

(19)



(11)

EP 3 686 298 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

29.07.2020 Bulletin 2020/31

(51) Int Cl.:

C21D 9/665^(2006.01) B21B 45/00^(2006.01)

(21) Application number: **18857961.9**

(86) International application number:

PCT/CN2018/106718

(22) Date of filing: **20.09.2018**

(87) International publication number:

WO 2019/057118 (28.03.2019 Gazette 2019/13)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

(72) Inventors:

- **CHEN, Yong**
Zhanjiang
Guangdong 524047 (CN)
- **ZHU, Weilin**
Zhanjiang
Guangdong 524047 (CN)
- **WANG, Ye**
Zhanjiang
Guangdong 524047 (CN)
- **ZHAO, Chunhe**
Shanghai 202163 (CN)
- **SONG, Tao**
Shanghai 202163 (CN)

(30) Priority: **20.09.2017 CN 201710853613**

19.06.2018 CN 201810632228

(74) Representative: **Kuhnen & Wacker**

**Patent- und Rechtsanwaltsbüro PartG mbB
Prinz-Ludwig-Straße 40A
85354 Freising (DE)**

(71) Applicants:

- **Baosteel Zhanjiang Iron & Steel Co., Ltd.**
Guangdong 524047 (CN)
- **Baoshan Iron & Steel Co., Ltd.**
Shanghai 201900 (CN)
- **Shanghai Heli Hydraulic
Mechanical & Electrical Co., Ltd.**
Shanghai 202163 (CN)

(54) **FIXED TYPE HOT COIL THERMAL INSULATION HEAT TREATMENT DEVICE**

(57) A fixed type thermal coil heat insulation heat treatment device, comprising: a steel coil tray (1); at least one steel coil bearing support (2), which is disposed on the steel coil tray; and a thermal insulation cover (3), covering the steel coil bearing support, the inner cavity volume of the thermal insulation cover being larger than the total volume of at least one steel coil (100) and the steel coil bearing support. The lower end of the thermal insulation cover is movably connected to the steel coil tray.

According to the fixed type hot coil thermal insulation heat treatment device, after coiling is completed, a steel coil is immediately subjected to thermal insulation treatment, the intermediate transfer time is reduced, and heat of the steel coil itself is used for performing a soaking and slow cooling heat treatment process on the steel coil, thereby achieving the purposes of high efficiency, energy conservation, and improvement of the yield.

EP 3 686 298 A1

Description

Technical Field

[0001] The present disclosure relates to a fixed type hot coil thermal insulation heat treatment device.

Background Art

[0002] The production of cold-rolled ultra-high-strength steel mainly has the problem of large performance fluctuation in the length and width directions of the strip steel, which results in severe fluctuation in rolling force during cold rolling production and failure to meet the tolerance standard for the thickness of final cold-rolled products. Not only the rolling stability of cold-rolling - pickling - continuous rolling mills is influenced, but also the yield rate of cold-rolled ultra-high-strength steel is seriously affected.

[0003] The existing thermal insulation devices are as follows:

(1) The most prominent problem of a rolling line thermal insulation device is that the interval between coiling of strip steel and entry of a steel coil into the insulation device is so long that metallographic structure transformation of the strip steel has already occurred or has been completed. The effect of off-line slow cooling in improving hot coil performances cannot meet the quality requirements for high-strength steel. A hot rolling production line adopts a thermal insulation pit set downstream of a coiler. A rolled steel coil is first conveyed by a transport chain or the like, and then hoisted by a bridge crane and placed in a thermal insulation pit that has a certain thermal insulation capacity. It will take a period of time as long as 20-30 minutes to hoist and transfer the hot coil into a thermal insulation enclosure, such that the air cooling time of the steel coil is too long, which affects the thermal insulation effect and material properties.

(2) The cost of adding special thermal insulation pits, thermal insulation furnaces, bell furnaces, heat treatment and the like to such thermal insulation devices is generally high. Moreover, it takes a long period of time to retrofit the devices, and thus normal production will be affected. In addition, there is a problem that the thermal insulation effect is not good (i.e. temperature drops fast).

