

[54] **PROCESS AND COMPOSITION FOR
BLAST-CLEANING AND
CORROSION-PROTECTING METAL
SURFACES**

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[57] **ABSTRACT**

A process and composition for blast-cleaning metal surfaces, particularly steel surfaces, and simultaneously depositing a corrosion protective metal thereon. Abrasive particles carrying a protective metal, especially zinc, at their outer surface are used as the blast abrasive. The protective metal is bound to the abrasive particles by means of a binder.

20 Claims, No Drawings

73023

13 Pgs

Process and Composition for Blast-Cleaning and Corrosion-Protecting Metal Surfaces

Author: Bender-Christensen, Bent

Source: US Patent 3,765,923

**PROCESS AND COMPOSITION FOR
BLAST-CLEANING AND
CORROSION-PROTECTING METAL SURFACES**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a process for improving the corrosion resistance of metal surfaces simultaneously with cleaning the metal surfaces, and more particularly the invention relates to the depositing of a protective metal on a surface part of another metal which is to be made more corrosion-resistant.

2. Description of the Prior Art

It has previously been proposed to expose steel parts to a priming treatment in which a rust-protecting zinc coating is applied to the steel surface in a two-step process. During the first step, the surfaces of the steel parts are descaled by a conventional blast cleaning operation using abrasive particles, and during the second step the descaled surfaces are exposed to another blasting operation performed with zinc powder which is driven onto the cleaned surfaces.

It has also previously been proposed (British Pat. Specification No. 1,041,620) to clean steel surfaces and simultaneously applying a corrosion-resisting metal thereto by blasting grit particles coated with protecting metal, usually zinc, onto the surfaces. In this known process, the coating of the grit particles with the zinc is performed by mixing the grit and zinc powder and agitating the mixture.

SUMMARY OF THE INVENTION

It has now been found that unexpected advantages are obtained when the protective metal is bound to the abrasive particles by means of a binder:

- a. Higher amounts of protective metal can be carried by the abrasive particles.
- b. Other metals than zinc, as well as additives and mixtures may easily be applied to the abrasive particles.
- c. The protective metal may be distributed on the abrasive particles in various manners, so that the highest efficiency for a given end use may be reached. (On top of the binder or embedded in the binder or in multiple or "sandwich" layers.)
- d. A faster production of the abrasive particle carrying protective metal and a more uniform product are obtained.
- e. Dust amount and dust danger in the blasting process are decreased due to better adhesion of protective metal to abrasive particles.
- f. The amount of protective metal deposited on the abrasive particles can be regulated by varying the amount and/or type of binder.
- g. Far better protection is obtained with the same amount of protective metal.
- h. Less decrease of protection is incurred by prolonged blasting.
- i. Better conditions may be provided for subsequent adhesion of paint (better "paintability" of the blasted metal surfaces).

Hence, the invention relates to a process for blasting metal surfaces and simultaneously applying a corrosion-protective metal thereto by blasting abrasive particles carrying the protective metal onto said surfaces, which process is characterized by using abrasive particles to which the protective metal is bound by means of a binder.

DETAILED DESCRIPTION OF THE INVENTION

In connection with the present invention, the term "blasting" is to be interpreted in its broadest sense comprising as well abrasion by means of abrasive particles flung against the surface parts in question by means of, e.g., rotating wheels or other mechanical means as abrasion by means of abrasive particles conveyed against the surface parts in question by a current of air or another gas and/or a liquid current. The process according to the invention may be performed using any type of blast cleaning equipment or apparatus. An interesting aspect of the process of the invention is "wet blasting," e.g., "wet sandblasting," wherein a water spray is used for removing dust formed by disintegration of the abrasive particles. Without the corrosion protection obtained by the present invention, "wet blasting" is often of little interest because the humidity increases the corrosion of the surfaces being blasted.

