(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 434 026 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.07.2019 Bulletin 2019/30

(21) Application number: **10777670.0**

(22) Date of filing: **10.05.2010**

(51) Int Cl.:
C21D 9/56 *(2006.01)* ***C21D 1/74*** *(2006.01)*
F27B 5/10 *(2006.01)* ***C21D 9/573*** *(2006.01)*
F27B 9/30 *(2006.01)* ***F27D 17/00*** *(2006.01)*
F27D 9/00 *(2006.01)*

(86) International application number:
PCT/JP2010/057851

(87) International publication number:
WO 2010/134436 (25.11.2010 Gazette 2010/47)

(54) **CONTINUOUS ANNEALING FURNACE**

DAUERGLÜHOFEN

FOUR DE RECUIT CONTINU

(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 SE SI SK SM TR

(30) Priority: **20.05.2009 JP 2009121593**
12.06.2009 PCT/JP2009/060753

(43) Date of publication of application:
28.03.2012 Bulletin 2012/13

(73) Proprietor: **Chugai Ro Co., Ltd.**
Chuo-ku
Osaka-shi
Osaka 541-0046 (JP)

(72) Inventors:
- **NAKAGAWA Hiroo**
Osaka-shi
Osaka 541-0046 (JP)
- **ARAKI Yuji**
Osaka-shi
Osaka 541-0046 (JP)
- **AKASAKA Motofumi**
Osaka-shi
Osaka 541-0046 (JP)

(74) Representative: **Glawe, Delfs, Moll**
Partnerschaft mbB von
Patent- und Rechtsanwälten
Postfach 13 03 91
20103 Hamburg (DE)

(56) References cited:
JP-A- 3 134 120
JP-A- 7 268 493
JP-A- H0 472 021
JP-A- H11 229 041
JP-A- H11 236 623

EP 2 434 026 B1

Description

[Technical Field]

[0001] The present invention relates to a continuous annealing furnace in which a subject material introduced through an inlet sealing portion is continuously transported from a heating zone to a cooling zone in a hydrogen-gas containing ambient gas so as to anneal the subject material by indirectly heating the subject material in the heating zone followed by cooling the heated subject material in the cooling zone and from which the annealed subject material is discharged through an outlet sealing portion. Particularly, the invention is characterized as follows. An ambient gas feeder feeds the hydrogen-gas containing ambient gas into the continuous annealing furnace in order to replenish the ambient gas leaked through the inlet sealing portion and outlet sealing portion and to remove oxygen by reaction with the hydrogen gas, the oxygen accompanying the subject material introduced into the continuous annealing furnace. In this case, the invention is adapted to suppress the discharge of the excess ambient gas fed into the continuous annealing furnace and to provide an effective utilization of the hydrogen gas present in the excess ambient gas.

[Background Art]

[0002] In a case where an elongate subject material such as a stainless steel strip formed by cold rolling or the like is annealed in the continuous annealing furnace, it has been a common practice in the art to bright anneal the subject material so as not to impair the brilliance of the material.

[0003] In the continuous annealing furnace, the elongate subject material is bright annealed as follows. As shown in Fig.1, an elongate subject material 1 is introduced through an inlet sealing portion 11 into a continuous annealing furnace 10 filled with the hydrogen-gas containing ambient gas or generally an ambient gas consisting primarily of hydrogen gas and nitrogen gas. The subject material 1 is indirectly heated in a heating zone 12 in the continuous annealing furnace 10. The heated subject material 1 is cooled by introducing the subject material into cooling zones 13a to 13c. The subject material 1 is further led from a top roll chamber 14 provided with rollers 14a to an outlet sealing portion 16 via a chute 15. The subject material is discharged from the continuous annealing furnace 10 through the outlet sealing portion 16 (see, for example, Patent Documents 1, 2).

[0004] In such a continuous annealing furnace 10, an ambient gas feeder 20 feeds the hydrogen-gas containing ambient gas into the continuous annealing furnace 10 in order to replenish the ambient gas leaked through the inlet sealing portion 11 and outlet sealing portion 16 and to remove oxygen by reaction with the hydrogen gas present in the ambient gas, the oxygen accompanying the subject material 1 introduced into the continuous annealing furnace 10.

[0005] When the ambient gas feeder 20 feeds the hydrogen-gas containing ambient gas into the continuous annealing furnace 10, as just described, it is a common practice for the ambient gas feeder 20 to feed an excess of the above ambient gas into the continuous annealing furnace 10 such that the oxygen accompanying the subject material 1 introduced into the continuous annealing furnace 10 may be sufficiently removed by reaction with the hydrogen gas present in the ambient gas.

[0006] In the case where the excess ambient gas is fed into the continuous annealing furnace 10 by the ambient gas feeder 20 as just described, the pressure of the ambient gas in the continuous annealing furnace 10 is gradually increased, which dictates the need for discharging the ambient gas from the continuous annealing furnace 10 to the outside. More recently, the inlet sealing portion 11 and the outlet sealing portion 16, in particular, employ roll seals or the like having high air-tightness so that the amount of ambient gas leaked through the inlet sealing portion 11 or the outlet sealing portion 16 is decreased. Accordingly, the ambient gas to be discharged from the continuous annealing furnace 10 tends to increase.

