

MAR 13 2002

Michael N. Milby
Clerk of Court

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT, TEXAS
BROWNSVILLE DIVISION

MEXINOX USA, INC., and
MEXINOX SA de CV,

Plaintiff,

v.

J & L SPECIALTY STEELS, INC.,

Defendant.

Civil Action No. B-02-047

**COMPLAINT FOR DECLARATION OF NON-INFRINGEMENT AND/OR
INVALIDITY OF REEXAMINED U.S. PATENT NO. 5,830,291 C1**

Plaintiffs, MEXINOX USA, INC., and MEXINOX SA de CV (collectively "Mexinox") for its complaint against Defendant J&L SPECIALTY STEELS, INC., ("J&L") alleges as follows:

THE PARTIES

1. Plaintiff, Mexinox USA, is a corporation organized and existing under the laws of Texas and having a principal place of business at 400 S. Port Road, P.O. Box 8637, Brownsville, TX 78526.

2. Plaintiff, Mexinox SA de CV, is a corporation organized and existing under the laws of Mexico and having its principal place of business at Av. Industrias No. 4100, Zona Industrial 1a. Seccion, 78395 San Luis Potosi, SLP, Mexico.

3. Defendant, J&L, is a corporation organized and existing under the laws of the State of Pennsylvania and having a principal place of business at

Westpointe Corporate Center One, 1550 Coraopolis Heights Road, Suite 500,
Coraopolis, PA 15108.

JURISDICTION AND VENUE

4. This action arises under the 28 U.S.C. § 2201 et seq. and 35 U.S.C. § 1 et seq.
5. This Court has jurisdiction under 28 U.S.C. § 1331 and § 1338.
6. Venue is proper in this District pursuant to 28 U.S.C. § 1391.

GENERAL ALLEGATIONS

7. Mexinox is a manufacturer of stainless steel products and maintains its principle place of business within this judicial district.
8. Upon information and belief, Defendant J&L manufactures flat rolled stainless steel products and sells its products and otherwise does business in this judicial district and throughout the United States.
9. J&L was granted United States Patent No. 5,830,291 ("the '291 patent") on November 3, 1998 for a Method for Producing Bright Stainless Steel. A copy of the '291 patent is attached as Exhibit A.
10. On May 22, 2001, the U.S. Patent and Trademark Office issued a Reexamination Certificate for U.S. Patent No. 5,830,291 C1 (the "reexamined '291 patent"). A copy of the reexamined '291 patent is attached as Exhibit B.
11. On or about February 14, 2002, Counsel for Mexinox received a letter dated February 14, 2002 from Mr. Russell D. Orkin, who stated in the letter that he was contacting Mexinox on behalf of his client, J&L. The letter referenced the reexamined '291 patent and stated: "J&L Specialty remains interested in discussing a possible license of the '291 patent including payments for any past infringements. J&L Specialty is willing to license both the ferritic and austenitic

grades, or solely the ferritic grades if you can demonstrate that the process used to manufacture the austenitic grades falls outside the claims of the '291 patent. Absent such an arrangement, Mexinox should immediately cease and desist the shipment of these infringing products to the United States. If I do not hear from you with a response that rapidly moves this matter toward an amicable resolution, I have been authorized to seek legal recourse."

12. Counsel for Mexinox sent a letter on February 26 in reply to Mr. Orkin's February 14 letter stating that they would review the February 14 letter with Mexinox and provide a further response shortly.

13. On March 11, 2002, Counsel for Mexinox received a letter from Mr. Orkin stating that J&L had filed (on March 8, 2002) a Complaint against Mexinox in the U.S. District Court for the Western District of Pennsylvania. That letter also stated that J&L was withholding service of the Complaint.

14. Mexinox brings this action under the patent laws of the United States, Title 35 of the United States Code, and under the Declaratory Judgement Act, 28 U.S.C. § 2201 et seq., seeking a judgement of non-infringement and/or invalidity of reexamined '291 patent. In view of the parties' letters and the filing of a lawsuit by J&L, an actual case and controversy exists between the parties.

15. Mexinox, denies present or past infringement of the reexamined '291 patent and based upon information and belief, asserts that the reexamined '291 patent is not infringed and/or is invalid.

**COUNT I - DECLARATORY JUDGMENT OF
NON-INFRINGEMENT OF THE '291 PATENT**

16. Mexinox incorporates herein by reference the allegations in paragraphs 1-15 above.

17. Mexinox does not infringe the reexamined '291 patent; Mexinox does not make, use, sell, offer for sale or import any products which infringe the reexamined '291 patent.

COUNT II - DECLARATION OF INVALIDITY OF THE '291 PATENT

18. Mexinox incorporates herein by reference the allegations in paragraphs 1-17 above.

19. The alleged invention claimed in the reexamined '291 patent is invalid because it is not new and useful and does not meet the conditions for patentability contained in 35 U.S.C. § 101.

20. Specifically, the invention allegedly covered by the reexamined '291 patent was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the alleged invention thereof by the applicant for patent, and/or was described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, and therefore the reexamined '291 patent is invalid under 35 U.S.C. § 102.


21. Any differences between the subject matter sought to be patented in the reexamined '291 patent and the prior art are such that the subject matter of the patent as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains, and therefore the reexamined '291 patent is invalid under 35 U.S.C. § 103.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff prays for judgement against Defendant as follows:

22. A declaration that reexamined '291 patent is not infringed by any Mexinox product.
23. A declaration that reexamined '291 patent is invalid.
24. That J&L be enjoined from bringing or maintaining an action or threatening to bring an action to enforce the reexamined '291 patent against Mexinox or from charging infringement thereof against Mexinox.
25. That Mexinox be awarded its costs and attorneys' fees, as this is an exceptional case under 35 U.S.C. § 285.
26. That the Court grant such other, further, or different relief as the Court deems proper under the circumstances.

Respectfully Submitted,



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US005830291A

United States Patent [19]
McGuire et al.