The abrasive particles may be of normally used types or of specially formulated types. Examples of abrasive particles are the following:

Metallic abrasives (e.g., cut-wire, cast iron shot and grit, steel shot and grit, etc.), oxides (synthetic or natural like alumina, zirconia, etc.), silicas (sand, glass shot and grit, flint, etc.), and conglomerates or slags (e.g., mineral slag, copper slag, etc.). The surfaces of the abrasive particles or bodies may be of any shape or type; they may for example be smooth, edged, porous, or grooved. The choice of a suitable abrasive material for a given purpose will depend upon considerations concerning, e.g., availability, cost, colour, and, especially, abrading properties, which are depending upon e.g. hardness (toughness), size, shape, chemical composition, specific gravity, etc.

The metal surfaces which may be treated by the process according to the invention are primarily surface parts of structural elements of iron or steel, such as steel plates, welding seams, cast iron, and the like. It is envisaged, however, that the advantages of the invention may also be obtained in treating surface parts on articles of other metals which are subject to corrosion.

As the process of the invention will usually result in the formation of a non-continuous layer of the protective metal on the metal to be protected, it is preferred that the protective metal is one which provides a distance-effect in corrosion protection, e.g., zinc, aluminum, cadmium, magnesium, or lead, but also other metals and alloys may be used, e.g., tin, and manganese. As examples of suitable alloys may be mentioned tin/zinc, copper/zinc, and Wood's alloy (25 parts of lead, 12.5 parts of cadmium, 50 parts of bismuth, and 12.5 parts of tin), in the following called "Wood-metal."

From considerations concerning cost, protection and health danger, zinc is the preferred protective metal used according to the invention, and the following description will, therefore, mainly be concerned with the use of zinc.

The amount of binder present in the abrasive particles used according to the invention is usually of the order of 1 percent by weight or less, calculated on the total weight of the abrasive composition. As little as 0.05 percent by weight may in some cases be used, and the maximum amount of binder will usually be just below the one at which the abrasive particles start being bound together. The range of usable types of

binders is surprisingly broad, and the only condition for a binder to be used according to the invention seems to be that it is a material which is able to adhere to the abrasive particles and to the protective metal particles so as to bind the protective metal particles to the abrasive particles to a greater extent than if no binder were present. The binder should, furthermore, be substantially non-evaporating and should preferably be of a type which will not vitiate the beneficial effect of the protective metal. Other desirable properties of the binders used according to the present invention are good wetting and penetrating properties under the conditions used when applying the binder to the abrasive particles, good stability, also at elevated temperatures, low toxicity, even when exposed at higher temperatures, and adequate resistance to adverse influence by water and alkali. Furthermore, it has been found preferable that the binder is not too brittle.

As examples of the surprisingly wide range of binders usable according to the invention may be mentioned binders which are oxidatively drying, such as alkyd resins, varnishes, drying oils, standoil, phenolic resins, styrenated alkyd resins and epoxy ester resins, binders which are physically drying, such as chlorinated rubber with or without plasticizer, phenoxy resins, cyclized rubber, epoxy resins, polyamide resins, acrylic resins, isobutylene resins, and amine-epoxy adduct resins, and binders which are reactively drying, such as polyamide-cured epoxy resins, amine-cured epoxy resins, sodium silicate, and alkyl silicates such as ethyl silicate, and also non-drying binders such as plasticizers (e.g., dialkylphthalates), tar, asphalt, surface active compounds like silicone oil and lecithin, wax, and vegetable and mineral oils, as well raw and refined.

Generally, softer binders such as, e.g., dialkylphthalates seem to be more suitable than harder binders such as, e.g., alkyl silicates, and chemically, the epoxy group is present in many binders found suitable. As a specific example of a binder which at present seems especially interesting may be mentioned dibutylphthalate.

One of the surprising effects obtained through the use of the binder, in comparison with the known process where the abrasive particles are coated without using any binder, is a very significant improvement of the corrosion protection with the same amount of protective metal, e.g., zinc, applied to the abrasive particles. In order to investigate whether this effect were due to zinc particles being bound to the treated metal surfaces by means of the binder, an experiment was made in which a treated steel surface was washed with hot solvent to remove any binder present. This, however, did not influence the protection properties, and, hence, it must be concluded that the adhesion of the zinc to the steel surface is the desired direct metal-to-metal bond and is not via any binder.