[0007] When the ambient gas is discharged from the continuous annealing furnace 10, it is necessary to cool the ambient gas or to dilute the ambient gas with air in order to prevent the combustion of the hydrogen gas present in the ambient gas. This leads to problems of increased costs and wasted hydrogen gas present in the excess ambient gas.

Prior Art Documents

Patent Documents

[0008] JP H 11 229041 A discloses a continuous annealing furnace comprising directly firing burners.

Patent Document 1: JP-A No.H3-134120
Patent Document 2: JP-A No.H7-268493

[Disclosure of the Invention]

[Problems to Be Solved by the Invention]

[0009] The invention addresses the above-described problems encountered by the continuous annealing furnace as disclosed in claim 1 in which the subject material introduced through the inlet sealing portion is continuously transported from the heating zone to the cooling zone in the hydrogen-containing ambient gas so as to anneal the subject material by indirectly heating the subject material in the heating zone followed by cooling the heated subject material in the cooling zone and from which the annealed subject material is discharged through the outlet sealing portion.

[0010] In the case where the ambient gas feeder feeds

the above-described ambient gas into the continuous annealing furnace in order to replenish the ambient gas leaked through the inlet sealing portion and outlet sealing portion and to sufficiently remove oxygen by reaction with the hydrogen gas, the oxygen accompanying the subject material introduced into the continuous annealing furnace, the invention seeks to suppress the discharge of the excess ambient gas fed into the continuous annealing furnace and to provide an effective utilization of the hydrogen gas present in the excess ambient gas.

[Means for Solving the Problems]

[0011] In accordance with the invention for achieving the above objects, a continuous annealing furnace according to claim 1 which comprises an inlet sealing portion allowing the introduction of an elongate subject material, a heating zone for indirectly heating the subject material by means of combustion in a combustion portion, a cooling zone for cooling the heated subject material, and an outlet sealing portion allowing the discharge of the cooled subject material and which anneals the subject material introduced through the inlet sealing portion by continuously transporting the subject material from the heating zone to the cooling zone in a hydrogen-gas containing ambient gas and discharges the annealed subject material through the outlet sealing portion, further comprises an ambient gas feeder for feeding the ambient gas into the continuous annealing furnace, a guide duct for introducing excess ambient gas from the continuous annealing furnace into the combustion portion of the heating zone, and an ambient-gas control unit for controlling the introduction of excess ambient gas through the guide duct into the combustion portion of the heating zone.

[0012] The continuous annealing furnace employ a so-called muffle heater as the heating zone for indirectly heating the subject material. The muffle heater includes an internal pipe allowing the passage of the subject material and an external pipe disposed around an outer periphery of the internal pipe and effects combustion in the combustion portion defined between the internal pipe and the external pipe.

[0013] The external pipe is provided with a combustion device such as a burner so as to effect the combustion in the combustion portion defined between the internal pipe and the external pipe.

[0014] In the continuous annealing furnace, the ambient-gas control unit introduces the excess ambient gas from the continuous annealing furnace through the guide duct into the combustion portion of the heating zone. If, in this case, the temperature of the ambient gas is extremely high, the ambient gas cannot be introduced into the combustion portion of the heating zone because of the heat resistance and the like of meters and gauges. It is therefore preferred to introduce the excess ambient gas from the cooling zone into the combustion portion of the heating zone, the cooling zone in which the ambient gas is cooled to some degree.

[0015] In the case where the ambient-gas control unit introduces the excess ambient gas from the continuous annealing furnace through the guide duct into the combustion portion of the heating zone, it is preferable that, in a case where the combustion portion has a temperature which is not lower than an ignition temperature of the hydrogen gas, the excess ambient gas is introduced to the combustion part by means of the ambient-gas control unit for the purpose of ensuring that the hydrogen gas present in the ambient gas is adequately burned up in the combustion portion.

[0016] Further, in the continuous annealing furnace, it is preferable that a gas refining unit for refining the ambient gas, a refining guide duct for introducing the excess ambient gas which is introduced through the guide duct into the gas refining unit, and a returning duct for returning the excess ambient gas which is refined by the gas refining unit into the ambient gas feeder are provided.

[0017] In the continuous annealing furnace comprised as above, in the case where the combustion portion has the temperature lower than the ignition temperature of the hydrogen gas, the excess ambient gas introduced through the guide duct by the ambient-gas control unit is introduced through the refining guide duct into the gas refining unit, and the refined ambient gas is returned through the returning duct to the ambient-gas feeder.

[Advantageous Effects of the Invention]

[0018] In the continuous annealing furnace according to the invention, the excess ambient gas in the continuous annealing furnace is introduced into the combustion portion of the heating zone by means of the ambient-gas control unit. Therefore, the hydrogen gas present in the excess ambient gas thus introduced is combusted in the combustion portion.

[0019] In the continuous annealing furnace according to the invention, therefore, the hydrogen gas present in the excess ambient gas in the continuous annealing furnace is effectively utilized for the combustion in the combustion portion of the heating zone, while the discharge of the excess ambient gas from the continuous annealing furnace is suppressed. This negates the need for cooling the ambient gas or diluting the ambient gas with air. In addition, the cost is also reduced.

