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(54) BAFFLE PLATE UNIT AND GAS WIPING DEVICE USING SAME

(57) The baffle plate unit (24) includes a pair of baffle plates (22) and a position adjustment mechanism (23) configured to adjust the positions of the pair of baffle plates (22) relative to the width direction edges of a metal strip. The position adjustment mechanism (23) includes a pair of electromagnetic-wave sensor units (32) configured to respectively detect the positions of the pair of width direction edges of the metal strip (1), whose detection values are used by a control section (33) to control the positions of the baffle plates (22). Each of the electromagnetic-wave sensor units (32) includes a detecting section (38) equipped with an antenna configured to emit electromagnetic waves and to receive electromagnetic waves reflected by corresponding one of the width direction edges of the metal strip (1), and a main body section (37). The detecting section (38) is fixedly disposed at a position distant by a predetermined length from corresponding one of the width direction edges of the metal strip (1).

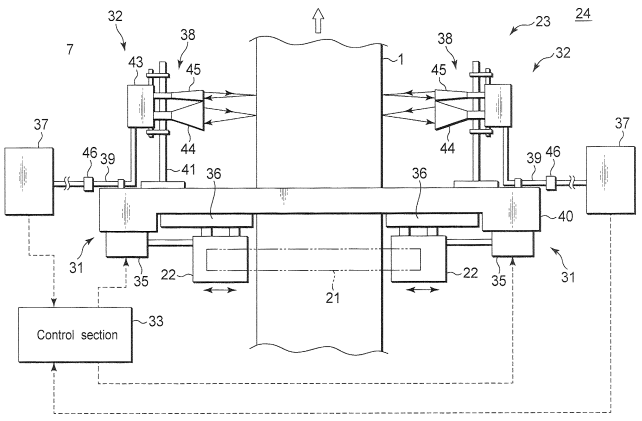

FIG.4

EP 2 594 658 A1

Description

[Technical Field]

[0001] The present invention relates to a baffle plate unit to be used in a gas wiping apparatus that removes excessive molten metal from a metal strip after molten metal coating is applied to the metal strip. The baffle plate unit includes baffle plates and a position adjustment mechanism for adjusting the positions of the baffle plates. The present invention further relates to a gas wiping apparatus using the baffle plate unit.

[Background Art]

[0002] For example, a molten zinc coating facility for a steel strip is designed to immerse the steel strip in a molten zinc coating bath and then vertically pull up the steel strip, thereby applying molten zinc to the top and bottom surfaces of the steel strip. A gas wiping apparatus is disposed directly above the coating bath and is configure to blow a gas to the top and bottom surfaces of the steel strip pulled up from the coating bath to remove excessive molten zinc.

[0003] A gas wiping apparatus of this type includes a pair of gas wiping nozzles having a length larger than the width of a steel strip. The wiping nozzles are disposed one on either side of the steel strip to face each other and extend in the width direction of the steel strip, so that the wiping nozzles can blow a gas to the steel strip.

[0004] However, in the case of this gas wiping apparatus, gas parts respectively spouted from a pair of gas wiping nozzles collide with each other and make gas flows turbulent at positions outside the steel strip in the width direction. Consequently, the wiping effect attenuates on the edge portions of the steel strip and an edge over-coating phenomenon occurs such that the coating weight becomes larger on the edge portions of the steel strip.

[0005] In light of this problem, there is a case where the setting positions of the gas wiping nozzles are provided with a plate called, e.g., side plate, dummy plate, or baffle plate (thus, the plate will be referred to as a baffle plate hereinafter) outside each of the opposite edges of the steel strip to prevent the gas collision described above (for example, Patent Documents 1, 2, and 3).

[0006] Each of the baffle plates for this purpose needs to be set at a position as close to the steel strip as possible, such as a position of about 1 mm from the steel strip, to prevent the over-coating phenomenon described above. In this case, since the width of a coating target steel strip is not constant, it is necessary to adjust the setting positions of the baffle plates in accordance with the width of the steel strip. Further, even where the width of the steel strip is constant, the steel strip being transferred sways from side to side, and so it is necessary to adjust the positions of the baffle plates to prevent the baffle plates from coming into contact with the steel strip.

[0007] Addressing this problem, the Patent Document 1 mentioned above uses guide rolls disposed on the baffle plates and configured to come into contact with the steel strip, so that the distances between the baffle plates and the steel strip are kept constant. However, in the case of this contact type, there is the possibility that the guide rolls cause damage to the edge portions of the steel strip and/or entangle zinc adhering to the edge portions of the steel strip and thereby forming defects. Accordingly, a technique for adjusting the positions of the baffle plates is required to prevent the baffle plates from coming into contact with the steel strip.