The use of the binder opens new possibilities which did not exist with the known processes. Thus, for example, the amount of protective metal may be increased almost to any desired value, and also special distributions of the protective metal of the abrasive particles may be obtained.

With regard to the amount of protective metal, it has been found that the anti-corrosion effect increases with the amount of protective metal applied. For zinc, this proportionality continues up to 30 — 40 percent by weight on sand as abrasive. With large amounts of zinc on heavy abrasives, the process according to the inven-

tion may result in corrosion protection of treated steel surfaces for up to several months under normal outdoor exposure conditions. It is, however, especially remarkable that also low amounts of zinc will give surprisingly good corrosion protection in the process according to the invention.

As far as the shape of the protective metal is concerned, it has been found that very fine zinc dust gives better results than zinc flake and coarser dust for zinc amounts above 3 percent by weight; at lower zinc amounts, there is no significant difference.

An interesting technique made possible through the present invention is to bind a mixture of particles of the protective metal and a particulate "paintability-improving material" to the abrasive particles. The "paintability-improving material" is a material which will improve the adhesion between the treated surfaces and the primer or other paint coatings applied after the blasting treatment. As an example of a paintability-improving material may be mentioned zinc oxide. In contrast to what would have been expected, it has been found that blends of 50 percent of zinc and 50 percent of zinc oxide will, in addition to the improved paintability, still give good corrosion protection. In connection with the known application of conventional zinc primer paint coatings to cleaned steel surfaces, it is believed to be necessary that the zinc particles are present in the primer in such amount that they are in contact with each other after the application. Such contact between the zinc particles is, as shown by the good protection obtained when using the mixture of zinc and zinc oxide, not necessary in the zinc deposits made according to the present invention. The paintability improvement obtained through the use of the zinc oxide together with the zinc is a highly interesting advantage, but it should be noted, however, that surfaces treated by the process according to the invention are, also without the use of a paintability-improving material, easy to paint because they possess the roughness imparted by the blasting process. In contrast, zinc primers painted on a blasted steel surface will result in a smoothening of the surface.

The invention also relates to a composition for use in blasting metal surfaces and comprising abrasive particles carrying corrosion-protective metal on their outer surfaces, which composition is characterized in that said protective metal is bound to the abrasive particles by means of a binder.

The composition according to the invention may be prepared in various manners, and the use of the adhesive binder opens several possibilities of obtaining special advantageous effects.

One method for preparing the composition according to the invention is to apply, to abrasive particles, a mixture of protective metal and binder, usually a dispersion of finely divided metal in liquid state of binder. The binder may be liquid per se, or the binder may be brought into the liquid state either by heating (for thermoplastic materials) or by being dissolved in a suitable solvent. (Many of the binders suitable for the purpose of the invention are commercially available as solutions.) After the addition of the dispersion of the protective metal in the binder, the resulting mixture of abrasive particles and dispersion is suitably rotated in a rotating drum or otherwise agitated, e.g., by shaking or vibrating, until the mixture is evenly distributed on the particles. If a dissolved binder is used, the solvent

may be evaporated during the agitation or rotation of the mixture, for example by passing hot air through the mixture.

Another method of preparing a composition according to the invention is to apply the protective metal to the abrasive particles subsequently to the application of the binder. In this method, the binder is first evenly distributed on the abrasive particles, and thereafter the protective metal is added, for example as a finely divided powder, which will then be concentrated at the outer surface of the binder coating. This concentration of the protective metal at the outer surface of the binder coating may be especially pronounced if the binder is allowed to obtain a higher viscosity before the metal is added. If, for example, the binder is a thermoplastic material, it may be applied at an elevated temperature and may then be allowed to cool to for example room temperature before the metal particles are added. This will result in a material having a significant concentration of metal particles at the outer surface of the binder.

Compositions of the above-mentioned type in which the protective metal is concentrated at the outer surface of the binder are highly interesting because of the especially good corrosion protection obtained with such compositions. Particularly with abrasive materials to be used only once, such as sand and copperslag, it is preferred that the protective metal is concentrated at the outer surface of the binder.