[0020] According to the present invention, the continuous annealing furnace further comprises the gas refining unit, the refining guide duct for introducing the excess ambient gas introduced through the guide duct into the gas refining unit, and the returning duct for returning the excess ambient gas which is refined by the gas refining unit to the ambient-gas feeder. In such a continuous annealing furnace, the following effects may be obtained. For example, in a case where the combustion portion has the temperature lower than the ignition temperature of the hydrogen gas, the excess ambient gas introduced through the guide duct is introduced through the refining

guide duct to the gas refining unit for refinement and the refined ambient gas is returned through the returning duct to the ambient-gas feeder, so that the excess ambient gas is effectively utilized even if the combustion portion has the temperature lower than the ignition temperature of the hydrogen gas.

[Brief Description of the Drawings]

[0021]

Fig.1 is a schematic diagram showing an example of the conventional continuous annealing furnace;
Fig.2 is a schematic diagram showing a continuous annealing furnace according to one embodiment of the invention; and
Fig.3 is a schematic diagram showing a variation example of the continuous annealing furnace according to one embodiment of the invention.

[Best Mode for Carrying Out the Invention]

[0022] A continuous annealing furnace according to an embodiment of the invention will be specifically described as below with reference to the accompanying drawings. It is to be noted that the continuous annealing furnace according to the invention is not particularly limited to the embodiment disclosed hereinbelow but may be embodied in any other suitable forms without departing from the spirit or essential characteristics thereof.

[0023] According to the embodiment, as shown in Fig. 2, an elongate subject material 1 such as a stainless steel strip formed by cold rolling or the like is introduced through an inlet sealing portion 11 into a continuous annealing furnace 10 filled with a hydrogen-gas containing ambient gas or generally an ambient gas consisting primarily of hydrogen gas and nitrogen gas.

[0024] It is noted here that the above inlet sealing portion 11 employs a roll seal 11a such as to inhibit the leakage of the ambient gas filled in the continuous annealing furnace 10.

[0025] In this continuous annealing furnace 10, the subject material 1 introduced through the inlet sealing portion 11a as described above is indirectly heated in a heating zone 12.

[0026] The following arrangement is made for indirectly heating the subject material 1 in the heating zone 12 as described above. The heating zone 12 is constructed in a double pipe structure wherein the subject material 1 is passed through an internal pipe 12a of the heating zone 12 while an external pipe 12b is provided with a combustion device 12c such as a burner. The combustion device 12 effects combustion in a combustion portion 12d defined between the internal pipe 12a and the external pipe 12b so that the subject material 1 passed through the internal pipe 12a is indirectly heated.

[0027] The heating zone 12 is arranged such that a combustion exhaust gas resulting from the combustion in the above combustion portion 12d is introduced into a cooler 12f via an exhaust gas pipe 12e. After cooled by the cooler 12f, the combustion exhaust gas is discharged to the outside via the exhaust gas pipe 12e.

[0028] Next, the subject material 1 thus heated in the heating zone 12 is cooled by sequentially introducing the subject material into first to third cooling zones 13a to 13c. The subject material 1 thus cooled is introduced into a top roll chamber 14 provided with rollers 14a. The subject material 1 is led from the top roll chamber 14 to an outlet sealing portion 16 via a chute 15. The subject material 1 is discharged from the continuous annealing furnace 10 through this outlet sealing portion 16.

[0029] The above outlet sealing portion 16 also employs a roll seal 16a such as to inhibit the leakage of the ambient gas filled in the continuous annealing furnace 10.

[0030] In the continuous annealing furnace 10 of the embodiment as well, an ambient gas feeder 20 feeds the excessive hydrogen-gas containing ambient gas into the continuous annealing furnace 10 in order to replenish the ambient gas leaked through the inlet sealing portion 11 and the outlet sealing portion 16 and to sufficiently remove oxygen, accompanying the subject material introduced into the continuous annealing furnace 10, by reaction with the hydrogen gas present in the ambient gas. In the continuous annealing furnace 10 according to the embodiment, the ambient gas feeder 20 is arranged to feed the hydrogen-gas containing ambient gas into the third cooling zone 13c when feeding the ambient gas into the continuous annealing furnace 10. However, the portion to be supplied with the ambient gas is not particularly limited.

[0031] The continuous annealing furnace 10 of the embodiment is further provided with a guide duct 33 which introduces the excess ambient gas supplied by the ambient gas feeder 20 from the continuous annealing furnace 10 into the combustion portion 12d of the heating zone 12. Still further, the continuous annealing furnace 10 of the embodiment is provided with an ambient-gas control unit 30 which controls the introduction of the ambient gas through the guide duct 33 to the combustion portion 12d of the heating zone 12.

[0032] The ambient-gas control unit 30 is provided with a pressure gauge 31 for measuring the pressure of the ambient gas in the continuous annealing furnace 10. The pressure of the ambient gas in the continuous annealing furnace 10, as measured by the pressure gauge 31, is outputted to a controller 32.

