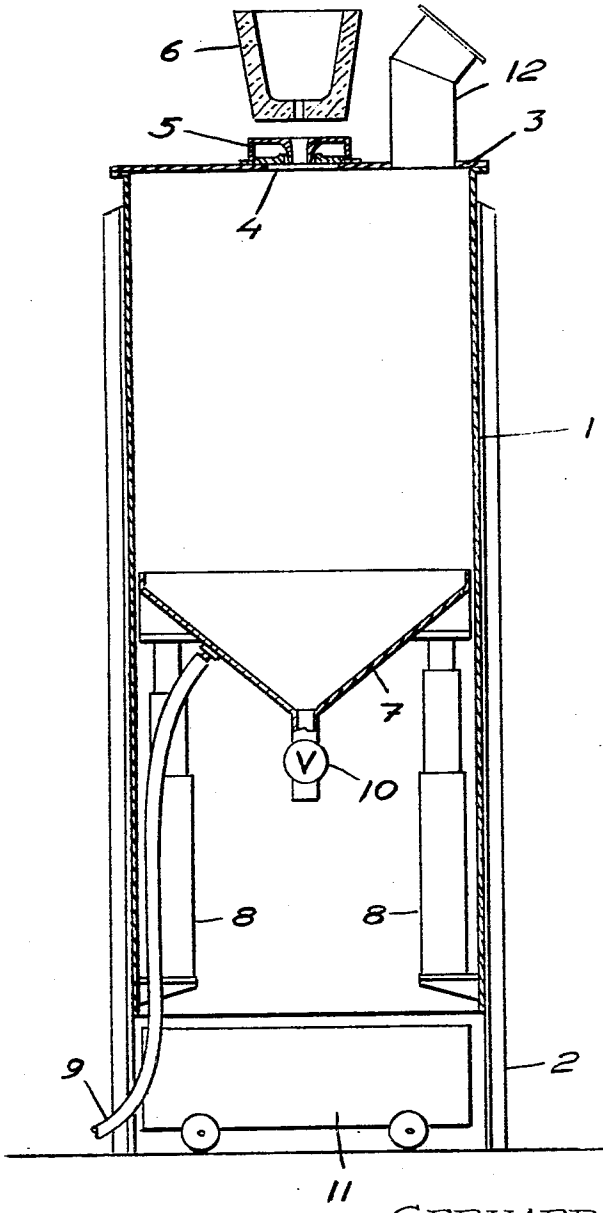
Nov. 28, 1961 G. NAESER ET AL 3,010,819

PROCESS AND APPARATUS FOR THE PRODUCTION OF POWDERED METAL

Filed June 8, 1959



INVENTORS
GERHARD NAESER
WERNER SCHOLZ
ELIS ERIK VILHELM HELIN
BY Cameron, Kerkam & Sutton
ATTORNEYS

United States Patent Office 3,010,819 Patented Nov. 28, 1961

3,010,819

PROCESS AND APPARATUS FOR THE PRODUCTION OF POWDERED METAL

Gerhard Naeser, Duisburg-Huckingen, and Werner Scholz, Duisburg-Ungelsheim, Germany, and Elis Erik Vilhem Helin, Gothenburg, Sweden, assignors, by mesne assignments, to Elektriska Svetsningsaktiebolaget, Gothenburg, Sweden, a corporation of Sweden, and Mannesmann Aktiengesellschaft, Dusseldorf, Germany, a corporation of Germany

Filed June 8, 1959, Ser. No. 818,611
Claims priority, application Sweden June 12, 1958
2 Claims. (Cl. 75—.5)

This invention relates to a process and apparatus for the production of powdered ferrochromium and ferromanganese the individual particles of which contain carbon and have been oxidized to such a degree that the proportions of carbon and oxygen contained in the powder are substantially equivalent.

In a known process for the production of low-carbon ferrochromium, high-carbon ferrochromium is subdivided in the liquid state into a powder by means of a blast of compressed air acting on a stream of the liquid metal discharged through a suitable port or orifice. The powder thus formed contains a certain proportion of oxide and is subsequently heated under reduced pressure so as to cause a reaction between the carbon and the oxide resulting in a decarburization of the metal. A similar process can be used for the production of low-carbon ferromanganese. The resulting product usually will be a sintered cake of ferrochromium or ferromanganese and is useful as an alloying addition in the steelmaking art. The liquid ferrochromium or ferromanganese for the liquid subdivision process may be supplied directly from the reduction furnace, for instance a blast furnace.

In the process above referred to it is desirable that the decarburized product contain as little carbon and oxygen as possible. A low carbon content is particularly important for ferrochromium, carbon contents of the order of 0.02% being frequently demanded. In the liquid subdivision process, it has proved to be difficult to effect just the degree of oxidization of the particles resulting in the desired stoichiometric ratio between the weights of oxygen and carbon present in the powder. As the carbon content of the liquid ferrochromium may vary considerably from one cast to another and these fluctuations have been reflected in the powder produced, it has been necessary to mix different powder batches in order to obtain the desired average composition.