[11] **Patent Number:** **5,830,291**
[45] **Date of Patent:** **Nov. 3, 1998**

- [54] **METHOD FOR PRODUCING BRIGHT STAINLESS STEEL**
- [75] **Inventors:** Michael F. McGuire, Pittsburgh, Pa.;
Kelley L. Senzarin-Kulfk, Uniontown;
Anthony J. Denol, North Canton, both
of Ohio
- [73] **Assignee:** J&L Specialty Steel, Inc., Pittsburgh,
Pa.
- [21] **Appl. No.:** 726,841
- [22] **Filed:** Oct. 8, 1996

Related U.S. Application Data

- [60] **Provisional application No.** 60/015,847 Apr. 19, 1996.
- [51] **Int. Cl. 6** C21D 8/00
- [52] **U.S. Cl.** 148/610; 148/606
- [58] **Field of Search** 148/610, 606

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Primary Examiner—Deborah Yee
Attorney, Agent, or Firm—Webb Ziesenheim Bruening
Logsdon Orkin & Hanson, P.C.

[57] **ABSTRACT**

A method for producing bright stainless steel whereby a hot mill band having a dull oxide-free surface is first formed. The hot mill band is cold reduced to form a full hard coil having a shiny surface. The coil is subjected to continuous annealing at a temperature of 1500°–1950° F. in an oxygen-containing atmosphere sufficient to form a protective FeCr₂O₃ scale. The annealed coil is subjected to a mild non-etching pickling process to remove the black scale. The coil is then rolled on a temper mill having specially finished rolls to impart a surface pattern that replicates an abrasively polished surface.