[0033] In the ambient-gas control unit 30, a first valve 33a and a second valve 33b are disposed in a guide duct 33 for introducing the excess ambient gas from the continuous annealing furnace 10 into the combustion portion 12d of the heating zone 12. Further, a discharge pipe 34 for discharging the ambient gas to the outside is connected to a part of the guide duct 33 that extends between the first valve 33a and the second valve 33b. The discharge pipe 34 is provided with a third valve 34a. The first valve 33a, the second valve 33b and the third valve

34a are controlled by the above-described controller 32.

[0034] In a case where the temperature of the combustion portion 12d is not lower than an ignition temperature of the hydrogen gas, the controller 32 introduces the excess ambient gas from the continuous annealing furnace 10 into the combustion portion 12d of the heating zone 12 via the guide duct 33 by opening the first valve 33a and the second valve 33b and closing the third valve 34a, such that the pressure of the ambient gas in the continuous annealing furnace 10 may be set to a predetermined value, as determined by the pressure gauge 31.

[0035] The hydrogen gas present in the ambient gas thus introduced into the combustion portion 12d is combusted by the combustion device 12c and is discharged along with the combustion exhaust gas to the outside of the furnace via the exhaust gas pipe 12e.

[0036] This approach prevents the hydrogen-gas containing ambient gas in the continuous annealing furnace 10 from being directly discharged to the outside of the furnace. Furthermore, the hydrogen gas present in the ambient gas to be discharged is effectively utilized for the combustion in the combustion portion 12d of the heating zone 12.

[0037] In a case where the combustion is not conducted in the combustion portion 12d of the heating zone 12, for example, in the case where the combustion portion 12d of the heating zone 12 has the temperature lower than the ignition temperature of the hydrogen gas, the controller 32 may also discharge the ambient gas to the outside via the discharge pipe 34 by opening the first valve 33a and the third valve 34a and closing the second valve 33b.

[0038] According to the embodiment, the heating zone 12 is constructed in the double pipe structure for indirectly heating the subject material 1 in the heating zone 12. The heating zone 12 is constructed such that the external pipe 12b is provided with the combustion device 12c such as a burner and the combustion device 12c effects the combustion in the combustion portion 12d defined between the internal pipe 12a and the external pipe 12b. However, an alternative arrangement may also be made such that a radiant tube burner (not shown) constituting the combustion portion is provided around an outer periphery of the internal pipe 12a and the hydrogen-gas containing ambient gas is introduced into this radiant tube burner (not shown).

[0039] Further, the continuous annealing furnace 10 according to the above embodiment may also have an arrangement (not shown) wherein the ambient gas leaked out of the continuous annealing furnace 10 through the inlet sealing portion 11 or the outlet sealing portion 16 is introduced into the combustion portion 12d of the heating zone 12 so that the hydrogen gas present in the ambient gas is combusted in the combustion portion 12d. Reference Characters List

[0040] In the continuous annealing furnace 10 according to the above embodiment, in the case where the combustion is not conducted in the combustion portion 12d of the heating zone 12, for example, in the case where the combustion portion 12d of the heating zone 12 has the temperature lower than the ignition temperature of the hydrogen gas, the controller 32 may also discharge the ambient gas to the outside via the discharge pipe 34 by opening the first valve 33a and the third valve 34a and closing the second valve 33b. However, as shown in the variation example of Fig. 3, the continuous annealing furnace may be composed such that the ambient gas discharged to the outside via the discharge pipe 34 is effectively utilized.

[0041] As shown in Fig.3, in the continuous annealing furnace 10 of the variation example, a refining guide duct 36 which introduces the excess ambient gas into a gas refining unit 35 is connected to a guide duct 33 which introduces the excess ambient gas into the combustion portion 12d of the heating zone 12, and a fourth valve 36a is provided with the refining guide duct 36. Further, the gas refining unit 35 is provided with a returning duct 37 which returns the excess ambient gas refined by the gas refining unit 35 into the ambient gas feeder 20.

[0042] In the continuous annealing furnace 10 of the variation example, in the case where the combustion is not conducted in the combustion portion 12d, for example, in the case where the combustion portion 12d of the heating zone 12 has the temperature lower than the ignition temperature of the hydrogen gas, the controller 32 of the ambient-gas control unit 30 closes the second valve 33b and the third valve 34a and opens the first valve 33a and the fourth valve 36a, so that the excess ambient gas is introduced through the refining guide duct 36 into the gas refining unit 35.

[0043] The gas refining unit 35 refines the excess ambient gas by applying deoxidation process and dehydration process and returns the refined ambient gas through the returning duct 37 into the ambient gas feeder 20, so that the refined ambient gas is reused.

[0044] This approach further suppresses the discharge of the ambient gas containing hydrogen gas from the continuous annealing furnace 10 to the outside of the furnace via the discharge pipe 34, and therefore, the ambient gas is more effectively utilized.

[0045] In the case where the excess ambient gas introduced through the guide duct 33 is burned in the combustion portion 12d of the heating zone 12, for example, in the case where the temperature of the combustion portion 12d is not lower than the ignition temperature of the hydrogen gas, one part of the excess ambient gas supplied into the combustion portion 12d may be introduced into the gas refining unit 35 by adjusting the fourth valve 36a and the excess ambient gas may be refined and returned to the ambient gas feeder 20, so that the volume of the excess ambient gas supplied into the combustion 12d of the heating zone 12 is adjusted.