Another interesting possibility with certain combinations of abrasive and protective metal is to concentrate the protective metal on one side of each abrasive particle. If, for example, sand is used as abrasive, and zinc is used as protective metal, the single particles carrying the zinc concentrated on one side thereof will, because of the difference between the higher specific weight of the zinc and the lower specific weight of the sand, have a tendency to be orientated with the zinc-rich side towards the surface to be treated immediately before the collision with said surface. In this manner, the probability that a high proportion of the zinc present of the particles will be forced onto and into the surface being treated is high, and, accordingly, less zinc may be needed to obtain a desired corrosion protection, compared to the amount necessary with particles on which the zinc is evenly distributed over the surface.

Compositions according to the invention having the protective metal concentrated on one side of each abrasive particle may be prepared in various suitable manners. One method is to spray a mixture of protective metal and binder on a bed of abrasive particles and moving the bed in relation to the spray of mixture. The bed may, for example, be a thin layer of particles placed on a moving belt, or the bed may be a curtain-like bed of falling abrasive particles on which the mixture of protective metal and binder is sprayed from one direction.

Very good results are often obtained by first applying a binder on the abrasive particles, then protective metal or a protective pigment or paintability-improving material (e.g., zinc oxide, graphite or asbestine), then binder, then another layer of protective metal or paintability-improving material, and so on, ending up with a final application of protective metal. Many combinations and additional layers are thinkable in this multi-layer or "sandwich layer" coating technique which, inter alia, permits the application of large

amounts of protective metal or other material on the particles. In such particles having a plurality of superimposed layers, the outermost of said layers should, as indicated above, comprise protective metal.

As mentioned above, the blasting process according to the invention may be carried out using any type of blast cleaning equipment and apparatus, and the abrasives used may be of a type used only once (not recycled for renewed blasting against the surface being treated), or of a type used several times (recycled for renewed blasting against the surface being treated).

In connection with either type of abrasive (used once or used several times), the blasting process may be performed either with abrasive particles which all or substantially all carry the protective material bound to the particles by means of the binder, or with a mixture of abrasive particles provided with protective metal and binder and abrasive particles without metal and binder. It has, surprisingly, been found that there is often little or no difference between the corrosion protection obtained with a certain percentage of zinc distributed on all abrasive particles and the protection obtained when the blasting is carried out using a mixture of abrasive particles without zinc and binder and abrasive particles having a high amount of zinc bound thereto by means of a binder, said latter particles being present in such amount that the same average percentage of zinc is obtained for the total composition used in the process. Thus, for example, blasting carried out using a 50:50 mixture of untreated sand and sand carrying 30% of zinc bound thereto gave substantially the same corrosion protection as blasting with treated sand to which 15% of zinc had been bound. This opens the possibility of shipping the composition according to the invention in a form which has a high concentration of protective metal and which is then diluted with abrasive without binder and metal by the end consumer.

When the blasting process is carried out with abrasives used more than once (and the use of such recyclable materials as steel sand, grit and shot is believed to become one of the most important embodiments of the process of the invention), the concentration of protective metal may become too low during blasting because of loss resulting from deposition on the surfaces being treated and disintegration of the particles. In such case, replenishing may be carried out by adding fresh particles having protective metal bound thereto, and most suitably the amount of particles added and the concentration of protective metal on the particles added are so chosen that the loss of protective metal is continuously compensated for so that the desired degree of protection is constantly obtained. Another way to compensate for loss of protective metal, especially in cases where there is little loss of the abrasive itself (e.g., with steel sand) is to add fresh binder and fresh protective metal to the recycled abrasive and thus apply a new layer of protective metal on the abrasive particles.

A further suitable way of maintaining the desired corrosion protection efficiency of the blasting process according to the invention when using an abrasive which is recycled is to apply the protective metal in such amounts and in such a way that the deposition of protective metal on the surfaces treated is substantially constant over the total working life of the abrasive. It is envisaged that this may be obtained by applying several layers of protective metal on the abrasive particles, and/or by using rather high amounts of binder, e.g., of

the order of 1% by weight and above, calculated on the total composition. Compared with compositions containing less binder, such compositions may have a smaller initial protection efficiency, but this efficiency may be retained substantially unchanged during the total working life of the composition.

