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COMPLETE SPECIFICATION.

Improvements in or relating to Blasting Agents.

We, GESELLSCHAFT DER LUDW. VON ROLL'SCHEN EISENWERKE A.G., a Swiss Body Corporate, of Gerlafingen, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to blasting agents.

In industry metallic surfaces are frequently cleaned, for example to prepare them to receive a paint or metal coating, by bombardment with blasting agents. Generally speaking, blasting agents should be usable for as long as possible, that is to say reusable a number of times, and they must be cheap. Blasting agents at present employed are steel grit, moulding sand, corundum and various types of quartz sand, such as pure quartz sand or river sand. The use of these blasting agents is, however, attended by certain disadvantages. Blasting agents consisting of cast iron or steel pit and roughen the surface excessively and this increases the danger of rusting under a sprayed metal or paint coating. Quartz sand is cheap and relatively wear-resistant, being usable several times for blasting surfaces. Because of these desirable properties, quartz sand is in general use, but it suffers from the very serious disadvantage that it leads to silicosis, and so practically all workmen engaged in blasting installations are exposed to a real danger of this desease. Consequently insurance companies and factory inspection authorities are endeavouring to ban this dangerous substance from production processes and thus to obviate the danger to the workers.

An extremely valuable blasting agent having optimum properties is granulated corundum. However, its cost of production is so high that here again its general use is scarcely practicable.

A quartz-free blasting agent has now been discovered which is as substantially sharp-edged as quartz sand, has at least substantially the same wear-resistance and yet is reasonably cheap.

The blasting agent of the invention is granulated slag which has been subjected to a heating operation sufficient only to fuse the surface layer of the individual granules without causing concomitant coagulation of the granules. It may be produced by first granulating a quartz-free slag by quenching, for example in water, heating the granulated slag to fuse the surface layer of the individual granules without causing concomitant coagulation of the granules and then cooling the product.

When quartz-free furnace slags are granulated, for example for quenching with water, a substance is formed which at first sight appears to be readily usable as a blasting agent. This substance has a hardness of about 7, but is subject to internal stresses. Consequently, the individual grains, when projected onto a metal surface rapidly disintegrate into extremely fine particles ; such granulated slag is therefore not suitable for use as a blasting agent. This disintegration of the individual grains results from the presence of small fissures in the grains which are caused by the sudden cooling during granulation. Heating the slag according to the present process has the effect of closing these fissures. The internal stresses are resolved and the granulated material acquires very surprising properties substantially similar to those of corundum in regard to wear-resistance and effectiveness. The heating temperature and the heating period, which must be such as to cause closure of the fissures of the individual granules without causing the granular mass to coagulate, must naturally be adapted to the chemical com-

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position of the slag and to the grain size. They also depend on whether the heat-treatment is effected by radiation or convection (e.g. by hot air).

Slags having the following composition have proved very satisfactory.

SiO_2	25—45%
$CaO+MgO$	35—60%
Al_2O_3	8—25%

and the ratio value $P = \frac{CaO}{SiO_2} = 0.8—2$

The following examples will serve to illustrate the invention :—

EXAMPLE I.

A typical slag from a blast furnace for the processing of iron ore was granulated by pouring the slag in a liquid state, having a temperature of about 1,400° C. in water at about 15° C. The granular slag obtained had a grain size of up to about 3 mm. a weight per unit volume of 1.4 kg. per dm^3 and a hardness number of about 7Moh.

The chemical composition of the slag, before and after the granulation, was :—

CaO	43.6%
SiO_2	33.8%
Al_2O_3	16.5%
MgO	3.1%
FeO	0.9%
S	1.1%
	99.0%

There were traces of manganese, chromium and phosphorus.

A portion of the granulated material was heated by radiation in a furnace of the vaulted type (Borell furnace) for a period of about one hour. The temperature of the furnace ranged from 920°—940° C. The resulting granulated material was cooled for a period of ten minutes, and showed a marked change in appearance but no substantial change in grain size (i.e. still up to about 3 mm. as compared with the granulated slag before heating. Before heating the material had a light grey to greenish colour and a glassy appearance ; after heating it was dark grey to black and had a dull appearance.

EXAMPLE II.

The procedure of Example I was repeated, with the exception that the heating for fusing the surface of the granules was carried out in a rotary kiln at a temperature ranging from 950° to 970° C. for a period of about five minutes. The resulting granulated slag was, in appearance and effectiveness as a blasting agent, equivalent to the product of Example I. The grain size of the slag before and after the heat treatment was up to about 3 mm.

The slag resulting from Example II was tested for effectiveness as a blasting agent. The granulated material was sieved and the fraction with an average particle size ranging from 1.0—1.5 mm. was used in a blasting apparatus having a nozzle with an inner diameter of 6 mm. and a working pressure of 4 atmospheres. The blasting material was blasted with this apparatus onto sheet-iron, with a distance of 5 cm. between the nozzle and the sheet-iron. In the following table the stability of the blasting agent was tested by running a given sample a number of times (3, 6, 9 and 12) through the blasting process. The numbers in columns 2 to 5 give the percentage of the granulated material retaining its original grain size.

TABLE.

Number of runs.	Untreated slag.	Surface-treated slag.	Quartz.	Corundum.
3	11.0	78.1	43.7	77.2
6	5.7	64.9	26.5	65.5
9	3.8	55.7	17.5	55.6
12	2.2	48.8	13.1	51.5

The comparison of the values in columns 3 and 5 demonstrates that the properties of the surface-treated slag of the present invention compare very favourably with the properties of corundum.

When the surface-treated slag obtained according to Example I was tested in the same manner, substantially the same results were obtained, within the margin of error of the measurement of grain size.

Any slag having an appropriate degree of hardness will give, after treatment and appropriate fusing of the surface of the granules in accordance with the invention, a suitable blasting material. Neither the temperature nor the period of heating are critical. The optimum degree of heating for a given slag with a given grain size is that which achieves complete closing of the surface fissures without coagulation of the granules. The optimum period of heating is the shortest period of heating which, at a given temperature, is necessary to attain the fusion of the surface of the individual granules.

WHAT WE CLAIM IS :—

1. A blasting agent consisting of granulated slag which has been subjected to a heating operation sufficient only to fuse the surface layer of the individual granules without causing concomitant coagulation of the granules.

2. A method of producing a blasting agent which comprises granulating furnace slag by suddenly cooling it, and subjecting the resulting granulated slag to a heating operation sufficient only to fuse the surface layer of the individual granules without causing concomitant coagulation of the granules and thereafter cooling the product.

3. A method according to Claim 2, wherein the slag, employed as starting material, has the following composition :—

SiO_2	25—45%
$CaO+MgO$	35—60%
Al_2O_3	8—25%

and the ratio value $P = \frac{CaO}{SiO_2} = 0.8—2$

4. A method according to Claim 2 or 3, wherein the heat-treatment is affected by radiation heating or by convection.

5. A method according to any of Claims 2 to 4 wherein the slag is granulated by quenching it, while molten, in a water bath.

6. A method of producing a blasting agent according to Claim 2 substantially as hereinbefore described with reference to the foregoing Examples I and II.

7. A blasting agent produced in accordance with any of Claims 2 to 6.

8. A blasting agent according to Claim 1 substantially as set forth in either of the foregoing Examples I and II.

9. A method of cleaning surfaces which comprises bombarding the surface with blasting agents according to Claim 1, 7 or 8.

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