18 Claims, 7 Drawing Sheets



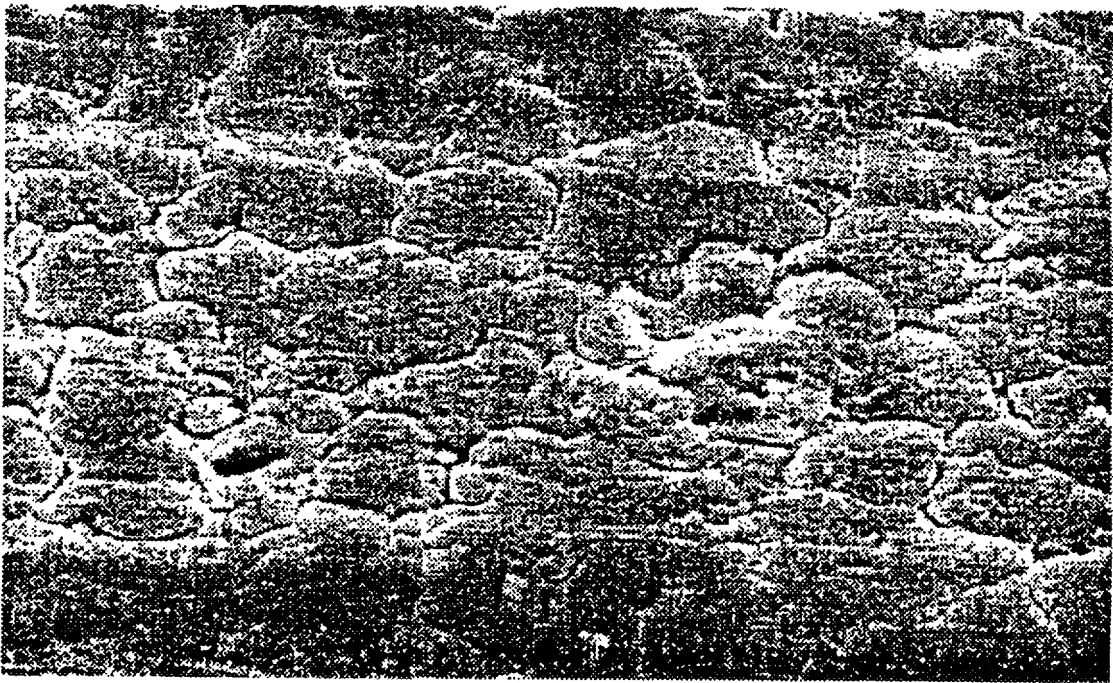


FIG. 1



FIG. 2

T304 BRIGHT PICKLE
ANNEALING TEMP. VS. FINAL GLOSS

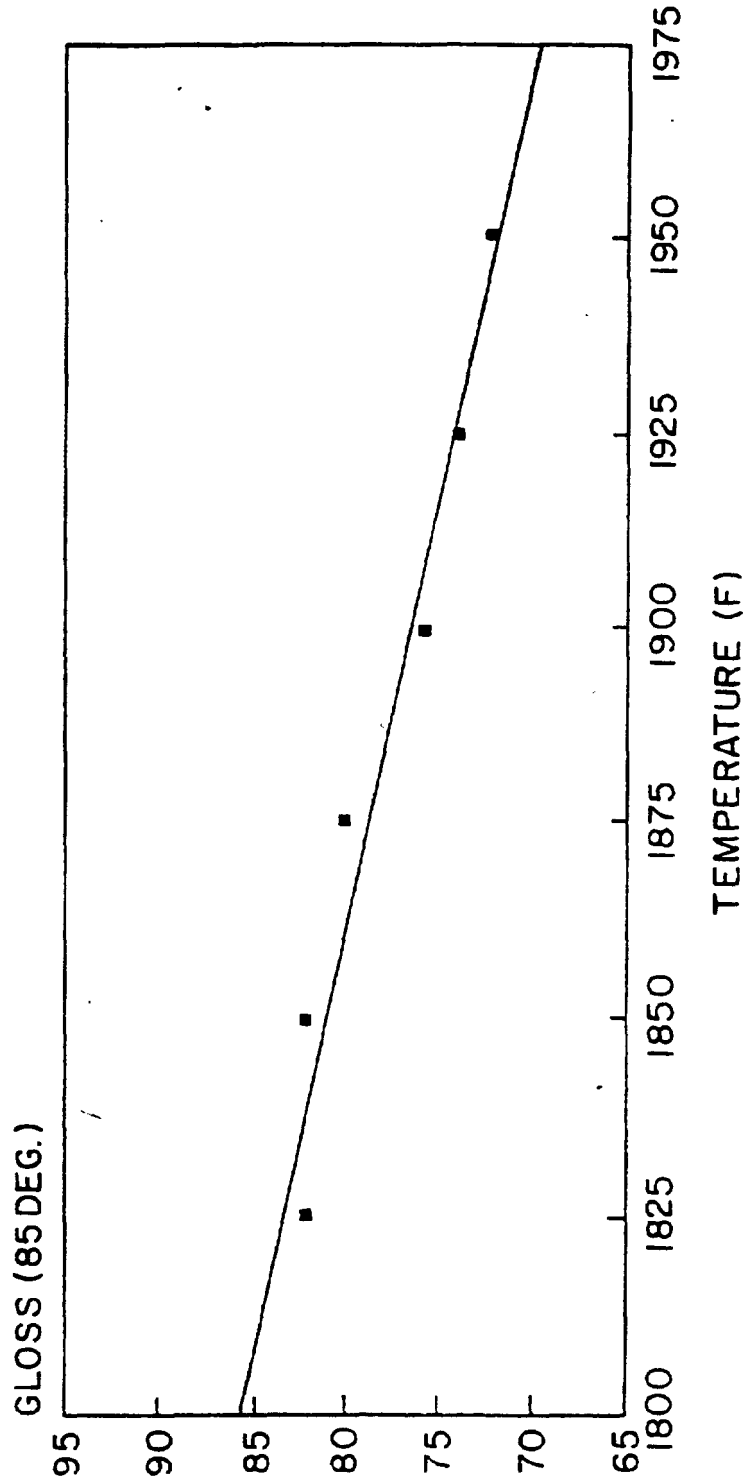


FIG. 3

—GLOSS

T304 BRIGHT PICKLE
ANNEALING TEMP. VS. YIELD STRENGTH

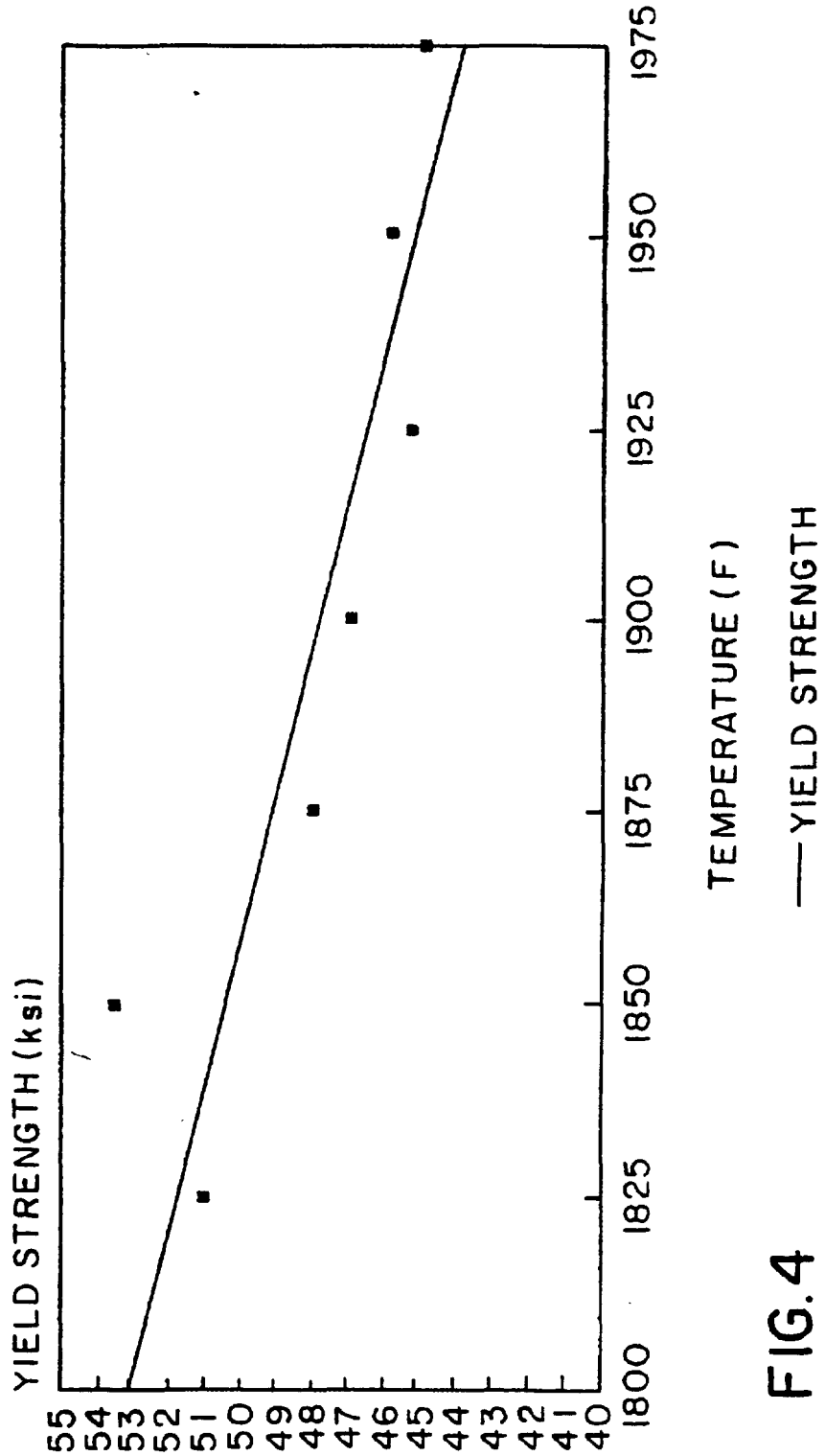


FIG. 4

FIG. 5A

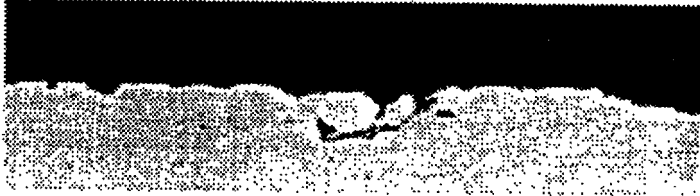


FIG. 5B



FIG. 5C



FIG. 5D



FIG. 5E



PHASE BOUNDARIES IN THE Fe-Cr-O SYSTEM

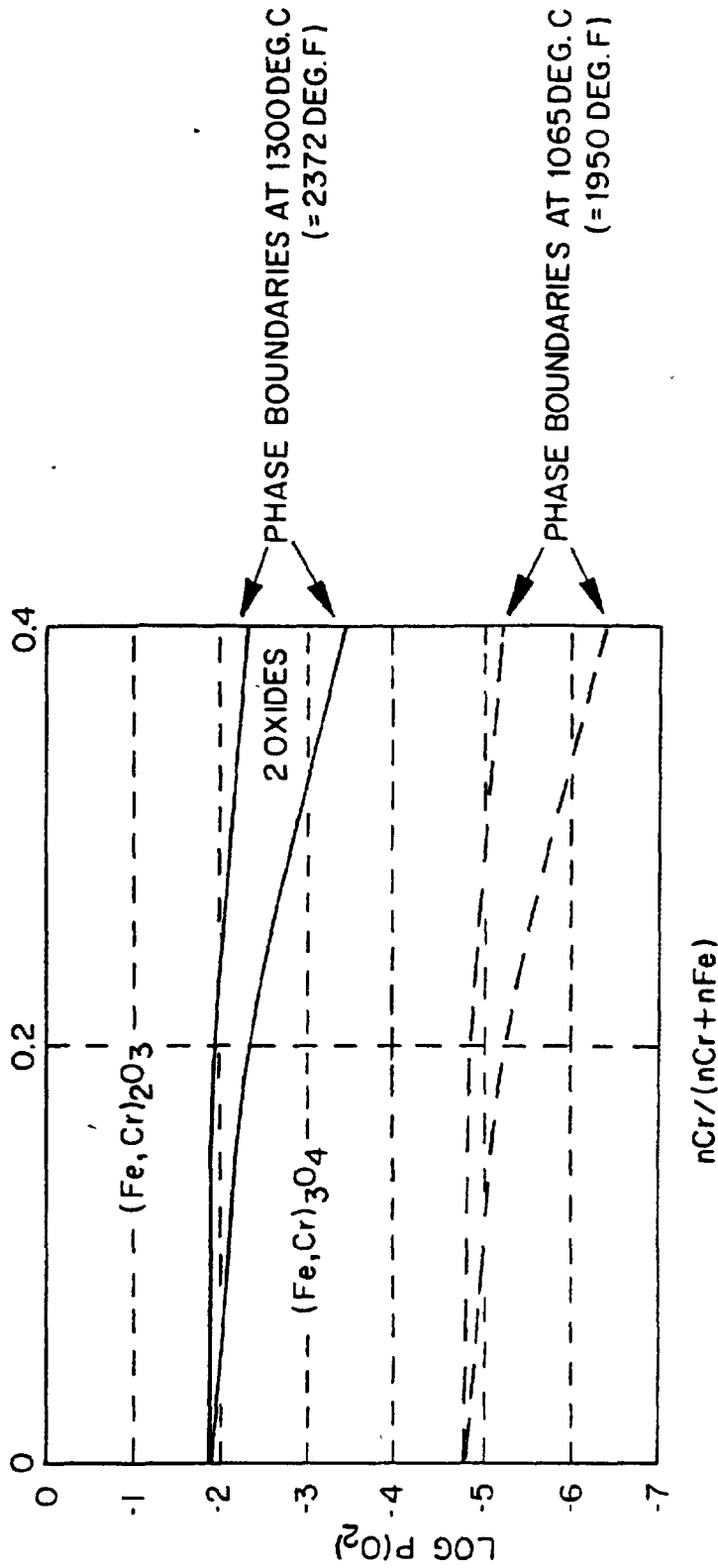


FIG. 6

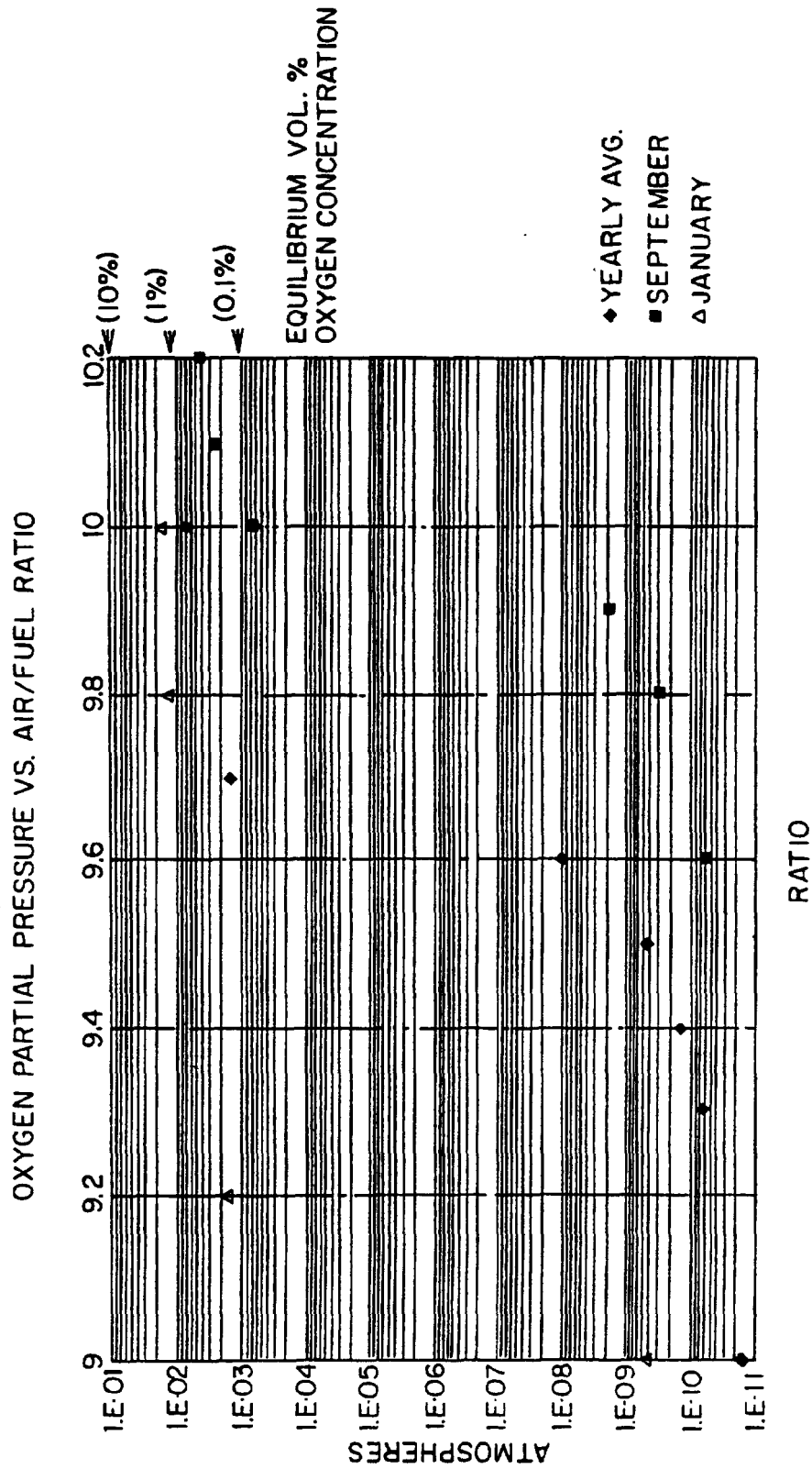


FIG. 7

METHOD FOR PRODUCING BRIGHT STAINLESS STEEL

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of earlier-filed U.S. Provisional patent application Ser. No. 60/015,847, filed Apr. 19, 1996.

BACKGROUND OF THE INVENTION

This invention relates to a process for producing stainless steels having a reproducible bright surface. More particularly, it relates to producing ferritic and austenitic stainless steels having a bright annealed-like surface but without the use of a protective atmosphere.

A significant portion of the flat rolled stainless steel sheet used in the world has a polished surface. This surface finish is generally produced by abrading the surface to produce a sanded appearance. A much smaller percentage is produced by embossing a similar pattern on stainless steel which has been annealed in a protective atmosphere. The embossed surface is generally the visual equivalent of the polished surface.

However, abrasive finishing is costly and time-consuming and may produce an inconsistent product in that it is prone to defects, such as polishing chatter, pits, minute surface tears, abrasive belt marks and the like. While embossed finishes are less costly to produce and are extremely uniform, the equipment to produce such finishes is scarce and an expensive bright annealed strip is required as the starting material. By bright annealed, we mean a strip that has been continuously annealed in a protective atmosphere, such as hydrogen and/or hydrogen/nitrogen so as to preclude the formation of surface oxides (in the first instance).