[0008] For position adjustment of a non-contact type, it is necessary to use a technique for detecting the edge positions of the steel strip by disposing position detectors, as in the technique disclosed in Patent Document 4. According to this Patent Document 4, laser through-beam sensors are respectively disposed on the opposite sides of a steel strip and configured to be linearly movable in the width direction of the steel strip, wherein the detectors are used as position detectors to detect the edge portions of the steel strip.

[Prior Art Document]

[Patent Document]

[0009]

[Patent Document 1]
Jpn. Pat. Appln. KOKAI Publication No. 2-107752
[Patent Document 2]
Jpn. Pat. Appln. KOKAI Publication No. 4-285146
[Patent Document 3]
Jpn. Pat. Appln. KOKAI Publication No. 9-202954
[Patent Document 4]
Jpn. Pat. Appln. KOKAI Publication No. 6-167307

[Summary of Invention]

[0010] However, in a case where the technique of the Patent Document 4 mentioned above is used for detecting the position of a steel strip to adjust the positions of the baffle plates, the position detector, which is of an optical type, becomes unusable, when it is clouded with zinc fume. Further, a position detector of such an optical type has no other choice than to be set closer to a detection target or steel strip, and so there is fear that the detector is thermally affected by high-temperature molten zinc adhering to the steel strip and causes malfunction. These problems can arise not only when molten zinc coating is applied to steel strips but also when any molten metal coating is applied to steel strips.

[0011] Accordingly, an object of the present invention is to provide a baffle plate unit and a gas wiping apparatus using this baffle plate unit, wherein the baffle plate unit can detect the position of a metal strip, without being affected by fume and/or heat from molten metal, and ad-

just the position of the baffle plate.

[0012] According to a first aspect of the present invention, there is provided a baffle plate unit to be used in a gas wiping apparatus that removes excessive molten metal from a metal strip by blowing a gas from gas wiping nozzles to opposite surfaces of the metal strip pulled up in a vertical direction from a molten metal bath, the baffle plate unit comprising: a pair of baffle plates respectively disposed outside a pair of width direction edges of the metal strip in accordance with setting positions of the gas wiping nozzles; and a position adjustment mechanism configured to adjust positions of the pair of baffle plates relative to the width direction edges of the metal strip, wherein the position adjustment mechanism includes a pair of electromagnetic-wave sensor units configured to respectively detect positions of the pair of width direction edges of the metal strip, a pair of shifting mechanisms configured to respectively shift the pair of baffle plates in a width direction of the metal strip, and a control section configured to control the pair of shifting mechanisms based on detection values obtained by the electromagnetic-wave sensor units such that the pair of baffle plates are set at predetermined positions close to the width direction edges of the metal strip, and wherein each of the electromagnetic-wave sensor units includes a detecting section equipped with an antenna configured to emit electromagnetic waves and to receive electromagnetic waves reflected by corresponding one of the width direction edges of the metal strip, and a main body section, the detecting section being fixedly disposed at a position distant by a predetermined length from corresponding one of the width direction edges of the metal strip.

[0013] According to a second aspect of the present invention, there is provided a gas wiping apparatus that removes excessive molten metal from a metal strip by blowing a gas to opposite surfaces of the metal strip pulled up in a vertical direction from a molten metal bath, the gas wiping apparatus comprising: a pair of gas wiping nozzles configured to blow the gas to the opposite surfaces of the metal strip, and the baffle plate unit described above.

[Brief Description of Drawings]

[0014]

[FIG. 1] This is a schematic constitutive view showing a molten zinc coating facility equipped with a gas wiping apparatus including a baffle plate unit according to an embodiment of the present invention.

[FIG. 2] This is a perspective view showing the structure of the gas wiping apparatus including the baffle plate unit according to the embodiment of the present invention.

[FIG. 3] This is a diagram for explaining the arrangement of gas wiping nozzles and baffle plates in the gas wiping apparatus including the baffle plate unit according to the embodiment of the present invention.

[FIG. 4] This is a front view showing the baffle plate unit according to the embodiment of the present invention.

[Embodiment for Carrying Out the Invention]

[0015] An embodiment of the present invention will now be described with reference to the accompanying drawings.

In this embodiment, an explanation will be given of a case where molten zinc coating is applied to a steel strip.

FIG. 1 is a schematic constitutive view showing a molten zinc coating facility equipped with a gas wiping apparatus including a baffle plate unit according to an embodiment of the present invention. FIG. 2 is a perspective view showing the structure of the gas wiping apparatus. FIG. 3 is a diagram for explaining the arrangement of gas wiping nozzles and baffle plates in the gas wiping apparatus. FIG. 4 is a front view showing the baffle plate unit according to the embodiment of the present invention.

