



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
20.01.1999 Bulletin 1999/03

(51) Int. Cl.⁶: **C21D 9/573**

(43) Date of publication A2:
29.10.1997 Bulletin 1997/44

(21) Application number: **97105044.8**

(22) Date of filing: **25.03.1997**

(84) Designated Contracting States:
AT DE GB

(30) Priority: **26.04.1996 JP 130851/96**

(71) Applicant:
NIPPON STEEL CORPORATION
Tokyo 100-71 (JP)

(72) Inventors:
• **Mine, Tatsunori,**
c/o Nippon Steel Corporation
Tobata-ku, Kitakyushu City, Fukuoka 804 (JP)

• **Sakurai, Koichi,**
c/o Nippon Steel Corporation
Tobata-ku, Kitakyushu City, Fukuoka 804 (JP)
• **Waki, Kouichi,**
c/o Nippon Steel Corporation
Tobata-ku, Kitakyushu City, Fukuoka 804 (JP)

(74) Representative:
VOSSIUS & PARTNER
Siebertstrasse 4
81675 München (DE)

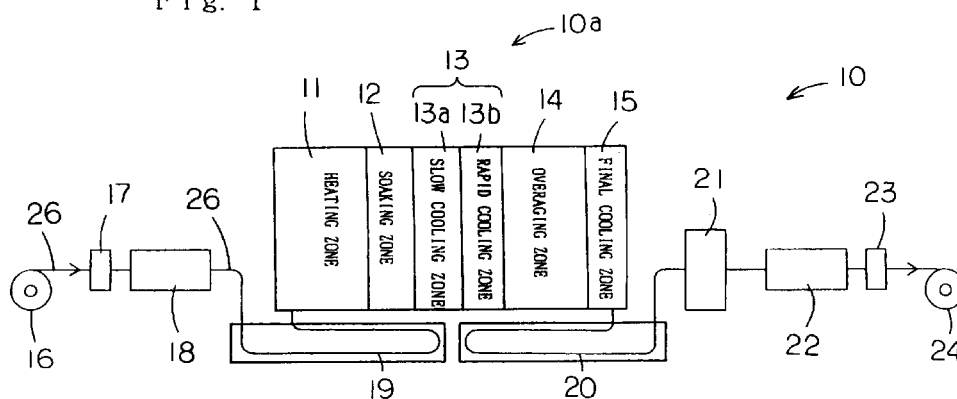
(54) **Primary cooling method in continuously annealing steel strips**

(57) In a primary cooling method in continuously annealing steel strips which comprises a heating step (A), a soaking step (B), a primary cooling step (C) including at least a rapid cooling step in a second half thereof, an overaging step (D), and a final cooling step (E), inert atmosphere gas containing H₂ gas is employed as cooling gas for use in the rapid cooling step and concentration of the H₂ gas is switched between two ranges of low and high concentrations of

H₂ gas, depending on the required cooling rate of the rapid cooling step corresponding to the product grades of steel strips (26).

Accordingly, the consumption of expensive H₂ gas is reduced thus enhancing the economy of the cooling operation while assuring the safety and efficiency of the primary cooling operation.

Fig. 1





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 5044

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | | | |
|--|---|--|---|--------------------------------------|------|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) | | |
| E | WO 97 24468 A (NIPPON STEEL CORP ; SAKURAI KOICHI (JP); SHIBUYA TATSURU (JP); WAKA) 10 July 1997 * the whole document * | 1-3 | C21D9/573 C21D1/613 | | |
| Y | US 5 137 586 A (KLINK JAMES H) 11 August 1992 * column 1, line 48 - line 56; claims 1,6,6,12 * | 1-3 | | | |
| Y | EP 0 182 050 A (NIPPON STEEL CORP) 28 May 1986 * the whole document * | 1-3 | | | |
| D,A | PATENT ABSTRACTS OF JAPAN vol. 095, no. 003, 28 April 1995 & JP 06 346156 A (NIPPON STEEL CORP), 20 December 1994 * abstract * | 1,2 | | | |
| A | DE 37 36 501 C (DEGUSSA AG) 9 June 1988 * column 1, line 54 - column 2, line 20 * | 1,2 | <table border="1"> <tr> <td>TECHNICAL FIELDS SEARCHED (Int.Cl.6)</td> </tr> <tr> <td>C21D</td> </tr> </table> | TECHNICAL FIELDS SEARCHED (Int.Cl.6) | C21D |
| TECHNICAL FIELDS SEARCHED (Int.Cl.6) | | | | | |
| C21D | | | | | |
| The present search report has been drawn up for all claims | | | | | |
| Place of search BERLIN | | Date of completion of the search 2 December 1998 | Examiner Kesten, W | | |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |

EPO FORM 1503 03 82 (P04C01)