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(54) PROCESS FOR THE ANTI-OXIDISING SURFACE TREATMENT OF STEEL PARTS

VERFAHREN FÜR ANTIOXIDIERENDE OBERFLÄCHENBEHANDLUNG VON STAHLTEILEN

PROCÉDÉ DE TRAITEMENT ANTIOXYDANT DE SURFACES DE PIÈCES EN ACIER

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Description

[0001] The present invention refers to a process for the anti-oxidising surface treatment of steel parts.

[0002] Various types of anti-oxidising surface treatments are known in the art, to which steel parts are subjected, which, at the end of such treatment, are put in such a condition as to efficiently resist to wear and corrosion, to which they are subjected according to the working environment in which they operate. IT TO 930 489 A1 describes an anti-oxidising surface treatment of steel parts.

[0003] In particular, for components used in the motor vehicle field, such as filters, gas springs, etc., a galvanic treatment can be performed, such as chromium-plating, nickel-plating or partially zinc-plating, etc. Another type of treatment, this time of the thermal type, is nitriding, followed by an oxidising step performed in salt baths at the presence of cyanide, cyanate and sodium carbonate, which therefore is rather obnoxious from the ecological and working safety points of view.

[0004] In the field of parts and components for motor vehicle filters, in order to build the external envelopes for protecting and containing such filters, the corrosion resistance feature is important, and is obtained, using the current technology, by painting such envelopes with a suitable corrosion-preventing paint: also this treatment has severe ecological problems, due to the toxic materials being used.

[0005] Object of the present invention is solving the above prior art problems, by providing a new process for the anti-oxidising treatment of steel parts that is ecological, does not show the above pollution and working safety problems and provides the same levels of wear and corrosion resistance of current technologies; such process further allows extending the length of such resistance, in components such as filters, because it will not be necessary any more to paint them, since such property will be embedded into the structure itself of the material being treated.

[0006] Another object of the present invention is providing a process as mentioned above that has a better resistance to saline mist, and allows a better oxidising, with respect to known processes. A further benefit of such process is that it is much safer than the previous ones, using a step of pre-heating with nitrogen instead of air, as happened in prior processes.

[0007] The above and other objects and advantages of the invention, as will appear from the following description, are obtained with a process as claimed in the independent claim. Preferred embodiments and non-trivial variations of the present invention are the subject matter of the dependent claims.

[0008] It is intended that all enclosed claims are an integral part of the present description.

[0009] The present invention will be better described by some preferred embodiments thereof, provided as a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 is a schematic view of an embodiment of the plant according to the present invention; and
- Figure 2 is a side sectional view of a pit furnace used in the plant of Figure 1.

[0010] With reference to the Figure, a preferred embodiment of the process and plant of the present invention is shown and described.

[0011] The process of the invention is used for the anti-oxidising surface treatment of steel parts, and comprises the steps of:

- washing or de-greasing a charge of steel components to be treated;
- nitriding under gaseous phase the charge, after its washing, wherein the step of nitriding is composed of the sub-steps of:
  - pre-heating with nitrogen till a temperature of 350 °C;
  - heating from 350 °C to 450 °C in an atmosphere composed of CO_2;
  - heating from 450 °C to 520 - 600 °C for half an hour in an atmosphere containing N_2;
  - maintaining, at the same temperature of 520 - 600 °C, for a period from 2 to 10 hours, in an atmosphere composed of a mixture containing NH_3, CO_2 and N_2;
- washing with nitrogen the environment where nitriding occurred; and
- steam oxidising, consisting in the immission of overheated steam at a temperature in the range between 490 °C and 540 °C for the necessary time to obtain a complete oxygen-iron exchange.