Summary

[0004] An object of the present disclosure is to design a fixed type hot coil thermal insulation heat treatment device. After coiling, the steel coil is thermally insulated immediately, so as to reduce the transferring time between the coiling and the thermal insulation, and use the heat of the steel coil itself to implement a heat treatment

process including soaking and slow cooling of the steel coil to achieve the goals of high efficiency, energy saving and high yield rate.

[0005] To achieve the above object, the technical solution of the present disclosure is as follows:

There is provided a fixed type hot coil thermal insulation heat treatment device, comprising: a steel coil tray; at least one steel coil supporting prop provided on the steel coil tray; and a thermal insulation enclosure disposed around the steel coil supporting prop, wherein the thermal insulation enclosure has an inner chamber having a volume larger than a combined volume of at least one steel coil + one steel coil supporting prop, and a lower end of the thermal insulation enclosure is movably coupled to the steel coil tray.

[0006] Further, the fixed type hot coil thermal insulation heat treatment device further comprises an electric heating device provided on an inner side wall of the thermal insulation enclosure; a temperature sensor provided in the thermal insulation enclosure; and an information acquisition control module, wherein the electric heating device and the temperature sensor are electrically coupled to the information acquisition control module. The thermal insulation enclosure not only enables use of residual heat of the hot-rolled steel coil to achieve slow cooling, but also allows for secondary heat treatment on some special steel materials to implement secondary tempering to improve the performances of the steel coil and refine grains.

[0007] Still further, the thermal insulation enclosure is further provided with a gas protection device capable of introducing a protective gas and a gas sensor which are electrically coupled to the information acquisition control module, respectively. A protective gas is introduced into the thermal insulation enclosure to replace the air around the steel coil. Oxidation of the steel coil and increase of the surface mass of the steel coil can thus be prevented.

[0008] Yet further, a signal emitting module is provided in the information acquisition control module to transmit data of air and temperature in the thermal insulation enclosure to a ground server.

[0009] Preferably, the thermal insulation enclosure has a composite structure, comprising: an outer protection layer, which is a high-strength steel plate; an intermediate layer, which is a thermal insulation material; and an inner layer, which is a high temperature resistant stainless steel plate.

[0010] Preferably, the thermal insulation enclosure is a composite structure, comprising an inner radiation layer, an electric heating wire layer, an intermediate mesh cover, an intermediate thermal insulation layer, and an outer protection layer in order from inside to outside.

[0011] Preferably, the composite structure of the thermal insulation enclosure is fixed with an anchor nail.

[0012] Preferably, the thermal insulation enclosure is a square thermal insulation enclosure or a circular thermal insulation enclosure.

[0013] Preferably, a positioning sleeve is provided on

a lower part of a side of the thermal insulation enclosure. Correspondingly, a positioning pin matching the positioning sleeve is provided on the steel coil tray. The positioning pin is preferably a cone-shaped body. When the steel coil is unloaded from the coiler cavity onto the tray, the thermal insulation enclosure can be automatically positioned by placing it on the cone-shaped positioning pin, so that the thermal insulation enclosure can be quickly installed and positioned to form a closed space to ensure that the heat will not be lost.

[0014] Preferably, the thermal insulation enclosure is provided with a ventilation hole and a corresponding exhaust valve. A ventilation hole is added in the thermal insulation enclosure, and an exhaust valve is installed. After the steel coil that has been coiled as a hot coil is placed on the transport chain tray and covered with the thermal insulation enclosure device, the temperature in the internal space is 600 °C or higher. In addition, while the strip steel is coiled and the steel coil is cooled by laminar flow, a small amount of water vapor is adhered to the surface of the steel coil. In order to ensure the safety of the equipment and improve the quality of the steel coil, the high-temperature gas is expelled before the protective gas is introduced into the thermal insulation enclosure.

[0015] Preferably, the electric heating device is an electric heating wire, and the temperature sensor is a thermocouple for detecting change of air temperature inside the thermal insulation enclosure.