Reference Characters List

[0046]

1: Subject material
10: Continuous annealing furnace
11: Inlet sealing portion
11a: Roll seal
12: Heating zone
12a: Internal pipe
12b: External pipe
12c: Combustion device
12d: Combustion portion
12e: Exhaust gas pipe
12f: Cooler
13a-13c: First to third cooling zones
14: Top roll chamber
14a: Roller
15: Chute
16: Outlet sealing portion
16a: Roll seal
20: Ambient gas feeder
30: Ambient-gas control unit
31: Pressure gauge
32: Controller
33: Guide duct
33a: First valve
33b: Second valve
34: Discharge pipe
34a: Third valve
35: Gas refining unit
36: Refining Guide duct
36a: Fourth valve
37: Returning duct

Claims

1. A continuous annealing furnace (10) which comprises an inlet sealing portion (11) allowing the introduction of an elongate subject material (1), a heating zone (12) for indirectly heating the subject material by means of combustion in a combustion portion, a cooling zone (13) for cooling the heated subject material, and an outlet sealing portion (16) allowing the discharge of the cooled subject material and which anneals the subject material introduced through the inlet sealing portion by continuously transporting the subject material from the heating zone to the cooling zone in a hydrogen-gas containing ambient gas and discharges the annealed subject material through the outlet sealing portion, the continuous annealing furnace further comprising an ambient gas feeder (20) for feeding the ambient gas into the continuous annealing furnace, **characterized by** a guide duct (33) for introducing excess ambient gas from the continuous annealing furnace into the combustion portion of the heating zone and an ambient-gas control unit (30) for controlling the introduction of excess ambient gas through the guide duct into the combustion portion of the heating zone,
wherein the heating zone (12) includes an internal pipe (12a) allowing the passage of the subject material and an external pipe (12b) disposed around an outer periphery of the internal pipe and performs combustion in the combustion portion defined between the internal pipe and the external pipe, and,
wherein the external pipe is provided with a combustion device .

2. The continuous annealing furnace according to Claim 1 , wherein the guide duct (33) introduces the excess ambient gas from the cooling zone into the combustion portion of the heating zone.

3. The continuous annealing furnace according to any one of Claims 1 or 2, wherein the ambient-gas control unit (30) introduces the excess ambient gas into the combustion portion in a case where the combustion portion has a temperature not lower than an ignition temperature of hydrogen gas.

4. The continuous annealing furnace according to any one of Claims 1 to 3 which comprises a gas refining unit (35) for refining the ambient gas, a refining guide duct (36) for introducing the excess ambient gas which is introduced through the guide duct into the gas refining unit, and a returning duct (37) for returning the ambient gas which is refined by the gas refining unit to the excess ambient gas feeder.

5. The continuous annealing furnace according to Claim 4, wherein the ambient-gas control unit (30) introduces the excess ambient gas into the gas refining unit (35) in a case where the combustion portion has a temperature lower than an ignition temperature of hydrogen gas.

Patentansprüche

1. Durchlauf-Glühofen (10) mit einem Einlass-Dichtungsteil (11) zur Einbringung eines länglichen Objektmaterials (1), einer Heizzone (12) zum indirekten Heizen des Objektmaterials mittels Verbrennung in einem Verbrennungsteil, einer Kühlzone (13) zum Kühlen des aufgeheizten Objektmaterials und einem Auslass-Dichtungsteil (16) zur Abgabe des gekühlten Objektmaterials, und der das Objektmaterial, das durch den Einlass-Dichtungsteil eingebracht wurde, durch kontinuierlichen Transport des Objektmaterials von der Heizzone zu der Kühlzone in einem Wasserstoffgas enthaltenden Umgebungsgas glüht und das geglühte Objektmaterial durch den Auslass-Dichtungsteil abgibt, wobei der Durchlauf-Glühofen ferner einen Umgebungsgas-Förderer (20) aufweist zum Zuführen des Umgebungsgases in den Durchlauf-Glühofen, **gekennzeichnet durch** eine Führungsleitung (22) zum Einbringen von überschüssigem Umgebungsgas aus dem Durchlauf-Glühofen

in den Verbrennungsteil der Heizzone und einer Umgebungsgas-Steuereinheit (30) zur Steuerung des Einbringens des überschüssigen Umgebungsgases durch die Führungsleitung in den Verbrennungsteil der Heizzone,
wobei die Heizzone (12) ein internes Rohr (12a) aufweist, das die Passage des Objektmaterials ermöglicht, und ein äußeres Rohr (12b), das um die äußere Peripherie des inneren Rohres ausgebildet ist, und eine Verbrennung in dem Verbrennungsteil durchführt, der zwischen dem inneren Rohr und dem äußeren Rohr definiert ist, und
wobei das äußere Rohr mit einer Verbrennungsvorrichtung versehen ist.

2. Durchlauf-Glühofen nach Anspruch 1, wobei die Führungsleitung (22) das überschüssige Umgebungsgas aus der Kühlzone in den Verbrennungsteil der Heizzone einbringt.