[0012] Preferably, but not in a limiting way, the steel parts can be components for motor vehicle use, or for oil platforms, or still more to be used in mechanics. Obviously, the inventive process is also applied to several other types of components that need nitriding and oxidising. The mixture with which the sub -step of maintaining at the same temperature of 520 - 600 °C is performed, contains, in volume, 70% of NH_3, from 10% to 15% of N_2 and, respectively, from 20% to 15% of CO_2. In particular, the mixture with which the sub-step of maintaining at the same temperature of 520 - 600 °C is performed, can contain, in volume, 70% of NH_3, 10% of N_2 and 20% of CO_2. A plant for performing the above-described anti-oxidising surface treatment of steel parts substantially comprises:

- a washing machine 5;
- a pit furnace 7;
- oxidising means 9; and
- handling means 2 (of the winch type) of a charge 3 with the parts to be treated;

wherein, through the handling means 2, the charge 3 is first inserted into the washing machine 5, to be washed and de-greased (removing impurities from previous working, such as for example oil), and is then inserted into the pit furnace 7 to be subjected to the steps of nitriding and washing the furnace 7 with nitrogen.

[0013] The oxidising means 9 are connected to the pit furnace 7 in order to perform in a single plant the step of steam oxidising after the step of washing with nitrogen the furnace 7.

[0014] At the end of the nitriding process, the charge 3 is extracted from the furnace 7, through the handling means 2, and is sent to following workings.

[0015] Figure 2 describes a typical pit furnace 7 used for the plant of Figure 1. With reference to Figure 2, the furnace 7 comprises an external structure 11 for support and heat insulation, composed of ceramic fiber and containing, inside, on its side walls and its lower wall, a plurality of electric resistances 13 for heating the internal environment. The charge 3 is inserted centrally and coaxially into the furnace 7 using its upper opening; the charge 3 is slinged in a supporting structure 15 ending with a cover 17 that facilitates its various handling operations. After having inserted the charge 3, the furnace 7 is closed by a plug 19, modelled in order to support a motored fan 21, whose blades 23 work in order to move the gas mixture contained inside the furnace, in order to keep its temperature uniform. The furnace 7 is further equipped, in its upper part, with an exhausting device 25, which is a barrel from which reaction gases from various processes go out: such gases are burnt by the flame generated by such exhausting device 25. Function of the exhausting device 25 is also signalling the moment in which the oxidising step (that has different operating times according to the number and sizes of treated parts) ends, because at such time the small flame contained therein is extinguished. The oxidising means 9 can be composed of an intermittence-type pump suitable to send distilled water onto the charge 3 for its oxidation, or be composed of a steam generator adapted to steam-oxidise the charge 3, or still more be oxidising means adapted to perform the oxidising of the charge 3 by using the same CO_2 already present in the nitriding plant.

Claims

1. Process for the anti-oxidising surface treatment of steel parts comprising the steps of:

   - washing or de-greasing a charge of steel components to be treated;
   - nitriding under gaseous phase said charge, after its washing, said step of nitriding being composed of the sub-steps of:

     • pre-heating with nitrogen till a temperature of 350 °C;
     • heating from 350 °C to 450 °C in an atmosphere composed of CO_2;
     • heating from 450 °C to 520 - 600 °C for half an hour in an atmosphere containing N_2;
     • maintaining, at the same temperature of 520 - 600 °C, for a period from 2 to 10 hours, in an atmosphere composed of a mixture containing NH_3, CO_2 and N_2, wherein the mixture with which the sub-step of maintaining at the same temperature of 520 - 600 °C is performed, contains, in volume, 70% of NH_3, from 10% to 15% of N_2 and, respectively, from 15% to 20% of CO_2;

   - washing with nitrogen the environment where said nitriding occurred; and
   - steam oxidising, consisting in the immission of overheated steam at a temperature in the range between 490 °C and 540 °C for the necessary time to obtain a complete oxygen-iron exchange.

2. Process according to claim 1, wherein the steel parts are components for motor vehicle use.

3. Process according to claim 1, wherein the steel parts are components for oil platforms.

4. Process according to claim 1, wherein the steel parts are components to be used in mechanics.

5. Process according to claim 1, wherein the mixture with which the sub-step of maintaining at the same temperature of 520 - 600 °C is performed, contains, in volume, 70% of NH_3, 10% of N_2 and 20% of CO_2.