In the process according to the invention the abrasive particles will descale or clean the metal surfaces in substantially the same manner as non-coated abrasive particles, and the protective metal carried by the abrasive particles will simultaneously come into contact with and be deposited on the cleaned surface. One of the disadvantages of conventional blast cleaning of steel surfaces is that the freshly cleaned steel surface is highly active and will immediately start reacting with air moisture and any other corroding components of the atmosphere in which the blasting is carried out. The application of a primer paint coat may stop corrosion, but some degree of corrosion, although perhaps invisible, will usually have taken place in the time interval between blasting and priming.

In contrast, the process according to the present invention can be said to prevent corrosion because there is no time interval between the blasting and deposition of the protective metal. Because of the intimate contact between the protecting metal and the treated surface a less amount of protecting metal is needed for sufficient protection which leads to a less decrease of speed in cutting and welding operations, a higher quality of welding seams and less development of toxic fumes during burning, cutting and welding than when using ordinary preconstruction primers.

Furthermore, it is believed that the process of the invention will prove an attractive and efficient process for cleaning old steelwork, especially steelwork which has been exposed to marine atmosphere and which shows deep rust pockets generally containing deliquescent iron salts like chloride, sulphate, etc., as it is envisaged that the treatment according to the invention will neutralize the harmful effect of these salts. The beneficial effect of the protective metal may in certain cases be enhanced by additionally applying, on the abrasive particles or bodies, catalysts or other additives which cooperate with the protective metal.

Although great advantages in corrosion resistance may be obtained when using the process of the invention, the difference between a normally cleaned metal surface and a metal surface cleaned by the process of the present invention will not be visible immediately upon cleaning even though the conventionally treated surface may already have started corroding. The reason for this is that it usually takes some time before a visible corrosion has taken place. For this reason and other reasons, it may be suitable to apply small quantities of a tracing means, for example a tracing compound, to the abrasive particles to be used in the process of the present invention so that a surface cleaned by the process of the invention will be easily distinguishable from a normally cleaned surface. A tracing compound may, for example, be a pigment having a high colour strength, which may suitably be bound to the abrasive particles by means of the binder used.

The invention is further illustrated by the following examples, which are not to be construed as limiting.

In the examples, the blasting was carried out using one of the following blasting equipments:

"Educt-O-Matic," a small suction-pressure unit. Recirculation. Made by Clementine USA.

"Guyson Blasting Cabinet" Model 550/40. Bigger suction-pressure unit. Made by Guyson Industrial Equipment Ltd., England.

"Airless" (Maschine 15835/4843, 1966). A centrifuged blaster made by Vogel & Schemmann AG, Federal Republic of Germany.

The testing of the blasted panels was carried out in accordance with ASTM Designation B 117-64 (salt spray at 35° C), and the evaluation of the rust formation is expressed in accordance with ASTM Designation D 610-68, according to which the ratings have the following meaning:

- 10 = 0% Rust
- 9 = 0.03% Rust
- 8 = 0.1% Rust
- 6 = 1% Rust
- 4 = 10% Rust
- 2 = 33% Rust
- 1 = 50% Rust
- 0 = 100% Rust

Various materials and chemicals used in the examples are defined more closely below:

MIBK: Abbreviation of methylisobutylketone.

Oxitol (Shell): Ethyleneglycolmonoethylether.

Zincoli 620 (Morris Ashby, England): Superfine grade of zinc dust.

Zinc flake - 83% (Eckart Werke, Federal Republic of Germany): "Stepa Zinc 8," paste containing 83% of zinc.

Woodmetal AS 31 (Eckart Werke, Federal Republic of Germany).

Magnesium MX 31 (Eckart Werke, Federal Republic of Germany).

Sand (O. Poulsen, Denmark): "Reezer Grus," 0.5 - 1.5 mm.

Epicote 828 (Shell): Epoxy resin, epoxide equivalent 175 - 210.

Epicote 834 (Shell): Epoxy resin, epoxide equivalent 225 - 290.

Epicote 1001 (Shell): Epoxy resin, epoxide equivalent

450 - 525.