3. Durchlauf-Glühofen nach einem der Ansprüche 1 oder 2, wobei die Umgebungsgas-Steuereinheit (30) das überschüssige Umgebungsgas in den Verbrennungsteil einbringt, wenn der Verbrennungsteil eine Temperatur aufweist, die nicht kleiner ist als die Zündtemperatur von Wasserstoffgas.

4. Durchlauf-Glühofen nach einem der Ansprüche 1 bis 3, mit einer Gas-Aufbereitungseinheit (35) zur Aufbereitung des Umgebungsgases, einer Aufbereitungs-Führungsleitung (36) zum Einbringen des überschüssigen Umgebungsgases, das durch die Führungsleitung eingebracht wird, in die Gas-Aufbereitungseinheit und einer Rückführleitung (37) zur Rückführung des Umgebungsgases, das durch die Gas-Aufbereitungseinheit aufbereitet wurde, zu dem Gasförderer für überschüssiges Umgebungsgas.

5. Durchlauf-Glühofen nach Anspruch 4, wobei die Umgebungsgas-Steuereinheit (30) das überschüssige Umgebungsgas in die Gas-Aufbereitungseinheit (35) einbringt, wenn der Verbrennungsteil eine Temperatur aufweist, die kleiner als die Zündtemperatur von Wasserstoffgas ist.

Revendications

1. Four de recuit continu (10) qui comprend une portion d'étanchéité d'entrée (11) permettant l'introduction d'un matériau objet allongé (1), une zone de chauffage (12) pour chauffer indirectement le matériau objet par combustion dans une portion de combustion, une zone de refroidissement (13) pour refroidir le matériau objet chauffé, et une portion d'étanchéité de sortie (16) permettant l'évacuation du matériau objet refroidi et qui recuit le matériau objet introduit par la portion d'étanchéité d'entrée par le transport en continu du matériau objet de la zone de chauffage à la zone de refroidissement dans un gaz ambiant contenant de l'hydrogène gazeux et évacue le matériau objet recuit à travers la portion d'étanchéité de sortie, le four de recuit continu comprenant en outre un dispositif d'apport de gaz ambiant (20) pour apporter le gaz ambiant dans le four de recuit continu, **caractérisé par** une conduite de guidage (33) pour introduire un excédent de gaz ambiant depuis le four de recuit continu jusque dans la portion de combustion de la zone de chauffage et une unité de commande de gaz ambiant (30) pour commander l'introduction d'excédent de gaz ambiant à travers la conduite de guidage jusque dans la portion de combustion de la zone de chauffage,
dans lequel la zone de chauffage (12) comprend un tuyau interne (12a) permettant le passage du matériau objet et un tuyau externe (12b) disposé autour d'une périphérie extérieure du tuyau interne et réalise une combustion dans la portion de combustion définie entre le tuyau interne et le tuyau externe, et, dans lequel le tuyau externe est pourvu d'un dispositif de combustion.

2. Four de recuit continu selon la revendication 1, dans lequel la conduite de guidage (33) introduit l'excédent de gaz ambiant depuis la zone de refroidissement jusque dans la portion de combustion de la zone de chauffage.

3. Four de recuit continu selon l'une quelconque des revendications 1 ou 2, dans lequel l'unité de commande de gaz ambiant (30) introduit l'excédent de gaz ambiant dans la portion de combustion dans un cas où la portion de combustion a une température non inférieure à une température d'inflammation d'hydrogène gazeux.

4. Four de recuit continu selon l'une quelconque des revendications 1 à 3 qui comprend une unité d'affinage de gaz (35) pour affiner le gaz ambiant, une conduite de guidage d'affinage (36) pour introduire l'excédent de gaz ambiant qui est introduit à travers la conduite de guidage jusque dans l'unité d'affinage de gaz, et une conduite de retour (37) pour retourner le gaz ambiant qui est affiné par l'unité d'affinage de gaz vers le dispositif d'apport d'excédent de gaz ambiant.

5. Four de recuit continu selon la revendication 4, dans lequel l'unité de commande de gaz ambiant (30) introduit l'excédent de gaz ambiant dans l'unité d'affinage de gaz (35) dans un cas où la portion de combustion a une température inférieure à une température d'inflammation d'hydrogène gazeux.