[0016] In FIG. 1, the reference sign 11 denotes a zinc pot that stores molten zinc L. A steel strip 1 is drawn into the molten zinc L inside this zinc pot 11 in a diagonal direction, then is caused to change the direction by a sink roll 12 disposed in the zinc pot 11, and then is pulled up from the molten zinc inside the zinc pot 11 in a vertical direction through support rolls 13 disposed in the zinc pot 11. The steel strip 1 to be drawn into the zinc pot 11 is guided into the zinc pot 11 through the inside of a cylindrical snout 15 kept in a non-oxidizing atmosphere. Further, a gas wiping apparatus 20 is disposed above the zinc pot 11 and configured to remove excessive molten zinc from the steel strip 1 pulled up in the vertical direction.

[0017] As shown in FIGS. 2 and 3, the gas wiping apparatus 20 includes a pair of gas wiping nozzles 21, which blow a gas to the top and bottom surfaces of the steel strip 1 and thereby to remove excessive molten zinc adhering to the steel strip 1, and a baffle plate unit 24.

[0018] Each of the gas wiping nozzles 21 is formed of an elongated body longer than the width of the steel strip 1 and extending in the width direction of the steel strip 1. Each nozzle 21 includes a slit 21a at the forefront to discharge the wiping gas toward the steel strip 1.

[0019] As shown in FIG. 4, in accordance with the setting positions of the gas wiping nozzles 21, the baffle plate unit 24 includes a pair of baffle plates 22 disposed outside the opposite edge portions of the steel strip 1 and a position adjustment mechanism 23 configured to adjust the positions of the baffle plates 22.

[0020] The baffle plates 22 are disposed at positions close to the steel strip 1 such that they form planes substantially flush with the steel strip 1 outside the opposite edge portions of the steel strip 1. The baffle plates 22 prevent wiping gas parts respectively discharged from the slits 21a of the pair of gas wiping nozzles 21 from colliding with each other outside the steel strip 1. Con-

sequently, it is possible to suppress such an edge over-coating phenomenon that the coating weight becomes larger on the edge portions of the steel strip 1 because the wiping effect attenuates at the edge portions of the steel strip 1.

[0021] The position adjustment mechanism 23 includes a pair of shifting mechanisms 31 for respectively shifting the pair of baffle plates 22, a pair of electromagnetic-wave sensor (radar sensor) units 32 for detecting the positions of the respective edges (width direction edges) of the steel strip 1, and a control section 33 configured to control the pair of shifting mechanisms 31, based on detection values obtained by the electromagnetic-wave sensor units 32, to set the pair of baffle plates 22 at predetermined positions close to the edges of the steel strip 1. Although not shown, the position adjustment mechanism 23 further includes mechanisms for respectively adjusting the positions of the baffle plates 22 in a direction perpendicular to the main surface of the steel strip 1 in accordance with the pass line of the steel strip 1.

[0022] Each of the shifting mechanisms 31 includes an actuator 35 formed of, e.g., a servo motor for shifting the corresponding one of the baffle plates 22 in the width direction of the steel strip 1, and a linear guide 36 for guiding the steel strip 1 being moved. The actuator 35 and linear guide 36 are fixed on the lower side of a frame member 40 serving as a base, so that the corresponding baffle plate 22 can be shifted relative to the frame member 40.

[0023] Each of the electromagnetic-wave sensor units 32 utilizes the principle of radars such that it emits electromagnetic waves toward the corresponding one of the edges of the steel strip 1 and receives reflected electromagnetic waves to detect the position of the corresponding edge of the steel strip. More specifically, electromagnetic waves, such as microwaves, are emitted toward the steel strip 1, and electromagnetic waves reflected by the corresponding edge of the steel strip 1 are received. Then, the time difference between the time of emission of the electromagnetic waves and the time of reception of the reflected electromagnetic waves is used as the basis to detect the position of the corresponding edge of the steel strip 1. In this embodiment, each of the electromagnetic-wave sensor units 32 can emit a first electromagnetic waves having a relatively high frequency that makes it possible to perform high accuracy detection and a second electromagnetic waves (carrier waves) having a relatively low frequency that makes it possible to perform stable detection. Consequently, the unit 32 can use the first electromagnetic waves under normal conditions to perform the position detection with a higher degree of accuracy. Further, if the measurement by the first electromagnetic waves is affected by environmental noise, the unit 32 can use the second electromagnetic waves for correction to more stably perform the position detection. As the electromagnetic waves, it is preferable to use microwaves. In preferable examples, the frequency of the first electromagnetic waves is 10 GHz, and the frequency of the second is 2.5 GHz.

