3,679,418
PROCESS FOR TREATING A METAL SURFACE AND REPROGRAPHIC MATERIAL COMPRISING THE SURFACE SO TREATED
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5 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a process for treating a metal surface, wherein a surface of a metal foil is subjected to a uniform treatment with a plasma arc jet, and also to a reprographic material which comprises a metal surface which has been treated according to the process.

In a more special application, the invention relates to a process for roughening a metallic planographic printing plate, in which process the cleaning and roughening of the metallic surface are performed in a novel manner.

In the preparation of planographic metal printing plates, a metal foil serves as the support for the printing image. Such metallic supports almost invariably must be cleaned, i.e. carefully freed from traces of grease adhering thereto from the rolling process, and, after cleaning, roughened on the surface which is to carry the printing image. Thereafter, the printing image is produced thereon. Frequently, the surface is modified before the printing image is applied in order to improve the adhesion of the printing image to the surface or to increase the hydrophilic properties of the surface, for example. Cleaning of the foil is effected by washing or by a chemical or electrochemical treatment, and for roughening the foil, mechanical or also chemical or electrochemical methods are used. Both the cleaning and the roughening of the foil surface are time-consuming, require washing agents or other chemicals and are bothersome due to the necessity of removing or recovering the washing or treating agent used. Further, it is generally necessary to effect the cleaning and roughening of the foil surface in two separate process steps.

The present invention provides a process in which no, or considerably less, treating agents are required and must be removed as waste, and in which cleaning and roughening preferably are performed in a single process step.

The process of the invention is based on the known process for roughening planographic printing plates consisting of metal foils, preferably aluminum or steel foils, in which the surface of the metal foil is provided with a printing image after it has been roughened. In the process according to the invention, roughening of the surface is effected by treatment with a plasma jet.

Plasma jet treatments have only recently been introduced into the art. Plasma jets are jets of gases of very high temperature and normally also of high gas speed.

Within the scope of the present invention, jets of heated gases are regarded as plasma jets which have a temperature of more than 3000° C. Preferably, the gases have temperatures of 6000 and are generated most advantageously by means of an electric arc produced in a protective gas, e.g. an argon atmosphere, between a heat-resistant electrode, e.g. a tungsten electrode, or a series of electrodes, on the one hand, and the web of material on the other hand. Surprisingly, it was found that, within an appropriate time of treatment, an entirely uniform, finely roughened surface is produced. The most suitable time of treatment may be easily determined by means of tests. It depends on the conditions of processing, e.g. on the kind of metal foil used, on the thickness of the foil and its heat capacity, and on the temperature surrounding the foil. It has proved to be of advantage to cool the foil with a cooling medium during the treatment, or to place it on a support cooled with a cooling medium.

In the tests made for determining suitable process conditions, the appearance of the surface produced normally also can be referred to for judgment, it being advisable to also examine a microscopic enlargement. Thus, when treating the surface of a crude, i.e. uncleaned, aluminum sheet with a plasma jet produced by means of an argon welding device provided with a screened welding electrode, it was observed that at amperages between 10 and 60 amperes the treated surface changed its appearance within a very short time. Even by watching the appearance of the surface with the naked eye, it could be determined at which electrode distance, amperage, treating speed, and with which shape and position of the electric arc electrode the surface assumed the desired uniformly matte appearance. By examining the treated surface under a microscope, at a 275 times enlargement, it could be determined, with still finer distinction, whether, under the process conditions employed, the action of the plasma jet was too weak or too strong. In the case of too weak an action, the structure impressed upon the surface of the aluminum sheet by the rolling process was still visible over the entire surface or part of it, while in the case of too strong an action, a fusion of the surface was observed which, depending on the degree of excessive influence, ranged from fine local melting to a molten surface of coarse-waved structure. Thus, a fluctuation (unsteadiness) of the electric arc also became visible as small areas where the surface had melted.

When uncleaned foil material is used for the process according to the invention for the preparation of planographic printing plates, the roughening process involves a cleaning of the surface. Therefore, cleaning of the surface prior to the plasma jet treatment can be dispensed with, and, consequently, foils which have not been freed from the rolling grease adhering to the surfaces are advantageously used in the process of the invention.

In addition to the advantages already mentioned, the process of the invention affords the possibility to combine the cleaning and roughening process with a modification of the plate surface. If the protective gas is mixed with smaller or larger quantities of air or oxygen, a certain degree of oxidation of the surface is caused, which, in the case of aluminum plates, for example, results in an improved hardness of the surface which in itself is desirable. If finely dispersed kieselguhr is introduced into the plasma jet, silicate formation on the surface is caused simultaneously with the cleaning and roughening effect, which improves the hydrophilic properties of the surface. Further, the process of the invention offers the possibility of effecting a metallization of the surface, simultaneously with the roughening and, if necessary, cleaning, by introducing the finely pulverized metal into the plasma jet. In this manner, a bimetal plate is produced when the process of the invention is combined with a copper-plating of the surface, for example. A particularly hard surface is obtained by metallizing with C. Hardened metal carbides, such as silicon carbide, also may be applied to the treated surface by the process of the invention.