Austenitic stainless steels are typically annealed at temperatures on the order of 1900° to 2100° F. At these temperatures, air annealing produces thick scale, which scale cannot be economically removed by the milder acids necessary to minimize differential attack on the metal once the scale is dissolved. In the case of ferritic stainless steels, the annealing temperature is subcritical, normally below 1600° F. However, when carried out in an air atmosphere, there is a tendency to deplete the surface of the stainless steel of chromium leading to inferior corrosion resistance.

One such proposed solution is that found in U.S. Pat. No. 4,450,058. This patent recognizes the desirability of using an air anneal to avoid the capital cost associated with a controlled furnace atmosphere facility. However, after air annealing at conventional temperatures, the patentee removes scale by making the strip an anode and applying a direct electric current to the strip in an acidic electrolyte. The use of direct current is not practical in most existing facilities and at the temperatures in which the examples are annealed; namely, 1500° F. and 1750° F., chromium depletion is believed to be a significant problem.

It is therefore an object of the current invention to obtain a reproducible bright surface, such as a high gloss shiny surface, without the need for a protective atmosphere anneal.

There is a further objective to emboss a pattern which replicates an abrasively polished surface on said bright surface to avoid brushing and sanding and yet still obtain a desired surface quality.

These objectives must be consistent with the need to maintain the desired mechanical properties, e.g., yield strength.

SUMMARY OF THE INVENTION

Our invention derives from the unexpected observation that austenitic and ferritic stainless steels annealed below 1950° F. have a scale which is thin yet can be removed by oxidizing the scale in molten salt and then dissolving the scale in sulfuric acid and nitric acid. This leaves the base metal bright and relatively unattacked. Any scale formation on stainless steel partially depletes a thin layer near the surface of some chromium. A thin scale, however, contains a correspondingly small volume of chromium so little depletion exists. Thus mild acids are sufficient to both remove the oxide and restore the corrosion resistance of the surface to its pre-annealed state by dissolving a small volume of the metal surface which has been partially depleted of chromium. The stronger halide acids, such as hydrofluoric acid, can be substantially reduced or eliminated from use in conjunction with the sulfuric and/or nitric acid baths. This minimizes the differential attack on the grain boundaries which causes the surface to become dull. We have found that the hydrofluoric acid content should be maintained at or below 0.5% by weight.