[0024] Each of the electromagnetic-wave sensor units 32 includes a main body section 37 that comprises a signal generator for generating a signal having a predetermined frequency, an amplifier for power-amplifying the signal and turning it into electromagnetic waves having the predetermined frequency, and a signal processor for performing signal processing on received electromagnetic waves. Each of the units 32 further includes a detecting section 38 equipped with antennas for emitting electromagnetic waves toward the corresponding edge of the steel strip 1 and receiving the electromagnetic waves reflected by the edge of the steel strip 1, along with an electromagnetic wave cable 39 connecting the main body section 37 to the detecting section 38.

[0025] The detecting section 38 includes a two-way transmission (emission/reception) portion 43, a first two-way transmission antenna 44 for the first electromagnetic waves, such as electromagnetic waves of 10 GHz, and a second two-way transmission antenna 45 for the second electromagnetic waves, such as electromagnetic waves of 2.5 GHz. This detecting section 38 is fixed to the frame member 40 by a stand 41 attached to the upper surface of the frame member 40, so that the detecting section 38 is distant from the upper surface of the frame member 40 by a suitable length. For example, the distance from the upper surface of the frame member 40 to the center of the antennas is set to be 800 mm. On the other hand, the main body section 37 is disposed on the ground to prevent it from being affected by heat.

[0026] The first two-way transmission antenna 44 and the second two-way transmission antenna 45 of the detecting section 38 may be fixedly disposed at a position about 250 to 1,000 mm distant from the corresponding edge of the steel strip 1. The first two-way transmission antenna 44 is used to emit electromagnetic waves having a predetermined frequency of, e.g., 10 GHz generated by the main body section 37, and the first two-way transmission antenna 44 is further used to receive electromagnetic waves reflected by the corresponding edge of the steel strip 1. The main body section 37 calculates positional information based on the time difference between the emission time and the reception time and sends the positional information to the control section 33. In a similar way, the second two-way transmission antenna 45 is used to emit electromagnetic waves of, e.g., 2.5 GHz, and the second two-way transmission antenna 45 is further used to receive electromagnetic waves reflected by the corresponding edge of the steel strip 1. The main body section 37 calculates positional information based on the time difference between the emission time and the reception time and sends the positional information to the control section 33.

[0027] The portion of the electromagnetic wave cable 39 on the detecting section 38 side is fixed to the frame member 40 and is detachably connected by a connector 46 to its portion on the main body section 37 side. This arrangement makes it possible to easily attach and de-

tach the frame member 40 when the baffle plate unit 24 is mounted or it is dismounted for a maintenance work. There may be a case where the relay of the electromagnetic wave cable transmitting radio frequency waves is unfavorable. In this case, it is preferable to relocate the portion for generating electromagnetic waves (radio frequency waves), which is now present in the main body section 37, into the detecting section 38 and to connect the main body section 37 to the detecting section 38 by a regular cable along with a connector disposed therein.

[0028] The control section 33 receives information about the edge position of the steel strip 1 from each of the electromagnetic-wave sensor units 32, and uses this signal as the basis to output a control signal to the actuator 35. Consequently, the control section 33 performs such control that each of the baffle plates 22 is set at a predetermined position close to the corresponding edge of the steel strip 1. In order to perform accuracy checking and calibration for the electromagnetic-wave sensor units 32, means employed is a calibration jig that includes a dummy steel strip mounted on a rail and movable thereon. More specifically, in the initial state or when changing conditions, such as the steel strip width, the calibration jig is placed between the pair of detecting sections 38 such that the dummy steel strip is positioned with its edges 500 mm distant from the respective antennas. In this state, one point calibration is performed and accuracy checking is further performed on the sensors while actually detecting the edges of the dummy steel strip by the sensor units 32. In addition, the dummy steel strip is utilized to adjust the positions of the baffle plates 22 in a direction perpendicular to the main surface of the steel strip 1.

[0029] Next, an explanation will be given of an operation of the gas wiping apparatus according to this embodiment.

At first, the gas wiping apparatus 20 is set up at a predetermined position above the zinc pot 11. More specifically, the gas wiping nozzles 21 are first placed at predetermined positions, and the baffle plate unit 24 is then placed at a predetermined position.

[0030] Thereafter, by use of the calibration jig including the dummy steel strip of a movable type, the positions of the baffle plates 22 in a direction perpendicular to the main surface are adjusted with reference to the pass line, and the accuracy checking and calibration are performed on the sensors of the electromagnetic-wave sensor units 32.

[0031] Then, the molten zinc coating process starts being performed on the steel strip 1, and excessive molten zinc is removed from the steel strip 1 by the gas wiping apparatus 20 while the steel strip 1 is pulled up from the zinc pot 11.