[0016] Preferably, the steel coil tray has a composite structure, comprising a base plate, a thermal insulation layer, and an internal radiation layer in order from bottom to top.

[0017] After the strip steel is coiled and transported to the fixed type thermal insulation enclosure tray, the thermal insulation enclosure is placed on the tray immediately to insulate the steel coil at the earliest time, thereby implementing thermal insulation treatment on the steel coil after the strip steel has been coiled.

[0018] In order to increase the processing capacity of the hot coil thermal insulation and slow cooling device, steel coil trays for single-row, double-row and multi-row steel coils may be made.

[0019] The beneficial effects of the present disclosure include:

The thermal insulation enclosure according to the present disclosure exists individually and independently. This saves time, and also improves production rhythm and efficiency.

[0020] According to the present disclosure, after coiling, the strip steel coil is subjected to thermal insulation treatment at the earliest time. This will greatly address the challenges of insufficient performance improvement caused by the excessively long time from coiling to entry of the steel coil to the slow cooling device, and large performance fluctuation of the strip steel in the length and width directions. In addition, severe fluctuation of rolling force in cold rolling production, and failure to meet

the tolerance standard for the thickness of final cold-rolled products are avoided. The rolling stability of cold-rolling - pickling - continuous rolling mills is improved, and the yield rate of cold-rolled ultra-high-strength steel is increased.

[0021] The structure design of the present disclosure has the characteristics of light structure weight, good thermal insulation effect, convenient steel coil loading and unloading, high degree of automation, good airtightness, etc., and has further optimized the equipment's thermal insulating, soaking and oxidation resisting effects.

[0022] By adopting the latest all-fiber annealing furnace technology standards in combination with the concept of light-weight structure of high-strength steel, an energy-saving green steel coil transport device, which meets certain airtightness requirements, has certain temperature control function and insulating and soaking effects, and is capable of full-automatic operation, is designed to achieve the best effect of improving high-strength steel performances.

Description of the Drawings

[0023]

Fig. 1 is a front view of an example according to the present disclosure.

Fig. 2 is a side view of an example according to the present disclosure.

Fig. 3 is a schematic structural view of the steel coil supporting prop and steel coil tray in an example according to the present disclosure.

Fig. 4 is a schematic structural view of a positioning pin matching a positioning sleeve of the thermal insulation enclosure in an example according to the present disclosure.

Fig. 5 is a cutaway view of the thermal insulation enclosure in an example according to the present disclosure.

Detailed Embodiments

[0024] Referring to Figs. 1-5, the fixed type hot coil thermal insulation heat treatment device according to the present disclosure comprises:

- a steel coil tray 1;
- at least one steel coil supporting prop 2 provided on the steel coil tray 1; and
- a thermal insulation enclosure 3 provided around the steel coil supporting prop 2, wherein the thermal insulation enclosure has an inner chamber having a volume larger than a combined volume of at least one steel coil 100 + one steel coil supporting prop 2, and a lower end of the thermal insulation enclosure 3 is movably coupled to the steel coil tray 1.

[0025] Further, the fixed type hot coil thermal insulation heat treatment device further comprises:

an electric heating device 4 provided on an inner side wall of the thermal insulation enclosure 3;
 a temperature sensor 5 provided in the thermal insulation enclosure 3; and
 an information acquisition control module 6, wherein the electric heating device 4 and the temperature sensor 6 are electrically coupled to the information acquisition control module 6.

[0026] Still further, the thermal insulation enclosure 3 is further provided with a gas protection device 7 capable of introducing a protective gas and a gas sensor which are electrically coupled to the information acquisition control module 6, respectively. After the steel coil that has been coiled as a hot coil is placed on the transport chain tray, the steel coil is covered with the thermal insulation enclosure to protect the steel coil from oxidation which will otherwise increase the surface mass of the steel coil. A protective gas is introduced into the thermal insulation enclosure to replace the air around the steel coil. Oxidation of the steel coil and increase of the surface mass of the steel coil can thus be prevented.