Epicote 1001-sol: 50 grams of Epicote 1001 dissolved in 25 grams of xylene and 25 grams of MIBK.

Zinc oxide (Rånæs Bruk, Sweden).

Epoxyester - 50% (Celanese, USA): "Epi-Tex 183." Made by esterification of the epoxide groups and hydroxyl groups of epoxy resin with fatty acids of drying oils. Contains 35 - 40% fatty acid and is dissolved in 50% by weight of xylene.

Acryloid All (Rohm & Haas, USA): Polymer of acrylic acid and methacrylic acid. Viscosity 1200 - 1900 cPs at 125° C, 35% solids in methylethylketone.

Chlorinated rubber (ICI, England): Alloprene R20. Chlorinated natural rubber with a chlorine content of about 76%. Viscosity 20 cPs at 25° C, 20% solids in toluene.

Chlorinated paraffin (Hoechst, Federal Republic of Germany): "Hordaflex LC." Contains about 50% chlorine. Viscosity about 20,000 cPs at 20° C.

Antracene oil (Superfos, Denmark): High boiling grade.

Soya lecithin (Dansk Sojakagefabrik, Denmark): "Lecithin DS."

Graphite (L. Struve, Federal Republic of Germany): "Grafit M88".

Copperslag (Melchemie, the Netherlands): "Semo-Aram," 0.5 - 3.5 mm.

Corundum (Dynamit Nobel AG, Fed. Rep. of Germany): Rewagit IV.

Cut-wire (Harrison Ltd., England): "Supral," 0.6 mm.

Steelgrit (Fanner Continental, the Netherlands): "GR25 CMA."

Ethylsilicate (Dynamit Nobel AG, Fed. Rep. of Germany): "Dynasil 40." Composed of mixed ethyl-polysilicates with an average of five silicon atoms per molecule. Contains about 40% SiO₂.

EXAMPLE 1.

Metal

Procedure

Sand (0.5 - 1.5 mm) is mixed with Epicote 828 (pre-heated to 60° C) and rotated until all particles are wetted completely.

Then the metal powder is added, and the mixture is rotated until it is dustfree, i.e., 2 - 5 minutes. The zinc flake, magnesium and Woodmetal are mixed with Epicote-sol and solvents before added to the sand and rotated.

Testing

The treated sand is blasted with Educt-O-Matic for 3 seconds on shopprimed steel. The shopprimer is based on polyvinylbutyral-phenolic resin and is only applied in 5 - 10 microns, just enough to indicate the blasted area.

The blasted panels are exposed to salt spray (ASTM B 117-4), and hours to reach rust degree 8 and 6 are measured.

METAL TYPE AND SHAPE, FORMULATIONS

Amounts in grams

Premixed				
Epicote 1001-sol	38	28	155	11
MIBK			18	2
Oxitol	2	2	27	2
Xylene			54	9
Zincoli 620	200			
Zinc flake - 83%				73
Woodmetal AS 31		200		
Magnesium MX 31			200	
Added to				
Sand	1000	1000	1000	1000
Rust degree 8	9 hours	4 hours	5 hours	4 hours
Rust degree 6	11 hours	5 hours	6 hours	6 hours

AMOUNT OF METAL ± COATABILITY-IMPROVING MATERIAL, FORMULATION

Amounts in grams.

Sand	1000	1000	1000	1000	1000
Epicote 828		5	5	5	8
Zincoli 620		20	120	200	25
Zinc oxide					25
					} mixed
Rust degree 8	0.1 hour	6 hours	24 hours	86 hours	4 hours
Rust degree 6	0.2 hour	7 hours	27 hours	88 hours	5 hours

EXAMPLE 2.

Binder

Procedure

The higher molecular binders (epoxyester, Acryloid All, chlorinated rubber) are first dissolved in solvents, and the zinc powder is dispersed therein, before added to the sand and rotated.

The other binders (Epicote 828, dibutylphthalate, Anthracene oil, soya lecithin) are added directly to the sand, and after distribution on the particles the zinc powder is added and rotated until dustfree, i.e., 2 - 5 minutes.