[0032] At this time, in order to prevent the edge over-coating phenomenon in which the coating weight becomes larger on the edge portions of the steel strip 1, the positions of the baffle plates 22 are adjusted by the position adjustment mechanism 23 of the baffle plate unit 24 such that the baffle plates 22 are set closer to the edges of the steel strip 1. The position adjustment mechanism 23 emits electromagnetic waves from the electromagnetic-wave sensor units 32, which are disposed one on either side of the steel strip 1, toward the edges of the steel strip 1, and receives reflected electromagnetic waves to detect the edge positions of the steel strip 1 in a non-contact state.

[0033] Conventionally, baffle plate units use optical sensors to detect the edge positions of steel strips. In this case, since optical sensors have short measurable distances, the sensors need to be disposed very close to baffle plates. Consequently, a trouble arises such that zinc fume adheres to their emission/reception portions and causes the sensors not to normally function due to lack of a sufficient amount of light. Accordingly, it is necessary to frequently perform maintenance/cleaning works thereon. Further, in order to place optical sensors to be very close to baffle plates, the sensors are inevitably designed to be movable along with the baffle plates, and thus the running operation has to be stopped during the maintenance work. Further, optical sensors are easily affected by heat (high temperature), and so, if they are disposed adjacent to baffle plates, they become apt to cause erroneous detection and/or breakdown.

[0034] On the other hand, electromagnetic-wave sensors, which are utilized in the position adjustment mechanism 23 of the baffle plate unit 24 according to this embodiment, have long measurable distances with a high degree of accuracy in principle. Accordingly, even if the detecting sections 38 are set to be about 1,000 mm distant from the steel strip or detection target, they can detect positions of the steel strip with a high degree of accuracy. Thus, the detecting sections 38 can be fixedly disposed at positions distant from the edges of the steel strip 1 and the zinc pot 11, so that they detect the edge positions of the steel strip 1 in an environment less affected by the thermal influence and/or zinc fume from the high-temperature steel strip 1. In addition, electromagnetic waves (microwaves) have advantages such that they can hardly affected by gas temperature, pressure, flow velocity change, powder dust, and so forth. As described above, not only the electromagnetic-wave sensor units 32 used in this embodiment are less easily affected by heat and/or fume in principle as compared to optical sensors, but also their installation environment is set to be less affected by heat and/or fume. Consequently, they can measure the position of the steel strip 1 with a high degree of accuracy and a longer service life. For practice, electromagnetic-wave sensors configured to emit electromagnetic waves (microwaves) with a frequency of 10 GHz were used to control the positions of the baffle plates. As a result, they made it possible to achieve ± 1.0 mm relative to the targeted gap between each baffle plate 22 and the corresponding edge of the steel strip 1.

[0035] Further, as described above, since the electromagnetic-wave sensor units 32 can be hardly affected by temperature and/or powder dust, there is essentially

no need to perform any maintenance work. Even if a maintenance work is required, the maintenance work can be performed without stopping the line because the detecting sections 38 are fixedly disposed at positions distant from the edges of the steel strip 1.

[0036] Further, since electromagnetic-wave sensors have high directivity, it is possible to perform the measurement stably and continuously without affecting peripheral devices even if the detecting sections 38 of the electromagnetic-wave sensor units 32 are disposed at positions in a narrow space on the frame member 40 and distant from the edges of the steel strip 1. In addition, since the detecting sections 38 are fixed by the stands 41 or stanchions, the measurement can be hardly affected when people come close to them to a certain extent. Further, electromagnetic-wave sensors can detect the position of a portion even having a width of about 0.3 mm by irradiating it with electromagnetic waves. In addition, since the detection is performed not by use of a certain area or only one point of an edge, measurement omission can be hardly caused.

[0037] Further, the detecting sections 38 of the electromagnetic-wave sensor units 32 include a small number of electronic components and have sufficiently high strength. Accordingly, they can serve for a long time essentially without causing breakdown, thereby reducing the number of maintenance works. In this respect, even if a maintenance work is required, the maintenance work can be performed without stopping the running operation, as described above.

[0038] Furthermore, the baffle plate unit 24 according to this embodiment forms an integrated structure in which the detecting sections 38 and actuators 35 of each electromagnetic-wave sensor unit 23 are fixed to the frame member 40 serving as a base member, and the baffle plates 22 are movable along the linear guide fixed to the frame member 40. Accordingly, when the baffle plate unit 24 is mounted or it is dismounted for a maintenance work, it can be integrally handled and thereby easily mounted/dismounted, leading to an improvement in maintenance performance. In this respect, each of the electromagnetic wave cables 39 comprises a portion fixed to the frame member 40 on the detecting section side, which is detachably connected to a cable portion on the main body section 37 side by the connector 46. Accordingly, the frame member 40 can be easily attached or detached while being connected or disconnected to or from the portion of each of the electromagnetic wave cables 39 on the main body section 37 side.