This is unexpected because ferritic steels, which can be and usually are annealed at very low temperatures, e.g., 1600° F. have thin scales, but show heavy chromium depletion which requires strong pickling. This makes polishing essential in the final product to arrive at a bright and shiny surface. By annealing at a higher temperature, we theorize the diffusion rate of chromium is sufficiently high to eliminate, by diffusion, the chromium concentration gradient, and permit a mild pickling without excessive chromium depletion.

Likewise on austenitic stainless steels, which are ordinarily annealed at high temperatures of about 2000° F., we theorized that lower temperature annealing minimizes scale growth and the corresponding chromium depletion. In each case the result is a thin scale, with minimum oxidation attack to the underlying metal and minimal distortion of the subsurface chromium concentration. These thin scales are then amenable to dissolution by the milder acids which dissolve oxides (scale) but do not etch the underlying metal surface. Under certain operating conditions scales are formed which are effective barriers to oxygen diffusion and thus to rapid scale growth. Slow scale growth is crucial to forming thin scale. Thin scale thus is favored by certain lower temperatures and higher oxygen partial pressures. Under normal conditions the partial pressure of oxygen should be on the order of 2% or greater although stable thin oxides can be obtained with partial pressures of oxygen as low as 0.1%. The fuel to air ratio to achieve the desired oxygen partial pressure varies with the humidity of the combustion air. Reference is to the percent of oxygen in the atmosphere. The use of an embossed surface instead of a polished surface not only eliminates the extra and costly processing but eliminates grinding defects including the microscopic defects which can carry through to the final product. This has led to improved stain removal on hard to remove stains such as permanent ink.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a photomicrograph at 4520x of a 304 stainless steel with a conventional anneal above 1950° F. and conventional pickling;