The invention more particularly relates to a process comprising the steps of producing a molten body of carbon-bearing ferroalloy, discharging said molten metal through a port or orifice, subjecting the stream of metal issuing from said orifice to a blast of an oxidizing gaseous agent emitted through an annular nozzle so as to disintegrate the stream of molten metal into a shower of partially oxidized particles, and collecting said particles in a pool of a quenching liquid. The invention is based on the discovery that the oxidization occurring in the liquid subdivision process is strongly and reproducibly dependent on the distance between the nozzle and the level of the quenching liquid. For a given kind of ferroalloy, for instance ferrochromium containing 60 to 72% Cr, it is possible to determine by means of a series of tests a definite relationship between the carbon content of the ferro alloy and the distance between the nozzle and the level of the quenching liquid at which there will be a stoichiometric ratio between the oxygen content and the carbon content of the resulting powder. Other conditions, such as the temperature of the molten metal and the pressure of the blasting agent (generally air) should be equal. According to a principal feature

ture of the process of the invention, the carbon content of the molten body of ferroalloy is determined prior to its disintegration, and the distance between the annular blasting nozzle and the level of the quenching liquid is adjusted so as to conform to the predetermined relationship between the carbon content and said distance. In this manner it will be possible consistently to obtain a product having the correct oxygen/carbon ratio, irrespective of the carbon content of the liquid ferro alloy.

Accordingly, the new apparatus according to the invention is distinguished by means for adjusting the vertical distance between the annular nozzle and the level of the quenching liquid. As a rule, the limits between which said distance is adjustable should have a ratio of not less than 1:2.

The process according to the invention is of particular interest for the production of powders from ferro alloys (ferrochromium and ferromanganese) having carbon contents between 4 and 8%. For the treatment of such alloys, the height of the annular nozzle above the level of the quenching liquid generally will have to be chosen in the range between 25 or 30 in. and 10 ft.

To illustrate the invention, the results are given below of a series of liquid disintegration tests with ferrochromium of varying carbon contents. The blasting agent employed consisted of air at a pressure of 50 lb./sq. in. supplied in the usual manner to an annular nozzle disposed coaxially to and slightly below the liquid metal discharge orifice. The figures in the right column indicate the distance between the nozzle and the level of the quenching liquid (water) at which the powder obtained had a stoichiometric oxygen-to-carbon ratio.

Carbon content, percent:	Distance, inches
4	47
5	63
6	79
7	89
8	99

The appended drawing somewhat schematically shows by way of example an apparatus for carrying out the invention.

A cylindrical tower **1** supported on standards **2** is provided at its upper extremity with a lid **3** having a central orifice **4**. The lid **3** supports an annular nozzle **5** adapted to be connected by means not shown to a source of compressed air. A pouring pot **6** is adapted to be held above the nozzle **5** in such a position that the stream of liquid metal emerging through the bottom port of the pot **6** will pass through the central orifice of the nozzel **5** without contacting the wall of said orifice. A hopper **7** vertically displaceable in the tower **1** by means of hydraulic lifting means **8** is adapted to be filled with a quenching liquid (usually water) through hose **9** connected to a suitable pump not shown. The bottom orifice of the hopper is provided with a shutter or valve **10** through which the charge of powder collected by the hopper may be emptied into a car **11** serving to convey the powder to a suitable drying apparatus.

The tube or chimney **12** attached to lid **3** is adapted to be connected to a suitable exhaust duct for the removal of the combustion gases and vapour produced in the course of the disintegration process.

Before processing a charge of liquid metal, a sample of the metal is analysed as to carbon content. The position of the hopper **7** is then adjusted accordingly with the aid of a known relationship between the position of the hopper and the carbon content of the metal, said relationship being ascertained by previous tests, as already explained.

We claim:

1. In a process for the production of a powdered ferro alloy of the group consisting of ferrochromium and ferromanganese containing substantially equivalent proportions of carbon and oxygen by producing a molten body of carbon-bearing ferro alloy, discharging said molten metal through a port or orifice, subjecting the stream of metal issuing from said orifice to a blast of an oxidizing gaseous agent emitted through an annular nozzle so as to disintegrate the stream of molten metal into a shower of partially oxidized particles, and collecting said particles in a pool of a quenching liquid, the improvement which comprises the steps of determining the carbon content of the molten body of ferro alloy prior to its disintegration, and adjusting the distance between the annular nozzle and the level of the quenching liquid so as to cause said distance to assume the relation to said carbon content indicated by a pre-established relationship between carbon contents of the ferro alloy and distances required to produce a degree of oxidization corresponding to a stoichiometric ratio between the oxygen content and the carbon content of the quenched powder.

2. The improvement in apparatus for producing powdered ferrochromium and ferromanganese by the liquid disintegration process, having a liquid metal container, a discharge port or orifice in the bottom of said container, an annular nozzle disposed beneath and coaxially to said liquid metal discharge orifice and adapted to eject a blast of a compressed gaseous agent directed substantially downwards and converging towards the axis of the stream of metal issuing from said orifice and a container for a quenching liquid disposed below said nozzle, the improvement of means for adjusting the vertical distance between the annular nozzle and the level of the quenching liquid through the approximate range of 25 inches to 10 feet.

References Cited in the file of this patent

UNITED STATES PATENTS

2,853,380	Evans et al.	Sept. 23, 1958
2,861,879	Michalke	Nov. 25, 1958

FOREIGN PATENTS

547,541	Canada	Oct. 15, 1957