with shutters 49 to prevent accumulation of metal powder therein. It will be noted that the peep-hole and light are directly in line with one another, and are in line with the point where the stream of molten metal issuing from the crucible meets the jet of gas from the nozzle 37.

The operation of the device is extremely simple. Magnesium is melted in the crucible and flows out through the pipe 19 when the valve 20 is open, the nozzle 22 determining the size of the stream of molten metal. This stream of metal falls into the trough-shaped jet of gas issuing from the nozzle 37, and is by the velocity of the gas disintegrated or broken up into a multitude of tiny particles which chill and harden almost instantly. This chilling does not occur so rapidly but that the laws of matter assert themselves and the particles of metal assume more or less spherical form. These particles are carried by the jet of gas into the collecting chamber 34 and fall from thence into the sump 39. Minute particles of metal, which are so small as to be practically dust and to remain in suspension in the air for a considerable period of time, are separated from the gas by the screens 42, so that the cleaned gas may be withdrawn from the pipe for compression and re-use. The location of the peep-hole and light enable the disintegrating action to be observed under ideal conditions, so that the velocities of the gas and metal jets may be regulated accurately to produce the desired results. If the metal will not flow out of the crucible with sufficient velocity or in sufficient volume, a pressure of gas may be maintained above the metal, the gas being introduced through the orifice 50. In order to protect the molten metal 51 from the air or other gas used, it is necessary to melt it under a flux 52 which will float on the surface of the metal. The flux used is preferably lithium chlorid. The stream of molten metal falls into the trough-shaped jet of gas, and is first disintegrated by the bottom part of the jet. Spatters of metal which would otherwise be thrown out of the effective zone are caught by the sides of the trough and broken up, so that in this way thorough and uniform disintegration is effected. When it is desired for any reason to clean out the crucible, the screw 28 is loosened to release the valve. The screw and its trunnion nut may then be lifted out of the casing 24 and the valve opened full by means of the handle. While certain details of construction, such as the fluid and metal nozzles, the clean-out, and the inspection arrangements, have been shown and described, it will be understood that the invention is

not limited to the specific form of these details, as variations may be made therein if required. These details have, however, been tried out and found satisfactory.

Having thus described my invention, what I claim is:—

1. In a device of the class described, a crucible having an outlet, a disintegrating chamber below said outlet, a collecting chamber associated with the disintegrating chamber, means in the disintegrating chamber for directing a jet of fluid against molten metal emerging from the crucible, and a removable cup located in the lower part of the disintegrating chamber and below the crucible outlet and adapted to receive any disintegrated metal.

2. In a device of the class described, a crucible having an outlet, a disintegrating chamber below said outlet, a collecting chamber associated with the disintegrating chamber, means in the disintegrating chamber for directing a jet of fluid against molten metal emerging from the crucible, diametrically opposed glazed openings provided in said disintegrating chamber alining with the meeting point of the metal and fluid.

In witness whereof, I have hereunto set my hand.

DAVID S. NICOL.