[0039] Furthermore, the position detection is performed on the steel strip 1 by use of electromagnetic waves having two frequencies, i.e., a first electromagnetic waves having a relatively high frequency, such as 10 GHz, which makes it possible to perform high accuracy detection and a second electromagnetic waves (carrier waves) having a relatively low frequency, such as 2.5 GHz, which makes it possible to perform stable detection. Accordingly, if the measurement by the first frequency is affected by environmental noise (unwanted reflected waves), the second electromagnetic waves can be used for correction to more stably perform the position detection.

[0040] As described above, a position adjustment mechanism used for adjusting the positions of the baffle plates relative to the edges of the metal strip in the width direction is a mechanism including a pair of electromagnetic-wave sensor units for respectively detecting the positions of the edges of the metal strip in the width direction. The detecting sections of the units are fixedly disposed at positions distant by a predetermined length from the edges of the metal strip in the width direction. Consequently, the position adjustment mechanism can detect the position of the metal strip, without being affected by fume and/or heat from molten metal, and adjust the position of the baffle plates.

[0041] The present invention is not limited to the embodiment described above, and it may be modified in various manners. For example, in the embodiment described above, the present invention is applied to a facility for performing molten zinc coating on a steel strip. However, this is not limiting. The present invention can be universally applied to a case where molten metal coating is performed on a metal strip. Further, in the embodiment described above, each of the detecting sections 38 includes two antennas that respectively emit electromagnetic waves having different frequencies. However, each of the detecting sections 38 may include only one antenna that emits electromagnetic waves having a single frequency.

[Reference Signs List]

[0042] 1 = steel strip, 20 = gas wiping apparatus, 21 = gas wiping nozzle, 22 = baffle plate, 23 = position adjustment mechanism, 24 = baffle plate unit, 31 = shifting mechanism, 32 = electromagnetic-wave sensor unit, 33 = control section, 35 = actuator, 36 = linear guide, 37 = main body section, 38 = detecting section, 39 = electromagnetic wave cable (cable), 40 = frame member (base member), 41 = stand, 43 = two-way transmission portion, 44 = first two-way transmission antenna, 45 = second two-way transmission antenna, and 46 = connector.

Claims

1. A baffle plate unit to be used in a gas wiping apparatus that removes excessive molten metal from a metal strip by blowing a gas from gas wiping nozzles to opposite surfaces of the metal strip pulled up in a vertical direction from a molten metal bath, the baffle plate unit comprising:

   a pair of baffle plates respectively disposed outside a pair of width direction edges of the metal strip in accordance with setting positions of the

gas wiping nozzles; and
a position adjustment mechanism configured to adjust positions of the pair of baffle plates relative to the width direction edges of the metal strip,
wherein the position adjustment mechanism includes
a pair of electromagnetic-wave sensor units configured to respectively detect positions of the pair of width direction edges of the metal strip,
a pair of shifting mechanisms configured to respectively shift the pair of baffle plates in a width direction of the metal strip, and
a control section configured to control the pair of shifting mechanisms based on detection values obtained by the electromagnetic-wave sensor units such that the pair of baffle plates are set at predetermined positions close to the width direction edges of the metal strip, and
wherein each of the electromagnetic-wave sensor units includes
a detecting section equipped with an antenna configured to emit electromagnetic waves and to receive electromagnetic waves reflected by corresponding one of the width direction edges of the metal strip, and
a main body section,
the detecting section being fixedly disposed at a position distant by a predetermined length from corresponding one of the width direction edges of the metal strip.

2. The baffle plate unit according to claim 1, wherein the detecting section and the pair of shifting mechanisms are fixedly disposed on a base member, and the pair of baffle plates are movable relative to the base member.

3. The baffle plate unit according to claim 2, wherein the detecting section is fixed by a stand on the base member.

4. The baffle plate unit according to claim 2 or 3, wherein the detecting section and the main body section are connected to each other by a cable, which includes portions detachably connected by a relay member disposed on the base member.

5. The baffle plate unit according to any one of claims 2 to 4, wherein the shifting mechanisms respectively include actuators fixed to the base member and configured to drive the baffle plates, and linear guides fixed to the base member and configured to guide the baffle plates.

6. The baffle plate unit according to any one of claims 1 to 5, wherein the detecting section is fixedly disposed such that the antenna is set at a position 250 to 1,000 mm distant from corresponding one of the width direction edges of the metal strip.