FIG. 2 is a photomicrograph at 4520x of a 304 stainless steel with an anneal below 1950° F. and bright pickling;

FIG. 3 is a graph of a 304 stainless steel bright pickled and plotting anneal temperatures versus gloss;

FIG. 4 is a graph of a 304 stainless steel bright pickled and plotting anneal temperatures versus yield strength;

FIGS. 5A-5D are optical microscopy images at 1000x showing the surface of a conventional processed stainless steel which has been polished;

FIG. 5E is an optical microscopy image at 1000x showing the surface of the subject invention;

FIG. 6 is the phase boundary diagram for the Fe-Cr-O system at 2372° F. and 1950° F., respectively; and

FIG. 7 is the oxygen partial pressure versus air/fuel ratio.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Conventional processing of the stainless steel is carried out through cold reduction. Exemplary of this processing is the melting of the appropriate scrap along with the necessary alloys, such as nickel and ferrochromium, to create a liquid steel melt. The melt is then transferred to a refining unit such as an argon oxygen decarburization (AOD) unit. The AOD process reduces the carbon levels in the steel and improves the steel's cleanliness and metallurgical consistency.

Following the refining process, the liquid steel is cast into appropriate thickness slabs on the order of 6 to 7½ inches on a continuous slab caster. The slab is then reheated in an appropriate reheat furnace and rolled on a conventional hot strip mill to thicknesses typically 0.10 inch to 0.25 inch. At this point in the process, the coil is referred to as a black band since it is covered with a dark colored oxide scale resulting from the hot rolling.

The black band is then hot annealed and pickled. The hot anneal for the austenitic stainless steel is normally carried out on the order of 2000° F. for the appropriate solution anneal. For ferritic stainless steels, a subcritical anneal to desensitize the product is carried out at 1600° F. (i.e., render the chromium composition uniform and homogeneous). Shot blasting may be used as part of the scale cleaning process in conjunction with the pickling.

At this time, a dull oxide free surface coil is metallurgically soft and ready for cold rolling. Cold rolling is normally carried out on a multi-roll Sendzimir mill, a multi-stand tandem mill or a 4-high reversing mill. The product off the cold mill is considered full hard and at final gauge with a mirror-like surface. Product thickness is normally on the order of 0.015 inch to 0.187 inch. Reductions from the hot band to the cold band are on the order of 30-85%. The coil can normally not be used in this condition and must be softened by annealing.

In the case of austenitic stainless steels, such as AISI 304, the full hard coil is subjected to an anneal in a standard air atmosphere continuous anneal using a partial pressure of oxygen of at least 2% and at a temperature of 1800° to 1950° F. Leaving the continuous anneal furnace, the strip has a black scale on the order of 3000 angstroms thick. At the conventional higher annealing temperatures for austenitic stainless steels, the scale would have had a thickness on the order of 10,000 angstroms. The strip is air cooled out of the continuous anneal to approximately 1000° F. where it is subjected to a molten salt treatment which has the effect of enriching the oxygen content of the scale so as to make the scale more soluble. The strip is then air cooled and fed into a series of pickle tanks which subject the strip to sulfuric acid, a water rinse, nitric acid, a water rinse and finally a repeat of the nitric acid and water rinse cycle. It is not necessary to use the typical stronger acid, such as hydrofluoric acid at conventional concentrations which etches and

causes a matte or dull type surface. Where hydrofluoric acid is used, it can be used in concentrations of 0.5% and less by weight. We have also found that by maintaining the iron content of the nitric acid tanks at or below 1% we are able to achieve the desired uniformity and level of brightness of the steel surface.

There are other known pickling techniques including electrolytic pickling using a salt bath and alternating current which can be utilized and which do not attack the base metal.

The surface of a conventionally processed 304 stainless steel annealed above 1950° F. and then pickled in a pickling process which include a conventional hydrofluoric acid bath is shown in FIG. 1. The grain boundaries are attacked more than the grains and the surface has a "ditched" grain boundary appearance.

In contrast the same steel which has been annealed below 1950° F. and bright pickled with no hydrofluoric acid present shows grain boundaries which are far less etched and shows an even attack of the pickling acid on the grain and grain boundaries alike, see FIG. 2.

As the annealing temperature decreases, the thickness of scale to be removed decreases and the surface gloss increases, see FIG. 3. However, at the same time, the yield strength increases with the decrease in annealing temperature, see FIG. 4. The annealing temperature range of 1800° F. to 1950° F. provides an optimum balance between surface gloss and yield strength.

The annealing to provide the thin scale is determined not only by temperature but also by oxygen partial pressure. Only the FeCr₂O₃ type scale sufficiently limits oxygen diffusion to provide a sufficiently thin scale for a final bright surface. FIGS. 6 and 7 show the oxygen partial pressures at which the proper scale type forms and the air/fuel ratio which in practice provides it.

It is necessary to have sufficient oxygen to have a stable FeCr₂O₃ scale at normal humidity levels this will result from an oxygen partial pressure of 2% or greater. Low humidity regions may be able to achieve such a result at partial pressures as low as 0.1%.

In the case of ferritic stainless steels, a preferred form of the invention is to utilize a stabilized chemistry, such as a titanium containing AISI 439 grade. It is understood that various other ferrite stabilizers such as Nb, Ta and Zr may be used to stabilize these non-nickel bearing ferritic grades. These grades can be annealed at a higher temperature of 1700° to 1950° F. At such a temperature, the scale is still thin and chromium depletion is avoided. In addition, mild pickling may be used without the need for conventional hydrofluoric acid concentrations or other complex electrolytic processes. On unstabilized ferritic grades, the annealing temperature should be kept low enough to avoid sensitization and the chromium content kept at the high end of the range to assure a corrosion resistant bright surface. On unstabilized grades, it may be necessary to anneal at temperatures as low as 1500° F. to obtain optimum properties.

The product can now go into the finishing operations, which are now further simplified. Because of the bright surface, a specially finished roll can be used to produce a pattern that replicates an abrasively polished surface. This specially finished roll pass can be preceded by a temper pass using smooth rolls. Such a surface would typically be defined by an arithmetic roughness (Ra) of 2 to 50 micro inch and an 85° transverse surface gloss of 40 to 90%. These surface measurements are in accordance with ASTM specification D 523-89. Specific gloss and surface appearance can be further controlled by known temper pass techniques.

