

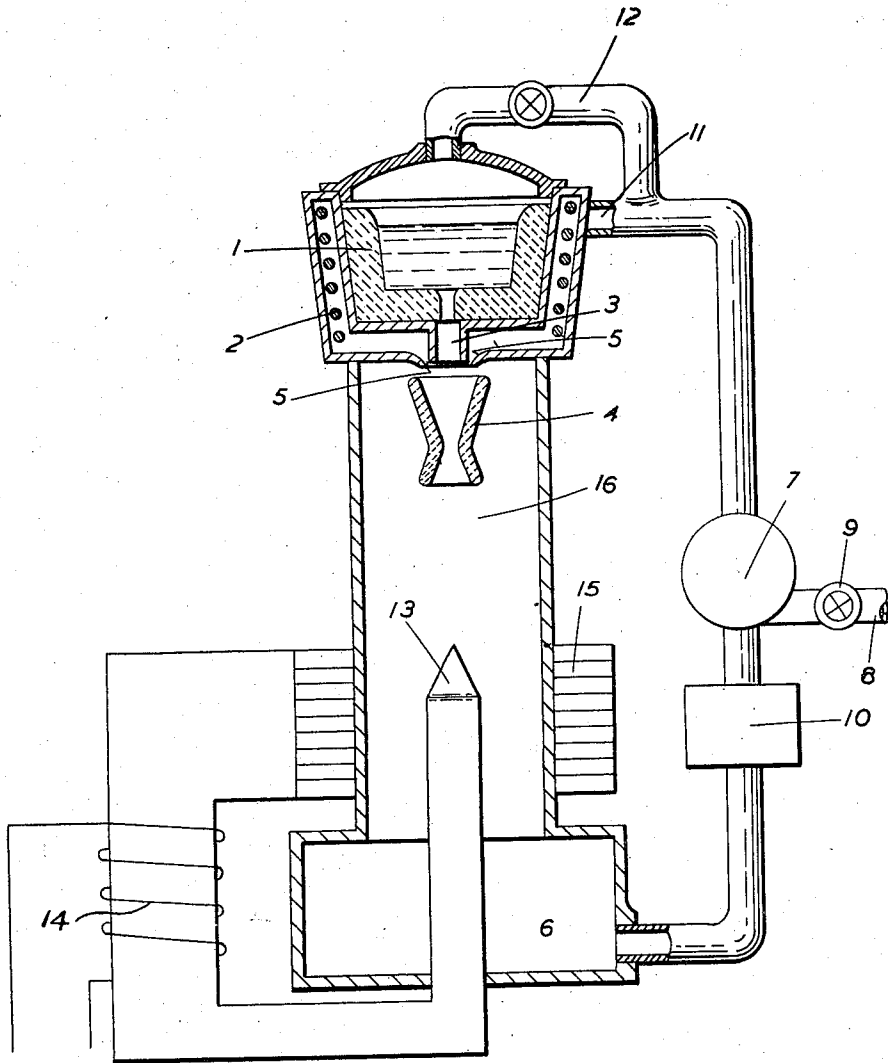
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REDUCTION OF METALS TO POWDERED OR GRANULAR FORM

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REDUCTION OF METALS TO POWDERED OR GRANULAR FORM

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1 Claim. (Cl. 83—91)

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This invention relates to the reduction of metals to powdered or granular form and comprises a method of and means whereby this desideratum can be accomplished. The invention is particularly applicable for the powdering, granulating, or atomising of metals or alloys of high melting point and metals of great ductility which are difficult to pulverise mechanically.

The invention consists broadly of an improved process for reducing metals to powdered or granular form according to which a stream of the metal in molten condition is caused to pass in contact with a blast of gaseous fluid.

More specifically the invention comprises the use in the process of a gaseous fluid which is neutral or inert where it is desired that the powder and granules shall remain of the same chemical composition as the metal being treated or of such a character as will combine with the metal to form powder or granules of a compound of the metal and the gaseous fluid.