[0027] Yet further, a signal emitting module is provided in the information acquisition control module 6 to transmit data of air and temperature in the thermal insulation enclosure 3 to a ground server, and transmit data and information related with the steel coil downstream at the same time. By using a wireless remote control box with the aid of a wireless device and a power storage device, functions such as mobile temperature measurement and sampling from the thermal insulation enclosure, wireless data transmission, and logistics information writing and reading are implemented.

[0028] Preferably, the thermal insulation enclosure 3 has a composite structure, comprising: an outer protection layer, which is a high-strength steel plate; an intermediate layer, which is a thermal insulation material; and an inner layer, which is a high temperature resistant stainless steel plate.

[0029] Referring to Fig. 5, the thermal insulation enclosure 3 according to the present disclosure is a composite structure, comprising an inner radiation layer 31, an electric heating wire layer 32, an intermediate mesh cover 33, an intermediate thermal insulation layer 34, and an outer protection layer 35 in order from inside to outside; wherein the composite structure of the thermal insulation enclosure 3 is fixed with an anchor nail 35.

[0030] Preferably, the thermal insulation enclosure 3 is a square thermal insulation enclosure or a circular thermal insulation enclosure.

[0031] Preferably, a positioning sleeve 8 is provided on a lower part of a side of the thermal insulation enclosure 3. Correspondingly, a positioning pin 9 matching the positioning sleeve 8 is provided on the steel coil tray 1. The positioning pin 9 is preferably a cone-shaped body.

[0032] When the steel coil is unloaded from the coiler onto the tray, automatic positioning can be accomplished by placing the positioning sleeve of the thermal insulation enclosure on the cone-shaped positioning pin, so that the thermal insulation enclosure can be quickly installed and positioned to form a closed space to ensure that the heat will not be lost.

[0033] Preferably, the thermal insulation enclosure 3 is provided with a ventilation hole and a corresponding exhaust valve 10. After the steel coil that has been coiled as a hot coil is placed on the transport chain tray and covered with the thermal insulation enclosure device, the temperature in the internal space is 600 °C or higher. In addition, while the strip steel is coiled and the steel coil is cooled by laminar flow, a small amount of water vapor is adhered to the surface of the steel coil. In order to ensure the safety of the equipment and improve the quality of the steel coil, the high-temperature gas is expelled before the protective gas is introduced into the thermal insulation enclosure.

[0034] Preferably, the electric heating device 4 is an electric heating wire, and the temperature sensor 5 is a thermocouple. The thermal insulation enclosure not only enables use of residual heat of the hot-rolled steel coil to achieve slow cooling, but also allows for secondary heat treatment on some special steel materials to implement secondary tempering to improve the performances of the steel coil and refine grains.

[0035] Preferably, the steel coil tray 1 has a composite structure, comprising a base plate 11, a thermal insulation layer 12, and an internal radiation layer 13 in order from bottom to top.

[0036] The fixed type hot coil thermal insulation heat treatment device according to the present disclosure is located near the steel coiling work station. After the coiling is completed, the hot rolled steel coil is immediately transferred into the thermal insulation heat treatment device to implement the thermal insulation treatment on the steel coil after the coiling of the strip steel.

[0037] The present disclosure fulfils the purpose of annealing treatment by making use of the residual heat in the steel coil that has just been coiled, which greatly addresses the challenges of insufficient performance improvement caused by the excessively long time from coiling to entry of the steel coil to the insulating and annealing device, and large performance fluctuation of the strip steel in the length and width directions. A special batch of hot-rolled strip steel may need to be subjected to special treatment such as in-depth processing. The heating device and protective cooling gas input system integrated within the thermal insulation enclosure can cooperate to achieve temperature control under necessary conditions.