Testing

As in Example 1.

BINDER, TYPE, FORMULATIONS

Amounts in grams

Epoxyester—50%, incl. driers	16		
Xylene	10	9	32
Acryloid All		9	
MIBK		8	
Chlorinated rubber			13
Chlorinated paraffin			10
Zincoli 620	100	100	200
Added to			
Sand	1000	1000	1000
Rust degree 8	4 hours	4 hours	6 hours
Rust degree 6	5 hours	6 hours	8 hours

BINDER, AMOUNT—TYPE, FORMULATIONS

Amounts in grams

Sand	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Epicote 828%	0	1	2	4			
Dibutylphthalate				6			
Anthracene oil					6		
Soya lecithin						6	
Zincoli 620	50	50	50	50	50	50	50
	Hours						
Rust degree 8	0.8	3	7	10	15	12	14
Rust degree 6	1.4	4	9	11	17	13	16

EXAMPLE 3.

Production Methods

Procedure

A. With solvents

The binder is dissolved in the solvents, and the zinc powder is dispersed therein. The mixture is added to the sand and rotated while heated air is blown into the container to remove the solvents.

B. Without solvents

The binder may be a liquid or easy to liquefy (e.g., by heating as done with Epicote 828) so it can be added and easily distributed on the sand particles under rotation. Then the zinc powder is added and rotated until it is dustfree, i.e. 2 - 5 minutes.

C. Additional Application

For higher amounts of zinc and/or to include materials for specific reasons (e.g., better adhesion to paints) in addition to the zinc first a binder layer is applied on the sand particles, then a layer of zinc or other materials, then binder again and so on. The last layer should be zinc.

This method can be carried out with solvents and without solvents, and there is no limitation in number and type of layers.

Testing

As in Example 1.

PRODUCTION METHODS, ± SOLVENTS, FORMULATIONS

Amounts in grams.

Epicote 828	A/9	B/9	5
MIBK	2		
Xylene	6		
Oxitol	3		
Zincoli 620	100	100	
Sand	1000	1000	
Rust degree 8	3 hours	13 hours	10
Rust degree 6	5 hours	16 hours	

PRODUCTION METHODS, ADDITIONAL APPLICATION, FORMULATIONS

Amounts in grams

	C	C	C
Sand	1000	1000	1000
Epicote 828	5	5	5
Zincoli 620	50	Zinc oxide:38	Graphite: 15
Epicote 828	5	5	5
Zincoli 620	50	50	50
Rust degree 8	6 hours	7 hours	8 hours
Rust degree 6	8 hours	8 hours	9 hours

EXAMPLE 4.

Abrasives, and Blasting

A. Abrasives Used Once

Testings are carried out using Educt-O-Matic which has shown results equivalent to results from open-blast cleaning when using a blasting time of 3 seconds.

For comparison the corundum is included though it is a material generally used several times.

Testing

As in Example 1.

FORMULATIONS, MADE WITHOUT SOLVENTS

Amounts in grams

Sand	1000		
Copperslag		1000	
Corundum			1000
Epicote 828	9	9	2
Zincoli 620	100	100	50
Rust degree 8	13 hours	22 hours	17 hours
Rust degree 6	16 hours	23 hours	23 hours

B. Abrasives Used More Than Once

The treated abrasives are made with solvents and without solvents. In one experiment without binder (not according to the invention) the cut-wire and the zinc were rotated 2 hours without being dustfree, and because the amount of dust did not change the last hour, the rotation stopped after 2 hours.

The influence of blasting time was measured by cleaning corroded panels after the abrasive has been in use 1/2 and 1 hour, respectively.

FORMULATIONS

Amounts in grams

	Guyson blasting			Air-less	Educt
Cut-wire	1,000	1,000		1,000	
Steelgrit			1,000		
Corundum			1,000		1,000
Epicote 828®		2.5		2.5	12
Epicote 834®		2.5		2.5	
Prehydrolyzed ethylsilicate			14		
Isopropanol			7		
Oxitol®			6		
Zincoli 620®	80	80	100	80	100

Hours

Rust degree 8	1.5	16	5	15	11	8
1/2 hour blast	0.5			12	4	
1 hour blast		4			2	
Rust degree 6	4		6	16	12	9
1/2 hour blast	1			13	5	
1 hour blast					2.5	

I claim:

1. A process for blasting a metal surface and simultaneously applying a corrosion-protective metal thereto, said process comprising blasting onto a metal surface abrasive particles having a protective metal bound to the outer surfaces of said abrasive particles by means of a binder.