Patentansprüche

1. Verfahren für die antioxidierende Oberflächenbehandlung von Stahlteilen, das folgende Phasen umfasst:

   - Waschen oder Entfetten mit einer Ladung der zu behandelnden Stahlkomponenten;
   - Nitrierhärtung der genannten Ladung in der gasförmigen Phase nach ihrer Wäsche, die genannte Nitrierhärtungsphase besteht aus folgenden Unterphasen:

     • Vorerhitzung in Stickstoff bis zu einer Temperatur von 350 °C;
     • Erhitzung von 350 °C bis 450 °C in einer Atmosphäre aus CO_2;
     • Erhitzung von 450 °C bis 520 - 600 °C für eine halbe Stunde in einer N_2-haltigen Atmosphäre;

• Erhaltung derselben Temperatur von 520 - 600 °C, für einen Zeitraum von 2 bis 10 Stunden, in einer Atmosphäre aus einer NH_3-, CO_2- und N_2,-haltigen Mischung, in der die Mischung, mit der die Unterphase der Erhaltung derselben Temperatur von 520 - 600 °C ausgeführt wird, volumenanteilig 70 % NH_3, von 10 % bis 15 % N_2 und jeweils von 15 % bis 20 % CO_2 enthält

- Wäsche der Umgebung, wo die genannte Nitierhärtung erfolgt ist, mit Stickstoff; und
- Dampfoxidation, die aus der Einführung von Dampf besteht, der für die notwendige Zeit, einen kompletten Sauerstoff-Eisen-Austausch zu erhalten, auf eine Temperatur im Bereich von 490 °C bis 540 °C erhitzt wird.

2. Verfahren gemäß Patentanspruch 1, in dem die Stahlteile Komponenten für die Anwendung in der Automobilindustrie sind.

3. Verfahren gemäß Patentanspruch 1, in dem die Stahlteile Komponenten für Bohrinseln sind.

4. Verfahren gemäß Patentanspruch 1, in dem die Stahlteile Komponenten für die Anwendung in der Mechanik sind.

5. Verfahren gemäß Patentanspruch 1, in dem die Mischung, mit der die Unterphase der Erhaltung derselben Temperatur von 520 - 600 °C ausgeführt wird, volumenanteilig 70 % NH_3, 10 % N_2 und 20 % CO_2 enthält.

Revendications

1. Procédé de traitement superficiel antioxydant de pièces en acier comprenant les phases de :

- lavage ou dégraissage d'une charge de composants en acier à traiter ;
- nitruration en phase gazeuse de cette charge, après son lavage, la phase de nitruration est composée des sous-phases de :

• préchauffage à l'azote jusqu'à une température de 350°C ;
• chauffage de 350°C à 450°C dans une atmosphère constituée de CO_2 ;
• chauffage de 450°C à 520 - 600°C pendant une demi-heure en atmosphère contenant N_2 ;
• maintien, à la même température de 520 - 600°C, pendant une période de 2 à 10 heures, dans une atmosphère composée d'un mélange contenant NH_3, CO_2 et N_2, où le mélange avec lequel on exécute la sous-phase de maintien à la même température de 520 - 600°C contient, en volume, 70% de NH_3, de 10% à 15% de N_2 et, respectivement, de 15% à 20% de CO_2

- lavage à l'azote du milieu où s'est produite la nitruration ; et
- oxydation à vapeur, consistant à introduire de la vapeur surchauffée à une température entre 490°C et 540 °C le temps nécessaire pour obtenir un échange complet oxygène-fer.

2. Procédé, selon la revendication 1, où les pièces en acier sont des composants pour usage automobile.

3. Procédé, selon la revendication 1, où les pièces en acier sont des composants pour plateformes pétrolières.

4. Procédé, selon la revendication 1, où les pièces en acier sont des composants pour l'utilisation en mécanique.

5. Procédé, selon la revendication 1, où le mélange utilisé pour la sous-phase de maintien à la même température de 520 - 600°C contient, en volume, 70% de NH_3, 10% de N_2 et 20% de CO_2.