The invention further contemplates the use, in some cases, of hydrogen or other reducing gas.

The invention further comprises the apparatus by means of which the process can be carried out, an example of which is illustrated in the accompanying diagrammatic drawing.

In carrying out the invention the metal to be powdered or granulated is brought to molten condition in a refractory crucible 1 heated for example by an electric induction heating coil 2. The molten metal passes in a thin stream through the orifice 3 to and through a Venturi nozzle 4 of refractory material. In its passage from the orifice 3 it is subjected to the action of a blast of fluid, for example a neutral gas issuing at high velocity through an annular nozzle 5 or it may be a ring of jets which may be so directed as to give the gas stream a whirling motion. The Venturi nozzle being of refractory material will serve to maintain the temperature of the metal and the Venturi action will increase the atomising effect of the gas.

The metal reduced to powder or granular form by the action of the blast passes from the Venturi nozzle and is deposited in the receiver 6 which may contain a cooling fluid which may have non-oxidizing or other protective properties, from which it can be removed from time to time. The numeral 7 designates a pump by which the gaseous fluid is circulated. In the case where a neutral gas is employed the gas is introduced through the pipe 8 under control of the valve 9 and when sufficient gas has been introduced into the system the valve 9 is closed and the gas con-

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tained in the system circulated continuously, a filter and purifier 10 being preferably employed to prevent any particles getting into and impairing the action of the pump, and to remove gaseous impurities. The gas passes to the nozzle 5 by way of the pipe 11. A branch 12 is led to the top of the crucible 1 so that gas pressure can be utilised when desired to assist in discharging the molten metal through the orifice 3.

In cases where a reacting gas such as air or oxygen is used in the process and combines with the metal to form powder or granules of a metallic compound of the metal and the gas, the gas will, of course, need to be continuously supplied to the pump inlet pipe 8 and the valve 9 will be left open.

Where the metal being treated is an alloy containing ferrous metal and it is desired to separate off the ferrous constituent, a magnetic system can be employed such as indicated in the drawing wherein 13 indicates one pole of an electro-magnet energised by a coil 14, the other pole of the magnet being constituted by the ring 15 surrounding the vertical stack 16 of the apparatus.

It is to be understood that the foregoing specific description is given by way of example only, because except for the essential condition of subjecting a stream of molten metal to a blast of gaseous fluid, which must be observed, the conditions and precise requirements may vary considerably. In some cases for example it may be desirable that the gaseous fluid should be cooled instead of preheated and in cases of preheating it may in some cases be advantageous to raise the temperature of the gas above the melting point of the metal. Moreover, by providing the vertical stack 16 with varying temperature zones, either by applying suitably disposed heating or cooling elements, the falling powder or granules may be subjected to special heat treatment in their passage to the receiver 6.

These heating or cooling elements may encircle the vertical stack 16 which may be suitably restricted in area in order to maintain the temperature in any particular zone substantially regular and homogeneous.

It is to be noted that an important advantage of the method hereinbefore described lies in the complete fusion of the metal or alloy before contact with the gaseous fluid, thus eliminating any possibility of the metal being subjected to the action of the gaseous stream while in a semi-fluid state resulting in irregularity in the size and shape of the particles as would occur, for

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example, if the metal were merely sprayed from a pistol type apparatus. Heretofore, it has been known to spray metals by contact with a flame with or without the presence of a gaseous jet for spraying the metal in a pistol type apparatus. In such cases the metal has been frequently driven off in a semi-fluid state with the result that the particles formed tend to be of an irregular size and shape.

What I claim and desire to secure by Letters Patent is:

Apparatus for subdividing metals comprising

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an elongated closed chamber, means including a nozzle at one end of said chamber for injecting a solid stream of molten metal into said chamber, means including a nozzle for impinging a stream of gas against said stream of metal, a Venturi nozzle within said chamber and spaced apart from the first and second named nozzles and alined therewith, means at the other end of said chamber for separating subdivided metal from gas and means for returning the separated gas to the second named nozzle.

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