In the process for the preparation of a planographic printing plate, treatment of the metal surface is followed by the application of the printing image to the treated surface. This process step, which is known in many modifications, is not part of the present invention, so it is not described in detail. Also in the case of the present inven-
tion, the application of the printing image may take place in any known manner. The following are examples of methods for applying the image, without any limitation to the methods mentioned: direct inscription or tracing; transfer printing; photomechanical reproduction, e.g. by means of light-sensitive colloid layers, diazo-type layers, or azido layers; electrophotographic reproduction; image production by imagewise heat action, e.g. by thermo-polymerization; and electrochemical and electrolytic image production.

A particularly advantageous method for a plasma arc jet treatment of the surface of webs of metal foils, which can be used not only for the preparation of metal support for printing plates, but also for other purposes, is a further feature of the present invention. According to this method, the upper surface of the web of metal foil is treated with a plasma arc jet while the web is conveyed longitudinally in a horizontal direction, by generating a plasma arc between a series of arc electrodes on the one hand and the web of metal foil on the other hand, in a zone which extends transversely across the web, while supplying, in the same zone, a stream of liquid cooling medium to the lower surface of the web over its entire width, and allowing the stream of cooling medium to flow off in a horizontal discharge channel, which extends under that portion of the web which approaches the treating zone as well as under the portion which leaves it, so that the web of metal foil is supported by the cooling medium flowing off in the horizontal discharge channel.

The method will be described in detail with reference to the accompanying drawing which is a diagrammatic illustration of a cross-section through an apparatus for performing the method.

A web of metal foil 3 is drawn off a roll 1 by cooling it to form the roll 8, with the aid of a driven winding device. In its course, the web of metal foil is deflected over the contact roll 2, guided horizontally beneath a series of tungsten electrodes 4 mounted transversely of the web, and then again deflected over a second, driven, contact roll 7. Between the series of electrodes 4 and the web 3 passing beneath it, a series of electric arcs 5 is generated in a protective argon gas atmosphere. Under the horizontally conducted part of the web 3, there is positioned a container 6 for a cooling medium, which is covered by a lid 9 having a smooth horizontal upper surface. In the zone where the plasma jet is generated, there is a slot 10 in the lid. Through this slot, cooling medium from the container 6 is caused to issue by means of a pump (not shown).

Under the web of metal foil 3, the cooling medium spreads on the upper surface of the container lid and finally flows into a collecting vessel, from which it is pumped back into the container for the cooling medium. Thus, in the zone where it is acted upon by the plasma jets, the web of metal foil is supported by a horizontal layer of container 6 for a cooling medium, which is covered by a moves transversely over the web of metal foil, so that the plasma arc jets act uniformly upon the foil surface. In a further modification, the electrical contact between the web of metal foil and the source of current may be made over the cooling medium, provided it is electro-conductive.

It will be obvious to those skilled in the art that many modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

What is claimed is:

1. A process which comprises subjecting the surface of an aluminum or steel foil web to a uniform treatment with a plasma arc jet for a time sufficient to produce a matte appearance on said surface but insufficient to uniformly melt said surface, said plasma arc jet being generated between a series of electrodes and one surface of said web in a zone extending transversely of said web while said web is conveyed transversely of said zone, and applying a liquid cooling medium to the other surface of said web.

2. A process according to claim 1 in which the web is conveyed in a horizontal direction and is supported by a film of the cooling medium flowing on a horizontal bed.

3. A process according to claim 2 in which the cooling medium is continuously flowing.

4. A process according to claim 1 in which a material selected from the group consisting of air, oxygen, kieselgur, a finely pulverized metal or metal carbide is introduced into the plasma jet.

5. A planographic printing plate comprising an aluminum or steel foil which has been subjected to a plasma jet treatment so that one surface thereof is roughened, and a photosensitive reproduction layer on said surface.

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EDWARD G. WHITBY, Primary Examiner

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96—33; 101—454, 456; 117—49, 71 M, 93.1 PF, 105.2, 106 C, 131; 148—6.3
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Joachim Strozsynski

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

Column 3, line 13, "support" should read -- supports --.

Column 3, line 17, "longitudinal" should read
-- longitudinally --.

Column 3, line 44, "coveved" should read -- covered --.

Column 4, line 1, this line should be deleted and replaced by:
-- cooling liquid. Advantageously, the row of electric arcs --.

Signed and sealed this 12th day of December 1972.

(SEAL)
Attest:

EDWARD M. FLl'TCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patents