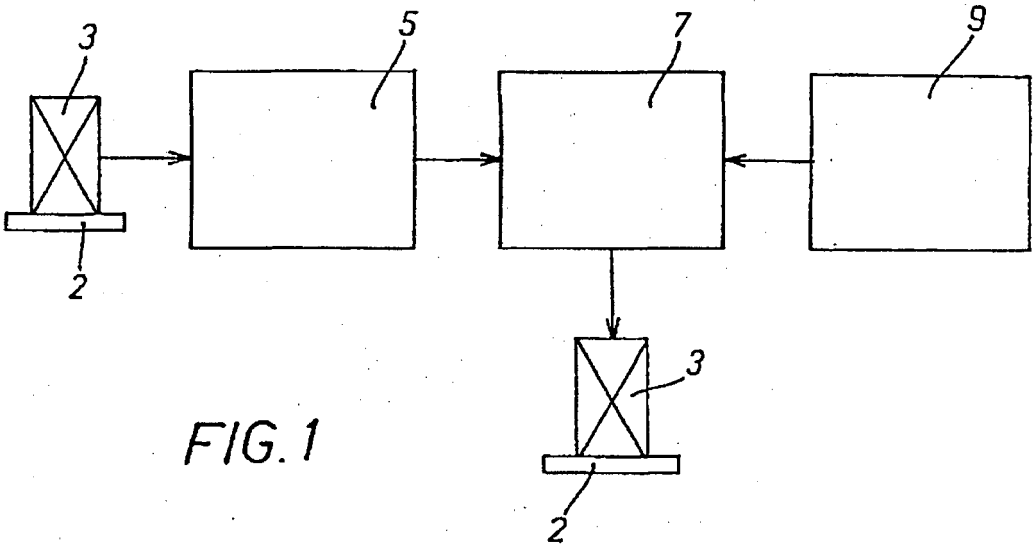

FIG. 1

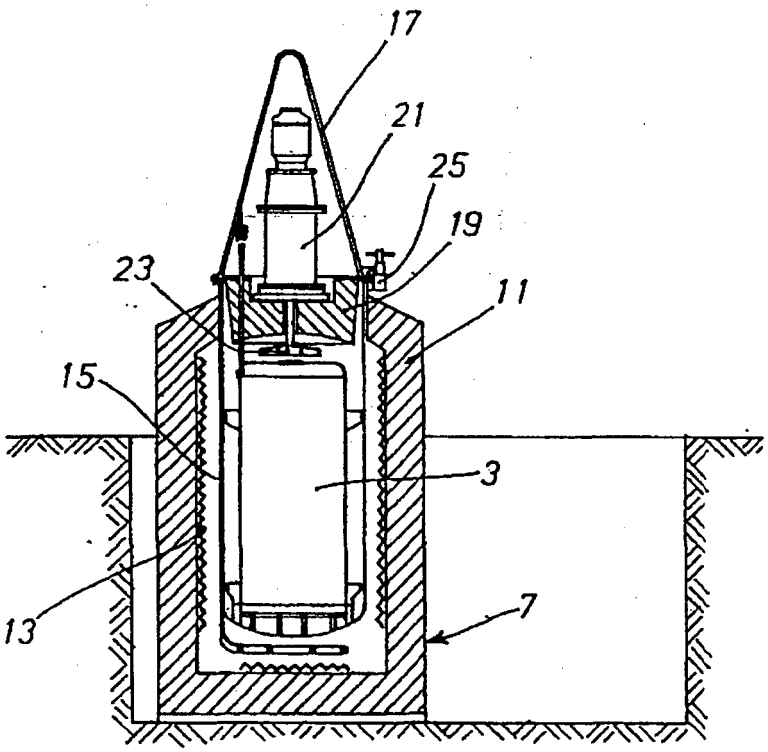

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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