The following Table I shows a summary of surface gloss and yield strength for a Type 430 stabilized ferritic stainless steel processed in accordance with the subject invention. Both the surface gloss and yield strength are acceptable.

TABLE I

GLOSS VS. YIELD FOR A STABILIZED 430 STAINLESS STEEL		
Coil	85° Transverse Surface Gloss	Yield (KSI)
W647580	66	50.2
W600168	41	42.4
W687369	55	46.2
W687368	48	48.4
W687366	50	51.3
W687365	50	50.4
W687367	57	49.8
W671068	70	45
W681817	72	52.1
W695017	76	47.2
W695020	65	47.9
W695024	68	48.9
W681822	64	55.6

It is recognized that the scale thickness is crucial to our process. Therefore, known factors, such as composition, excess oxygen in the furnace and annealing time can be adjusted to further minimize scale formation and contribute to the final surface quality.

Likewise, factors which enhance recrystallization such as percent cold reduction can also be utilized to decrease exposure to scale formation.

We are thus able to achieve a reproducible bright surface on conventional air continuous anneal lines without the need for protective atmospheres and without the need for expensive polishing operations.

The elimination of grinding also produces a product having improved cleaning for certain staining agents such as black ink. It is believed that this improvement comes about because of the lesser surface tears associated with an embossed temper pass over conventional grinding.

Typical microscopically shown surface crevices caused by surface grinding are illustrated in FIGS. 5A-5D. The same steel made in accordance with the subject invention including an embossed temper pass in lieu of mechanical polishing has far less surface tears and crevices as shown in FIG. 5E. This results in the improved ability to remove normally difficult to remove stains such as black ink.

The following tests reported in Table II were run by the National Sanitation Foundation using permanent black ink as the staining agent. Embossed steels made in accordance with the subject invention were compared with conventional steels receiving a #4 grinding polish.

TABLE II

PERMANENT BLACK INK STAINING AFTER PERIODS OF DRYING					
SS Type	Finish	Stain After Drying			
		1 Hr.	4 Hr.	24 Hr.	72 Hr.
430	embossed	very faint	faint	very faint	very faint
430	Embossed	barely visible	faint	faint	faint
304T	Embossed	barely visible	barely visible	barely visible	barely visible
201	Embossed	none	none	none	none

TABLE II-continued

PERMANENT BLACK INK STAINING AFTER PERIODS OF DRYING					
SS Type	Finish	Stain After Drying			
		1 Hr.	4 Hr.	24 Hr.	72 Hr.
430	#4 Polish	dark	very dark	very dark	very dark
304	#4 Polish	very dark	very dark	very dark	very dark

At all cleaning times and for all types of stainless steel tested, more of the black ink was removed from the steels of the present invention than the conventionally processed #4 polish finish.

While specific embodiments of the invention have been described in detail, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. The presently preferred embodiments described herein are meant to be illustrative only and not limiting as to the scope of the invention which is to be given the full breadth of the appended claims and any and all equivalents thereof.

We claim:

1. A method for producing bright stainless steel comprising:

a) forming a hot mill band having a dull oxide free surface;

b) cold reducing the hot mill band to form a full hard coil having a shiny surface;

c) subjecting said full hard coil to a continuous anneal at a temperature of 1500°-1950° F. in an oxygen containing atmosphere sufficient to form a protective FeCr₂O₃ scale;

d) subjecting said annealed coil to a mild non-etching pickling process to remove the scale; and

e) rolling said annealed coil on a temper mill having specially finished rolls configured to impart a surface pattern that replicates an abrasively polished surface.

2. The method of claim 1 wherein the mild non-etching pickling process includes air cooling the annealed coil to an intermediate temperature where it is subjected to a molten salt treatment and then air cooling to ambient temperature where the coil is subjected to a mild acid pickle.

3. The method of claim 2 wherein the intermediate temperature is between 800° F. and 1000° F.

4. A method for producing bright stainless steel comprising:

a) forming a hot mill band having a dull oxide free surface;

b) cold reducing the hot mill band to form a full hard coil having a shiny surface;

c) subjecting said full hard coil to a continuous anneal at a temperature of 1500°-1950° F. in an oxygen containing atmosphere sufficient to form a protective FeCr₂O₃ scale;

d) subjecting said annealed coil to a mild non-etching pickling process to remove the scale, wherein the mild non-etching pickling process includes air cooling the annealed coil to an intermediate temperature between 800° F. and 1000° F. where it is subjected to a molten salt treatment and then air cooling to ambient temperature where the coil is subjected to a mild acid pickle, and wherein the mild acid pickle includes subjecting

said annealed coil to at least one of a nitric acid bath and rinse, a sulfuric acid bath and rinse with hydrofluoric concentration of 0.5% or less on either acid bath; and

- e) rolling said annealed coil on a temper mill having specially finished rolls configured to impart a surface pattern that replicates an abrasively polished surface.
5. The method of claim 3 including a mild acid bath and maintaining an iron content of the nitric acid bath at or below 1%.
6. The method of claim 1 wherein the surface pattern following temper rolling is defined by an arithmetic roughness on the order of 2 to 50 micro inch and an 85° transverse surface gloss of 40 to 90%.
7. The method of claim 1 wherein the stainless steel is of the austenitic type and the annealing temperature is 1800° to 1950° F.
8. The method of claim 1 wherein the stainless steel is of the ferritic type and the composition includes ferrite stabilizers.
9. The method of claim 8 wherein the ferrite stabilizers include at least Ti.
10. The method of claim 1 wherein the atmosphere has an oxygen partial pressure of at least 0.1%.
11. The method claim of 10 wherein the oxygen partial pressure is at least 2%.
12. The method of claim 1 wherein the air/fuel ratio used for combustion is at least 9.2 to 1.
13. The method of claim 1 wherein said coil is subject to a temper pass on a smooth roll prior to the specially finished roll pass.
14. A method for producing bright stainless steel from a cold reduced, full hard coil, comprising the steps of:

subjecting the full hard coil to a continuous anneal at a temperature of 1500°-1950° F. in an oxygen containing atmosphere to form an $FeCr_2O_4$ containing scale on the annealed coil;

pickling the annealed coil with a mild non-etching pickling process to remove the scale, wherein the pickling process includes treating the annealed coil with an acid bath including at least one of nitric and sulfuric acid, the acid bath having a hydrofluoric acid content of less than 0.5%; and

rolling the descaled coil on a temper mill having specially finished rolls such that a surface pattern is imparted to the rolled coil which replicates an abrasively polished surface.