7. A gas wiping apparatus that removes excessive molten metal from a metal strip by blowing a gas to opposite surfaces of the metal strip pulled up in a vertical direction from a molten metal bath, the gas wiping apparatus comprising:

a pair of gas wiping nozzles configured to blow the gas to the opposite surfaces of the metal strip, and
the baffle plate unit according to any one of claims 1 to 6.

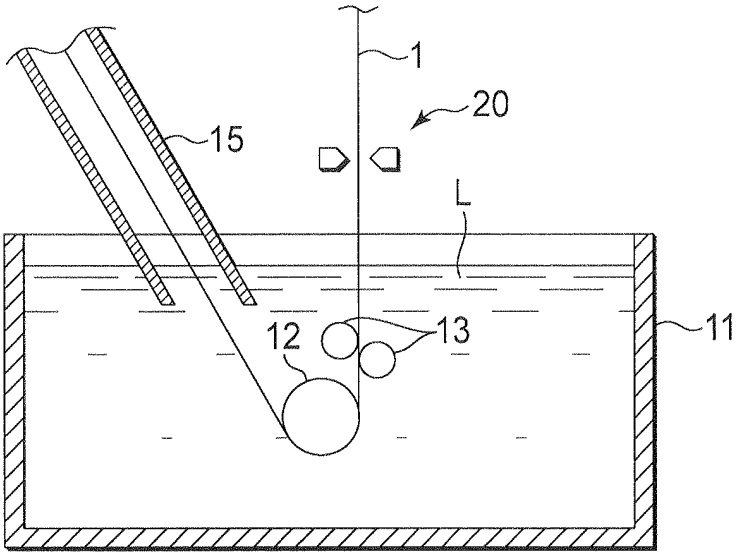
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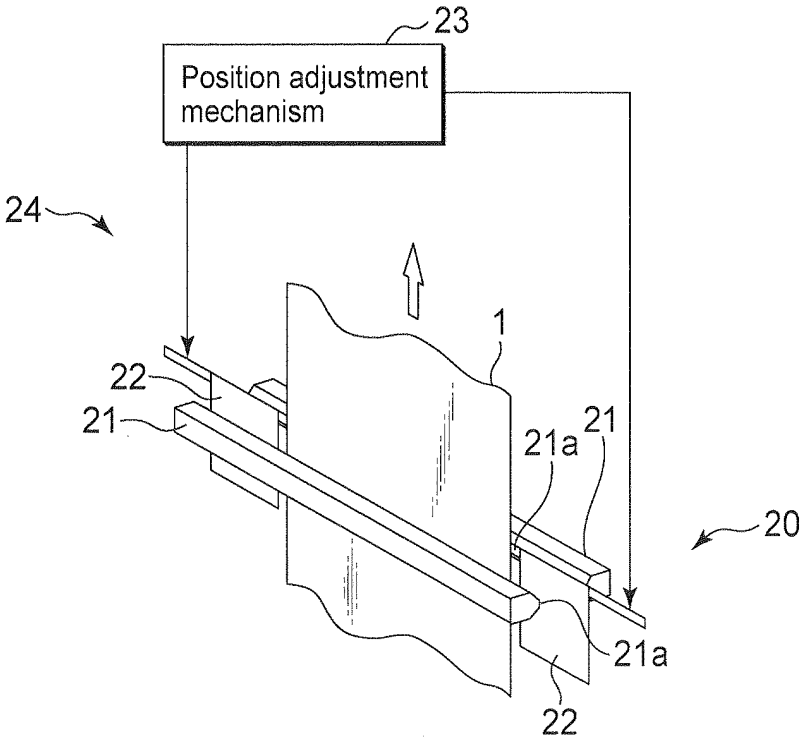
FIG.1


23
Position adjustment mechanism
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21a
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21a
22