Fig. 1

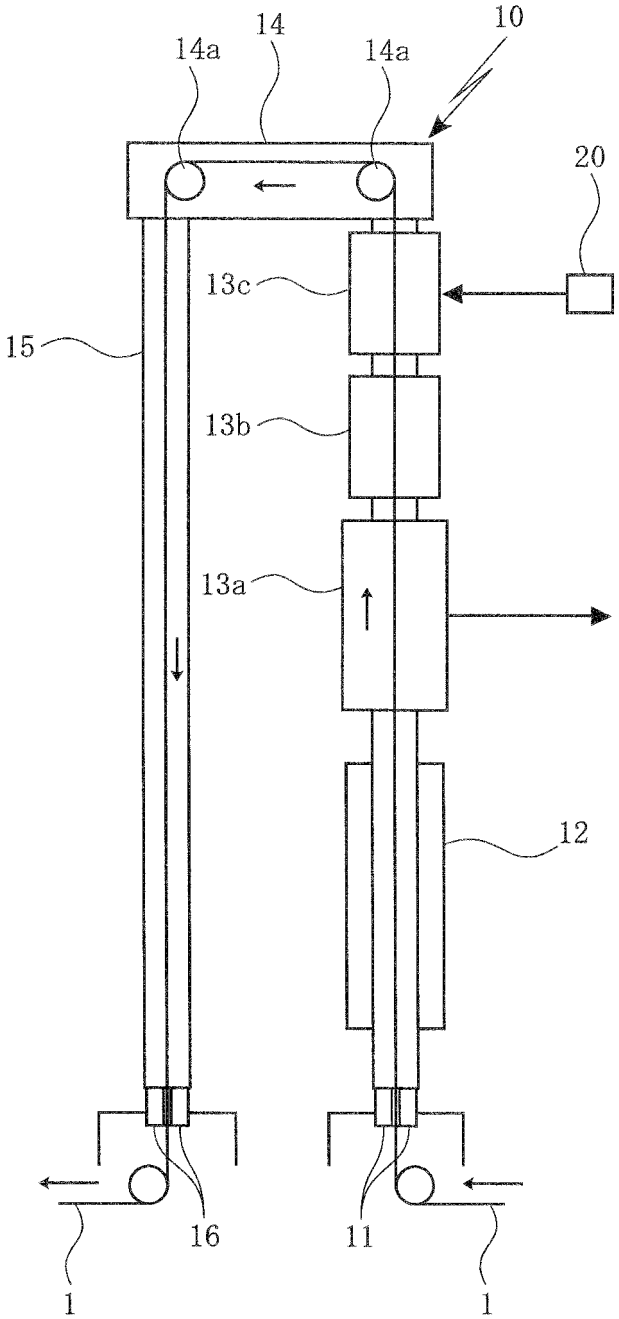


Fig. 2

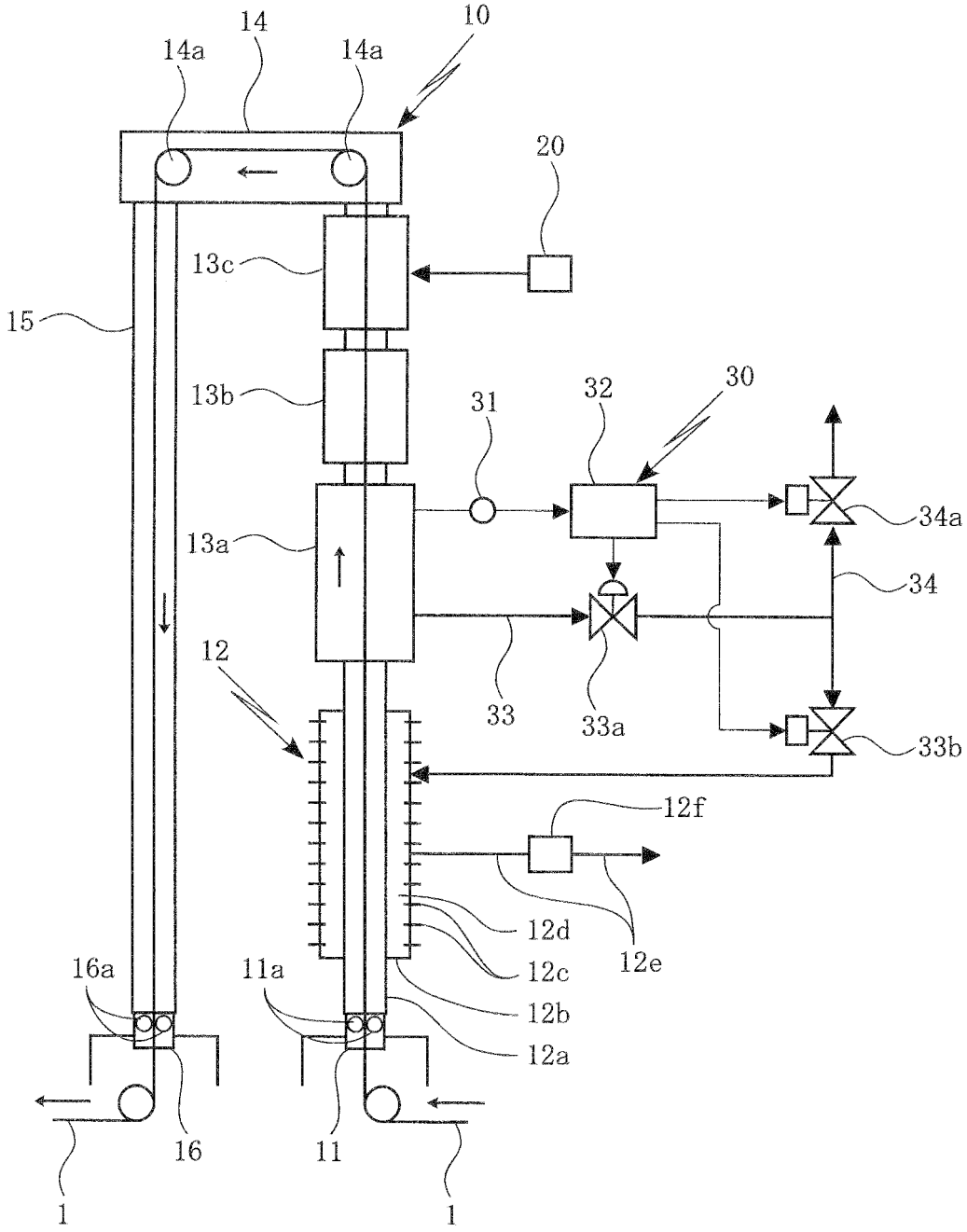
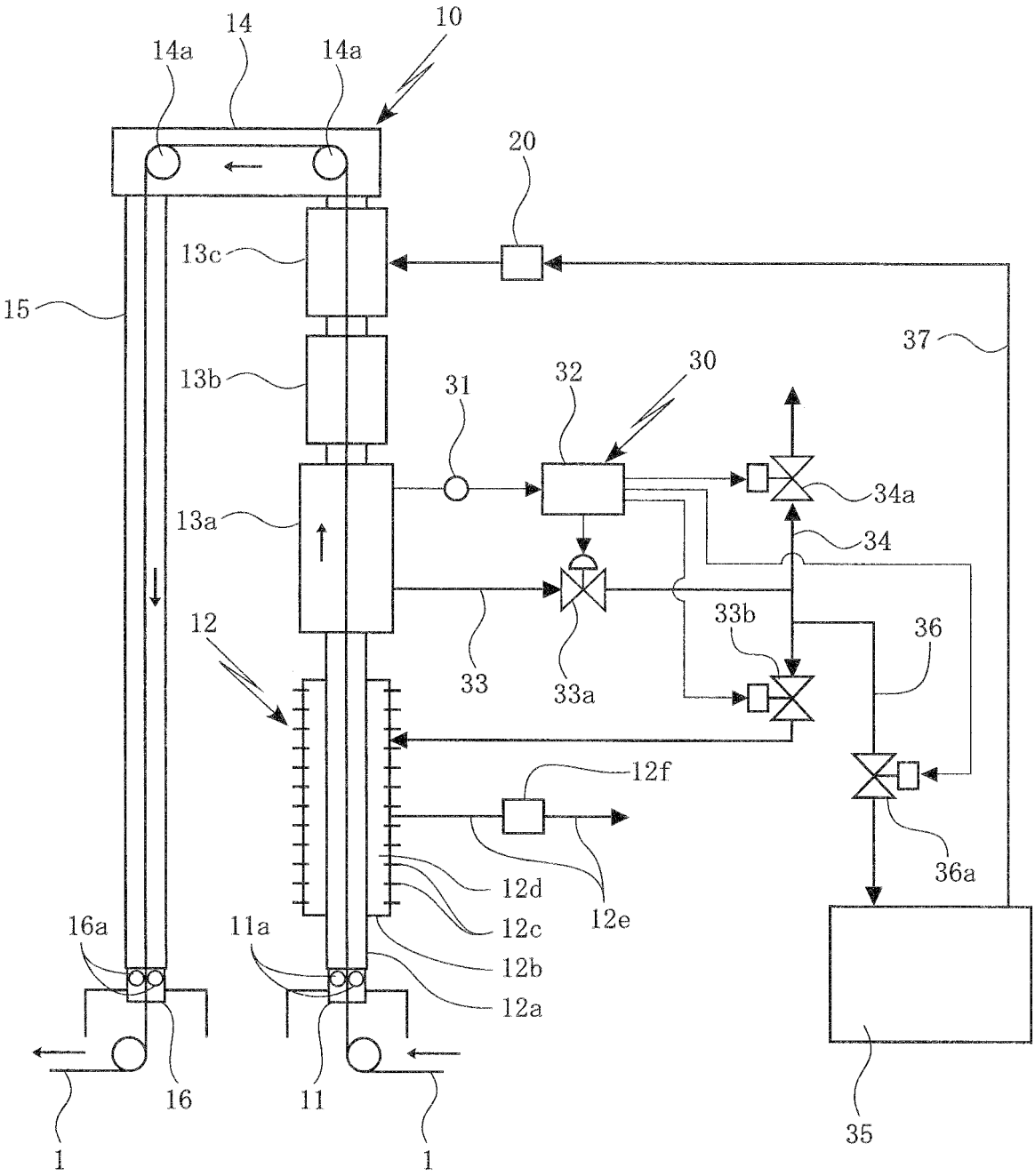

14
10
14a
14a
20
13c
15
13b
31
32
30
34a
13a
34
12
33
33a
33b
12f
12d
12e
12c
16a
11a
12b
12a
16
11
1
1

Fig. 3


10
14
14a
14a
20
13c
15
37
13b
31
32
30
34a
13a
34
33b
36
12
33
33a
12f
36a
12d
12e
12c
12b
12a
16a
11a
16
11
1
1
35

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H11229041 A **[0008]**
- JP H3134120 A **[0008]**
- JP H7268493 A **[0008]**