15. The method as claimed in claim 14, wherein the steel is an austenitic steel and the annealing temperature is 1800°-1950° F.

16. The method as claimed in claim 15, wherein the atmosphere has an oxygen partial pressure of at least two percent.

17. The method as claimed in claim 14, wherein the steel is ferritic steel having at least one ferrite stabilizer selected from the group consisting of Ti, Nb, Ta and Zr and the annealing temperature is 1700°-1950° F.

18. The method as claimed in claim 14, including: cooling the annealed coil to an intermediate temperature; subjecting the annealed coil to a molten salt treatment; and cooling the annealed coil to ambient temperature.

* * * * *



US005830291C1

(12) **REEXAMINATION CERTIFICATE** (4367th)

United States Patent
McGuire et al.

(10) Number: **US 5,830,291 C1**
(45) Certificate Issued: **May 22, 2001**

- (54) **METHOD FOR PRODUCING BRIGHT STAINLESS STEEL**
- (75) Inventors: **Michael F. McGuire, Pittsburgh, PA (US); Kelley L. Senzarin-Kullk, Uniontown; Anthony J. Denol, North Canton, both of OH (US)**
- (73) Assignee: **J&L Specialty Steel, Inc., Pittsburgh, PA (US)**

3-075317	3/1991 (JP)
6-269809	9/1994 (JP)
6-299249	10/1994 (JP)
7-048628	2/1995 (JP)

OTHER PUBLICATIONS

Article entitled "Annealing and Pickling Lines for Stainless Steels," by B. Bousquet and J. Castel, published in Nov. 1985, Rev. Metall. Cab. Inf. Tech., pp. 821-831.

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Article entitled "Stainless Steels," edited by P. Lacombe, Baroux and G. Beranger, published in 1993, pp. 834-840; 873-880.

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Primary Examiner—Deborah Yee

(57) **ABSTRACT**

A method for producing bright stainless steel whereby a hot mill band having a dull oxide-free surface is first formed. The hot mill band is cold reduced to form a full hard coil having a shiny surface. The coil is subjected to continuous annealing at a temperature of 1500°-1950° F. in an oxygen-containing atmosphere sufficient to form a protective FeCr₂O₃ scale. The annealed coil is subjected to a mild non-etching pickling process to remove the black scale. The coil is then rolled on a temper mill having specially finished rolls to impart a surface pattern that replicates an abrasively polished surface.

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No. 90/005,498, Sep. 16, 1999

Reexamination Certificate for:

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Filed:	Oct. 8, 1996

Related U.S. Application Data

- (60) Provisional application No. 60/015,847, filed on Apr. 19, 1996.
- (51) Int. Cl.⁷ **C21D 8/00**
- (52) U.S. Cl. **148/610; 148/606**
- (58) Field of Search **148/610, 606**

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

60-262922 12/1985 (JP).



1

**REEXAMINATION CERTIFICATE
ISSUED UNDER 35 U.S.C. 307**

THE PATENT IS HEREBY AMENDED AS
INDICATED BELOW.

Matter enclosed in heavy brackets [] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 4 and 14-18 is confirmed.

Claim 1 is determined to be patentable as amended.

Claims 2, 3, and 5-13, dependent on an amended claim, are determined to be patentable.

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1. A method for producing bright stainless steel comprising:

- a) forming a hot mill band having a dull oxide free surface;
- b) cold reducing the hot mill band to form a full hard coil having a shiny surface;
- c) subjecting said full hard coil to a continuous anneal at a temperature of 1500°-1950° F. in an oxygen containing atmosphere sufficient to form a protective $FeCr_2O_3$ scale;
- d) subjecting said annealed coil to a mild non-etching pickling process *sufficient* to remove the [scale] oxide and restore corrosion resistance with minimal differential attack on grain boundaries and grain surface thereby preventing the surface from becoming dull; and
- e) rolling said annealed coil on a temper mill having specially finished rolls configured to impart a surface pattern that replicates an abrasively polished surface.

* * * * *

United States District Court

SOUTHERN

DISTRICT OF

TEXAS

BROWNSVILLE DIVISION

MEXINOX USA, INC., AND
MEXINOX SA DE CV,

Plaintiff

v.

J & L SPECIALTY STEELS, INC.,
Defendant

SUMMONS IN A CIVIL ACTION

CASE NUMBER:

CIVIL ACTION NO. B-02-047

TO: (Name and Address of Defendant)

J & L SPECIALTY STEELS, INC.
WESTPOINTE CORPORATE CENTER ONE
1550 CORAOPOLIS HEIGHTS ROAD
SUITE 500
CORAOPOLIS, PA 15108

BY SERVING ITS PRESIDENT AND CEO,
JOSEPH K. KUSIC
J & L SPECIALTY STEELS, INC.
1550 CORAOPOLIS HEIGHTS ROAD
SUITE 500
CORAOPOLIS, PA 15108 Ph: 412/375-1600

YOU ARE HEREBY SUMMONED and required to file with the Clerk of this Court and serve upon

PLAINTIFF'S ATTORNEY (name and address)

Eduardo Roberto Rodriguez
Alison D. Kennamer
Rodriguez, Colvin & Chaney, L.L.P.
P. O. Box 2155
Brownsville, Texas 78522

an answer to the complaint which is herewith served upon you, within 20 days after service of this summons upon you, exclusive of the day of service. If you fail to do so, judgment by default will be taken against you for the relief demanded in the complaint.

Michael N. Milby, Clerk

CLERK

DATE

March 14, 202

BY DEPUTY CLERK

[Handwritten Signature]

United States District Court

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Michael N. Milby, Clerk

CLERK

DATE

March 14, 2002

BY DEPUTY CLERK