Claims

1. A fixed type hot coil thermal insulation heat treatment device, comprising:

- a steel coil tray;
 at least one steel coil supporting prop provided on the steel coil tray;
 a thermal insulation enclosure provided around the steel coil supporting prop, wherein the thermal insulation enclosure has an inner chamber having a volume larger than a combined volume of at least one steel coil + one steel coil supporting prop, and a lower end of the thermal insulation enclosure is movably coupled to the steel coil tray.
2. The fixed type hot coil thermal insulation heat treatment device according to claim 1, further comprising:
- an electric heating device provided on an inner side wall of the thermal insulation enclosure;
 a temperature sensor provided in the thermal insulation enclosure; and
 an information acquisition control module, wherein the electric heating device and the temperature sensor are electrically coupled to the information acquisition control module.
3. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2, wherein the thermal insulation enclosure is further provided with a gas protection device capable of introducing a protective gas and a gas sensor which are electrically coupled to the information acquisition control module, respectively.
4. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2 or 3, wherein a signal emitting module is provided in the information acquisition control module to transmit data of air and temperature in the thermal insulation enclosure to a ground server.
5. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2 or 3, wherein a positioning sleeve is provided on a lower part of a side of the thermal insulation enclosure; correspondingly, a positioning pin matching the positioning sleeve is provided on the steel coil tray; wherein the positioning pin is preferably a cone-shaped body.
6. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2 or 3 or 5, wherein the thermal insulation enclosure is provided with a ventilation hole and a corresponding exhaust valve.
7. The fixed type hot coil thermal insulation heat treatment device according to claim 1, wherein the electric heating device is an electric heating wire, and the temperature sensor is a thermocouple.
8. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2 or 3 or 5, wherein the thermal insulation enclosure has a composite structure, comprising: an outer protection layer, which is a high-strength steel plate; an intermediate layer, which is a thermal insulation material; and an inner layer, which is a high temperature resistant stainless steel plate.
9. The fixed type hot coil thermal insulation heat treatment device according to claim 1 or 2 or 3 or 5, wherein the thermal insulation enclosure is a composite structure, comprising an inner radiation layer, an electric heating wire layer, an intermediate mesh cover, an intermediate thermal insulation layer, and an outer protection layer in order from inside to outside.
10. The fixed type hot coil thermal insulation heat treatment device according to claim 1, wherein the steel coil tray has a composite structure, comprising a base plate, a thermal insulation layer, and an internal radiation layer in order from bottom to top.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/106718

5	A. CLASSIFICATION OF SUBJECT MATTER C21D 9/665(2006.01)i; B21B 45/00(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC	
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C21D B21B Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS, CNTXT, CNKI, VEN: 热卷, 钢卷, 钢带, 保温, 热处理, 退火, 粗轧, 热轧, 罩, 箱, 缓冷, 密闭, 密封, 托盘, 基座, 支架, coil, steel, belt, heat, keep+, preservat+, thermal, anneal+, rolling, rough, cover, shield, box, slow, cool+, seal, tray, base, support	
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages
30	Y	CN 103757196 A (ANGANG STEEL CO., LTD.) 30 April 2014 (2014-04-30) see description, paragraph [0005] to paragraph [0014], and figures 1-3
35	Y	CN 104769137 A (SAC CO., LTD.) 08 July 2015 (2015-07-08) see description, paragraph [0046] to paragraph [0052], and figures 1-6
40	PX	CN 107470377 A (SHANGHAI HELI HYDRAULIC ELECTROMECHANICAL CO., LTD.) 15 December 2017 (2017-12-15) see description, paragraph [0005] to paragraph [0019], and figures 1-2
45	A	CN 1078270 A (POHANG IRON AND STEEL CO., LTD. ET AL.) 10 November 1993 (1993-11-10) see entire document
50	A	CN 205275647 U (BAOSHAN IRON & STEEL CO., LTD.) 01 June 2016 (2016-06-01) see entire document
55	A	JP 58154409 A (KAWASAKI STEEL CO.) 13 September 1983 (1983-09-13) see entire document
	A	KR 20170060716 A (UNIV KEIMYUNG IND. ACAD COOP FOUND) 02 June 2017 (2017-06-02) see entire document
	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.	
	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
	Date of the actual completion of the international search 08 November 2018	Date of mailing of the international search report 28 November 2018
	Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