FIG.2

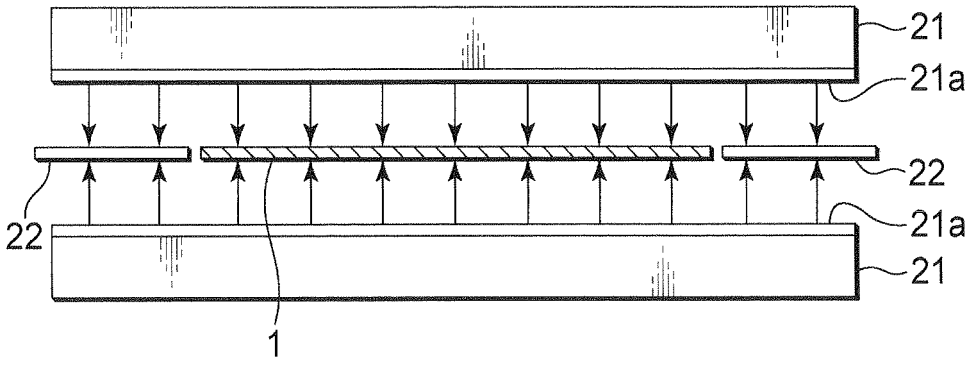
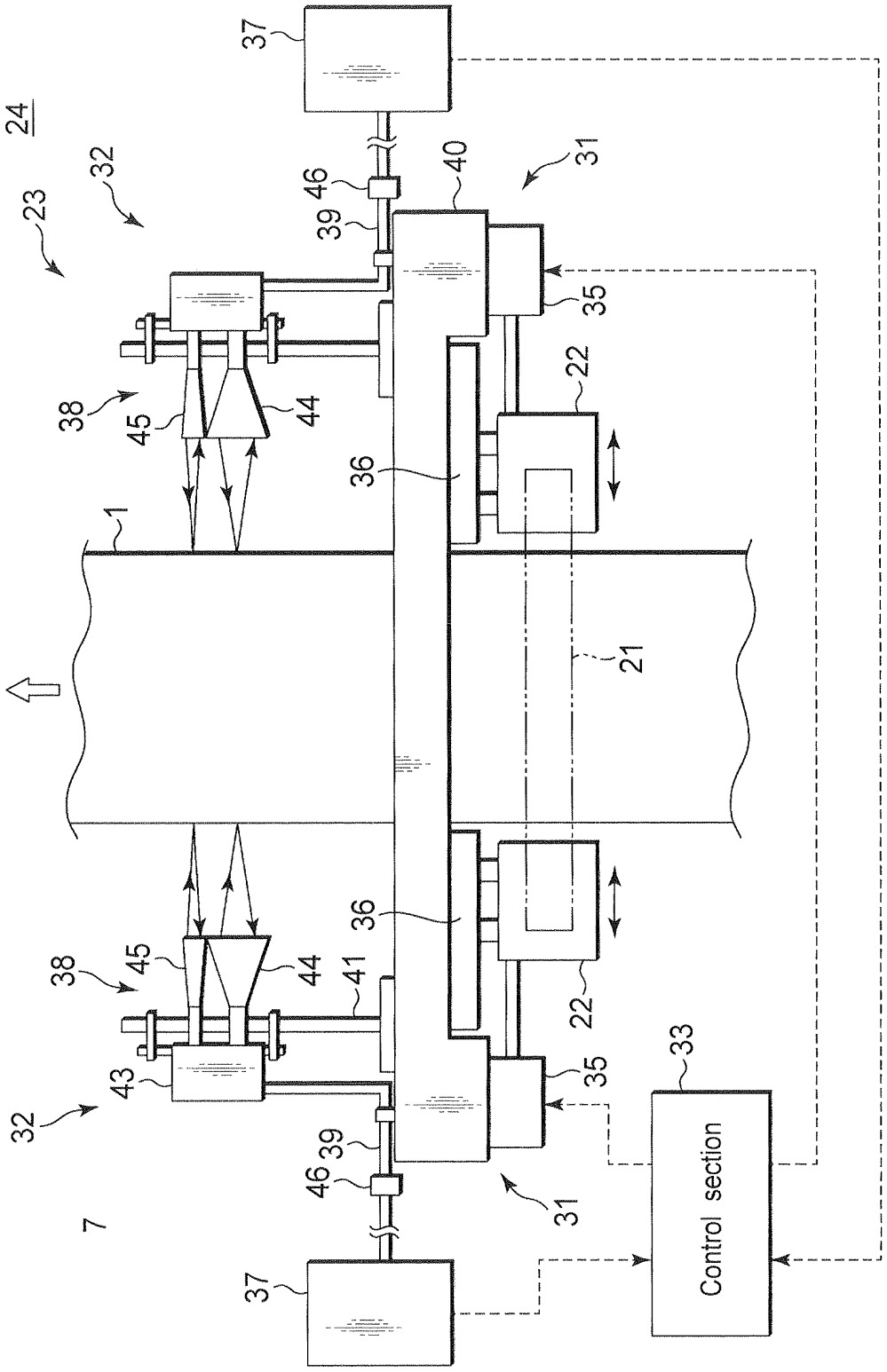


FIG.3


24
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33
Control section
7

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/065772

A. CLASSIFICATION OF SUBJECT MATTER
C23C2/20(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C23C2/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI(C23C_002_20/ic*'plate*'/tx)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-091630 A (Mitsubishi-Hitachi Metals Machinery, Inc.), 30 April 2009 (30.04.2009), claims; paragraph [0027] (Family: none)	1-7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
04 October, 2011 (04.10.11)	18 October, 2011 (18.10.11)
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REFERENCES CITED IN THE DESCRIPTION

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