2. A process according to claim 1, wherein the protective metal is zinc.

3. A process according to claim 1, wherein blasting is effected with abrasive particles to which a mixture of particles of the protecting metal and a particulate paintability-improving material is bound by means of said binder.

4. A process according to claim 3, wherein the protective metal is zinc, and the paintability-improving material is zinc oxide.

5. A process according to claim 1, wherein blasting is effected with abrasive particles which are at least partially coated with said binder, and on which the protective metal is concentrated at the outer surface of said binder coating.

6. A process according to claim 5, wherein the protective metal is zinc.

7. A process according to claim 1, wherein blasting is effected with abrasive particles having a plurality of superimposed layers, each said layer including protective metal or a paintability-improving material, the outermost of said layers including protective metal.

8. A process according to claim 1, wherein blasting is effected with a mixture of abrasive particles and abrasive particles having a protective metal bound thereto with a binder.

9. A composition for use in blasting metal surfaces and comprising abrasive particles in free relationship to each other, said abrasive particles having zinc bound to the outer surfaces thereof by means of a binder.

10. A composition according to claim 9, wherein the abrasive particles have a mixture of zinc particles and a particulate paintability-improving material bound thereto.

11. A composition according to claim 10, wherein the paintability-improving material is zinc oxide.

12. A composition according to claim 9, wherein the abrasive particles are at least partially coated with said binder, and the zinc is concentrated at the outer surface of the binder coating.

13. A composition according to claim 9, wherein the abrasive particles have a specific weight smaller than that of the zinc, and wherein at least a portion of said abrasive particles have the zinc concentrated on one side of each abrasive particle.

14. A composition according to claim 9, wherein the abrasive particles have a plurality of superimposed layers, each said layer including zinc or a paintability-improving material, the outermost of said layers including zinc.

15. A process for preparing a composition according to claim 12, comprising applying a binder to a plurality of abrasive particles in free relationship to each other

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,765,923

Dated October 16, 1973

Inventor(s) Bent Bender-Christensen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

should read -- before visible --. Column 7, line 54: "For this reason and" should read -- For this and --. Column 7, line 61: "colour" should read -- color --.

Column 8, lines 6-7: "centrifuged" should read -- centrifugal --. Column 8, line 25: "defined more closely below" should read -- defined below --. Column 8, line 31: "af" should read -- of --.

Column 9, lines 21-22: "are wetted completely." should read -- are completely wetted. --. Column 9, line 25: "before added" should read -- before being added --. Column 9, line 34: "to salt" should read -- to a salt --. Column 9, lines 35-36: "and hours to reach rust degree 8 and 6 are measured." should read -- and the time required to reach rust degree 8 and 6 respectively, is measured. --. Column 9, line 54: "COATABILITY-IMPROVING MATERIAL," should read -- PAINTABILITY-IMPROVING MATERIAL, --.

Column 10, line 5: "molecular binders" should read -- molecular weight binders --. Column 10, line 7: "before added" should read -- before being added --. Column 10, line 52: "easy to liquefy" should read -- easily liquefiable --. Column 10, line 58: "higher" should read -- larger --. Column 10, line 60: "zinc first a binder layer is applied on" should read -- zinc, a binder layer is first applied on --. Column 10, line 64: "in number" should read -- in the number --.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,765,923 Dated October 16, 1973

Inventor(s) Bent Bender-Christensen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 11, line 51: "rotated 2 hours" should read -- rotated for 2 hours --. Column 11, line 52: "change the" should read -- change during the --. Column 11, line 55: "has" should read -- had --. Column 11, line 56: "use 1/2" should read -- use for 1/2 --.

Column 11, line 29: "are" should read -- were --.

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents