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(54) **HIGH TEMPERATURE PARTICULATE COOLING FACILITY EQUIPPED WITH AN AIR SUPPLY DEVICE**

HOCHTEMPERATURKÜHLEINHEIT FÜR PARTIKEL MIT LUFTZUFUHRVORRICHTUNG

MOYENS DE REFOIDISSEMENT DE PARTICULES À HAUTE TEMPÉRATURE ÉQUIPÉS D'UN DISPOSITIF D ADMISSION D AIR

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(56) References cited:
**JP-A- 4 139 380 JP-A- 6 257 955
JP-A- 2000 310 489 JP-U- 4 061 296
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Description

Technical Field

[0001] The present invention relates to an air supply apparatus for supplying air to a carriage which moves in a carriage path, and a cooling facility having the air supply apparatus for hot grain/lump material. The cooling facility loads hot sintered ore, pelletized ore and the like into the carriage and cools the same.

Background Art

[0002] A sintered ore cooling facility is one of cooling facilities for hot grain/lump material. The sintered ore cooling facility is formed so that sintered ore, which is a hot grain/lump material, is loaded into a carriage and the carriage is moved along a generally circular carriage path while cooling air is blown from a lower part of the carriage to an upper part in order to cool the sintered ore (refer to Patent References 1 to 3, for example) .

[0003] In the sintered ore cooling facility, a carriage formed of plural connected pan carriages for loading the sintered ore thereinto is arranged between an inner circumferential sidewall and an outer circumferential sidewall, which extend along a circular path, so as to be freely movable. In a bottom part of the pan carriage, provided is a cool-air box which the cooling air is supplied into. The cool-air box of each pan carriage is connected to a stationary circular duct through a connecting duct. The stationary circular duct is connected to a movable circular duct so that the movable circular duct is fitted into the stationary circular duct through a water sealing device so as to be freely movable. Further, a cooling air supply apparatus is arranged through the connecting air duct to supply cooling air.

[0004] The water sealing device has an inner circumferential circular water seal chamber and an outer circumferential circular water seal chamber, which are formed in the movable circular duct. The water sealing device comprises water sealing plates whose lower ends are sunk in sealing water in the inner circular water seal chamber and the outer circular water seal chamber, the water sealing plates being formed in the stationary circular duct.

[0005] Now, an example of the above-mentioned sintered ore cooling facility is described on the basis of Figs. 9 to 15.

[0006] In Fig. 10, a carriage 1 is provided along a circle-shaped carriage path A shown in Fig. 9 so as to be freely movable. The carriage 1 moves sintered ore from a material feed zone 8 to a material discharge zone 9 via a cooling zone C while cooling the sintered ore by means of cooling air. The material feed zone 8 and the material discharge zone 9 are collectively referred to as a feed and discharge zone B (or an atmospheric zone B), hereinafter. A waste heat recovery zone D is provided in a part of the cooling zone C in some cases, as shown in

Fig. 15.

[0007] The carriage 1 comprises plural pan carriages 7, an inner circular sidewall 3 and an outer circular sidewall 4, as shown in Fig. 10. The plural pan carriages 7, linked each other, are provided on a pair of right and left guide rails 6a laid along a carriage path A through a guide wheels 5a so as to be freely movable. The inner circular sidewall 3 and the outer circular sidewall 4 are connected to each other by means of a connection beam 2 to be provided on the pan carriage 7 and include a side wheel 5b guided by a side rail 6b. Each of the pan carriages 7 is connected to the horizontal axis between the circular sidewalls 3 and 4 at its front part so as to be able to freely incline downward on the axis. In the material discharge zone 9, the guide rails 6a are bent downward with respect to a horizontal direction, as shown in Fig. 11, to incline the pan carriage 7 downward through the guide wheels 5a, so that the loaded sintered ore can be discharged downward.

[0008] Each of the pan carriages 7 comprises, as shown in Fig. 12, a pan carriage main body 11 including the guide wheels 5a on both sides, and a cool-air box 12 provided at a bottom part of the pan carriage main body 11. On the upper surface of the cool-air box 12, provided is an air-vent board 13 in which many air-vents are formed. Moreover, the cool-air box 12 is provided with openings, such as opening 14 under the inner circular sidewall 3. The inner circular sidewall 3 of the carriage 1 is provided, along the circular carriage path A shown in Fig. 9, with a movable circular duct 21 whose upper surface is open, as shown in Figs. 12 and 13. The cool-air box 12 of the pan carriage 7 and the movable circular duct 21 are communicated with each other through a connection air duct 26 connected to the opening 14. In the movable circular duct 21, an inner sidewall part 22 and an outer sidewall part 23 are formed into a double-wall structure by means of inner plates 22a and 23a and outer plates 22b and 23b, respectively, so that an inner circumferential circular water seal chamber 24a and an outer circumferential circular water seal chamber 24b are formed with upward opening, and, between the inner sidewall part 22 and the outer sidewall part 23 of the movable circular duct 21, and a circular movable air path 25 is formed.

[0009] A stationary circular duct 31 is provided so as to cover the upper part of the movable circular duct 21 all over and to form a circular stationary air path 37 communicating with the movable air path 25. In the stationary circular duct 31, a top cover plate 40 and both sidewall parts 32 and 33 are formed into the shape of "C" having an opening on its bottom side in cross section. The top cover plate 40 in the cooling zone C is connected to plural middle air ducts 38 from an arc-shaped air header 39 shown in Figs. 9 and 10 to supply the stationary air path 37 with cooling air. In the feed and discharge zone B (the material feed zone 8 and the material discharge zone 9), no middle air duct 38 is connected.

[0010] The stationary circular duct 31 is connected to

the movable circular duct 21 through a water sealing device 28, as shown in Figs. 12 and 13. The water sealing device 28 comprises the inner circumferential circular water seal chamber 24a, the outer circumferential circular water seal chamber 24b and water sealing plates 34a and 34b, which are suspended from the both sidewall parts 32 and 33 of the stationary circular duct 31 through a fitting flange 35 so that their lower ends sink under the surface of the water in the circular water seal chambers 24a and 24b on the both sides. Cover plates 36a and 36b are projectingly provided above and outside the respective water sealing plates 34a and 34b so as to cover the outside of the circular water seal chambers 24a and 24b. In Figs. 12 and 13, a numeric sign 24i denotes an upper space of the water seal chamber on a movable air path 25 side.

[0011] A dead plate 42 is mounted to the stationary circular duct 31 at a part other than the middle air duct 38 through an expansion joint 41. To the upper end parts of the inner plate 22a and the outer plate 23a, mounted are labyrinth sealing plates 43a and 43b whose top ends are close to the dead plate 42 to provide the labyrinth seal.

[0012] In an upper part of the carriage path A, provided is a stationary hood 51 formed from the inner and outer circumferential stationary plates 51a and 51b, which are provided at the upper end parts of the inner and outer circular sidewalls 23 and 24 through sealing devices, and a stationary top plate 51c for connecting the upper end parts of the inner and outer circumferential stationary plates 51a and 51b. An exhaust duct 52 is connected to a predetermined place of the stationary hood 51.

[0013] Furthermore, a partition plate 47 is provided for every connection air duct 26 (every pan carriage 7) in the movable air path 25 of the movable circular duct 21, as shown in Fig. 14. A labyrinth seal 43c is provided at the upper end of the partition plate 47 closely to the dead plate 42. This causes the movable air path 25 to be partitioned for every section having the connection air duct 26 in the circumferential direction (in a direction of rotation). On the other hand, the water sealing device 28 has no such partition plate. A waste heat recovery zone D may be provided in a part of the cooling zone C in some cases, as shown in Fig. 15. In the waste heat recovery zone D, heat is recovered from the hot air which is used for cooling sintered ore, and then, the air is sent to the stationary circular duct 31 again as the cooling air.

Patent Reference 1: JP-A-4-139380

Patent Reference 2: JP-A-6-257955

Patent Reference 3: JP-A-2000-310489

[0014] JP H04 61296 U discloses in combination the features of the pre-characterizing part of claim 1.

Disclosure of the Invention

Problems that the Invention is to Solve

[0015] The sintered ore cooling facility having the above-mentioned structure has the following problems.

[0016] The pressure of the movable air path 25 and the cool-air box 12 is the atmospheric pressure in the feed and discharge zone B. On the other hand, the pressure of the movable air path 25 in the cooling zone C is 300 to 500 mmAq (referred to as "differential pressure in cooling", hereinafter). The latter pressure is kept also in the upper space of the water seal chamber 24i by means of the dead plate 42 and the labyrinth sealing plates 43a, 43b and 43c due to the structure. The length of the dead plate 42, however, is 10 m or more, and therefore, it is difficult in view of technology of manufacture to completely seal the dead plate 42 having such long length. Moreover, combined with aging due to long-term use, generated is a gap between the labyrinth sealing plates 43a, 43b and 43c and the dead plate 42, so that the cooling air in the spaces of the water seal chambers 24i and 24i is leaked. This causes a lowering of cooling efficiency.

[0017] Further, the air as much as the air leakage leaked in the feed and discharge zone B flows into the upper spaces of the water seal chambers 24i and 24i from the movable air path 25 in the cooling zone C, and violently flows toward the feed and discharge zone B within the upper spaces of the water seal chambers 24i and 24i, due to the differential pressure of the cooling air. This causes, in the circular water seal chambers 24a and 24b in the feed and discharge zone B, wave in the sealing water, or the air leakage from the labyrinth sealing part to the movable air path 25, which causes water splash over the movable air path 25 together with sealing water in the circular water seal chambers 24a and 24b. The sealing water splashed and accumulated in the movable air path 25 will further splash about the pan carriage 7 to adhere to a wall surface in the feed and discharge zone B or in the pan carriage 7. And, the dust of the sintered ore adheres to the adhered drops of water and solidifies and grow to become the wet dust, which causes troubles such as corrosion or a clogging of the pan carriage 7, so that normal operation is disturbed. Furthermore, wave or splash of the sealing water deteriorates water-sealing performance. This lowers cooling efficiency.

[0018] In order to overcome the problems, levels of an upper end of the partition plate 47 and upper ends of the labyrinth sealing plates 43a, 43b and 43c should be adjusted in all over the zone to be controlled so that gaps between the dead plate 42 and the partition plate 47 become almost closed. It is difficult, however, to control the large number of labyrinth sealing plates 43a, 43b and 43c provided in the extremely long length of movable circular duct 21. The operations and aging of the facility further widen the gap and deteriorate the sealing performance, but it is impossible to rectify during the operation of the facility.

[0019] Patent Reference 3 has proposed that the upper spaces of the water seal chambers 24i and 24i on a movable air path 25 side are supplemented with compressed air (auxiliary air) in the feed and discharge zone B, as shown in Fig. 16, for the purpose of prevention of troubles caused by splashing of the sealing water. That is to say, an inlet side branch duct (an auxiliary air supply means) 61a is connected to the middle air duct 38 provided at an end of an exit of the cooling zone C to branch off, a top end part of the inlet side branch duct 61a is connected to the top cover plate 40 of the stationary circular duct 31 provided at an entrance of the material discharge zone 9, an outlet side branch duct (an auxiliary air supply means) 61b is connected to the middle air duct 38 provided at an entrance end of the cooling zone C to branch off, and a top end part of the outlet side branch duct 61b is connected to the top cover plate 40 of the stationary circular duct 31 provided at an exit of the material feed zone 8. The auxiliary air supplied from the branch ducts 61a and 61b is supplied to the upper spaces of the inner water seal chambers 24i and 24i from a space between expansion joints 41, which are provided at intervals, through both side parts of the dead plate 42. This allows the auxiliary air supplemented from the branch ducts 61a and 61b to greatly decrease the speed of the air flowing in the upper spaces of the water seal chambers 24i and 24i toward the feed and discharge zone B. Accordingly, splashing of the sealing water can be prevented.

[0020] However, in the method proposed in Patent Reference 3, a large quantity of auxiliary air should be supplied as back pressure in the case where the air leakage is increased, resulting in an increase not only in air leakage quantity of the cooling air but also in troubles by loss of the balance caused by the air leakage.

[0021] In view of the above, the object of the present invention is to provide a cooling facility for hot grain/lump material provided with an air supply apparatus, which are superior in efficiency of use and excellent in maintenance performance.

Means for Solving the Problems

[0022] In order to achieve the above object, the invention provides the following cooling facility for hot grain/lump material.

[1]. A cooling facility for hot grain/lump material, in which air supplied from an air supply apparatus to plural carriages (arranged along a circular carriage path so as to be movable, is used to cool the hot grain/lump material, wherein:

the air supply apparatus includes a movable circular duct arranged along the carriage path and connected to each of the carriages through a connection air duct, a stationary circular duct arranged along the carriage path and fitted into the movable circular duct through a water

sealing device so as to be freely movable, and a connection air duct closing mechanism for closing the connection air duct, wherein the movable circular duct and the stationary circular duct form a circular air path; the water sealing device includes a circular water seal chamber arranged along the carriage path and a water sealing plate having a lower end part thereof sunk in sealing water in the circular water seal chamber; an atmospheric zone for stopping leakage of air in the carriages is provided in a predetermined position of the carriage path; and the cooling facility is configured to cause the connection air duct closing mechanism to close the connection air duct in the atmospheric zone and to cause the connection air duct closing mechanism to open the connection air duct in the zones other than the atmospheric zone,

the cooling facility being characterized in that:

an upper space of the circular water seal chamber on an circular air path side is communicated with the circular air path on a movable circular duct side; and the circular air path on the movable circular duct side has no partition plate for partitioning the circular air path on the movable circular duct side in a circumferential direction so as to make the circular air path on the movable circular duct side communicate in the circumferential direction such that, in use, the pressure in the atmospheric zone and zones other than the atmospheric zone is the same.

[2]. The cooling facility according to [1], characterized in that a guiding plate for guiding cooling air, in which a notch part is provided in order to make the circular air path on the movable circular duct side communicate in the circumferential direction, is provided in the circular air path.

[3]. The cooling facility according to [1] or [2], characterized in that the connection air duct closing mechanism includes an air damper, wherein the air damper is closed in the atmospheric zone, and the air damper is opened in the zones other than the atmospheric zone.

[4]. The cooling facility according to [1] or [2], characterized in that the connection air duct closing mechanism includes a connection air duct closing plate and an inlet of the connection air duct is closed by means of the connection air duct closing plate.

[5]. The cooling facility according to any one of [1] to [4], characterized by comprising a foreign matter in-

trusion prevention plate for preventing a foreign matter from intruding into the circular water seal chamber from the circular air path, the foreign matter intrusion prevention plate being provided in an upper part on the circular air path side.

[6]. The cooling facility according to any one of [1] to [5], characterized by further comprising: a side rail for guiding and holding the carriages in moving from a side of the carriages; and a side wheel, the side wheel having a structure that a position of the side wheel is adjustable even during movement of the carriages.

Advantages of the Present Invention

[0023] The present invention provides a cooling facility for hot grain/lump material provided with an air supply apparatus, which are superior in efficiency of use and excellent in maintenance performance.

Brief Description of the Drawings

[0024]

Fig. 1 is an enlarged view of an integral part of the embodiment 1 in accordance with the invention.

Fig. 2 is an enlarged view of an integral part of the embodiment 1 in accordance with the invention.

Fig. 3 is an enlarged view of an integral part of the embodiment 1 in accordance with the invention.

Fig. 4 is an enlarged, view of an integral part of the embodiment 1 in accordance with the invention.

Fig. 5 is an enlarged view of an integral part of the embodiment 2 in accordance with the invention.

Fig. 6 is an enlarged view of an integral part of the embodiment 2 in accordance with the invention.

Fig. 7 is an enlarged view of an integral part of the embodiment 3 in accordance with the invention.

Fig. 8 is an enlarged view of an integral part of the embodiment 3 in accordance with the invention.

Fig. 9 is an entire plan view of an example of a conventional sintered ore cooling facility.

Fig. 10 is a sectional view of an integral part of an example of a conventional sintered ore cooling facility.

Fig. 11 is a front view of an example of a conventional sintered ore cooling facility.

Fig. 12 illustrates a conventional sintered ore cooling facility.

Fig. 13 illustrates a conventional sintered ore cooling facility.

Fig. 14 illustrates a conventional sintered ore cooling facility.

Fig. 15 is an entire plan view of another example of a conventional sintered ore cooling facility.

Fig. 16 illustrates a conventional sintered ore cooling facility (Patent Reference 3).

Description of Reference Numerals and Signs

[0025]

5	A:	CARRIAGE PATH
	B:	FEED AND DISCHARGE ZONE
	C:	COOLING ZONE
	D:	WASTE HEAT RECOVERY ZONE
	1:	CARRIAGE
10	2:	CONNECTION BEAM
	3:	INNER CIRCULAR SIDEWALL
	4:	OUTER CIRCULAR SIDEWALL
	5a:	GUIDE WHEEL
	5b:	SIDE WHEEL
15	6a:	GUIDE RAIL
	6b:	SIDE RAIL
	7:	PAN CARRIAGE
	8:	MATERIAL FEED ZONE
	9:	MATERIAL DISCHARGE ZONE
20	11:	PAN CARRIAGE MAIN BODY
	12:	COOL-AIR BOX
	13:	AIR-VENT BOARD
	14:	OPENING
	21:	MOVABLE CIRCULAR DUCT
25	22:	INNER SIDEWALL PART
	22a:	INNER PLATE OF INNER SIDEWALL PART
	22b:	OUTER PLATE OF INNER SIDEWALL PART
30	23:	OUTER SIDEWALL PART
	23a:	INNER PLATE OF OUTER SIDEWALL PART
	23b:	OUTER PLATE OF OUTER SIDEWALL PART
35	24a:	INNER CIRCUMFERENTIAL CIRCULAR WATER SEAL CHAMBER
	24b:	OUTER CIRCUMFERENTIAL CIRCULAR WATER SEAL CHAMBER
	24i:	UPPER SPACE OF WATER SEAL CHAMBER
40	25:	MOVABLE AIR PATH
	26:	CONNECTION AIR DUCT
	28:	WATER SEALING DEVICE
	31:	STATIONARY CIRCULAR DUCT
45	32, 33:	SIDEWALL PART
	34a, 34b:	WATER SEALING PLATE
	35:	FITTING FLANGE
	36a, 36b:	COVER PLATE
	37:	STATIONARY AIR PATH
50	38:	MIDDLE AIR DUCT
	39:	ARC-SHAPED AIR HEADER
	40:	TOP COVER PLATE
	41:	EXPANSION JOINT
	42:	DEAD PLATE
55	43a, 43b, 43c:	LABYRINTH SEALING PLATE
	47:	PARTITION PLATE (CONVENTIONAL)
	47a:	PARTITION PLATE (PRESENT IN-

	VENTION)
61a, 61b:	BRANCH DUCT
81:	AIR DUMPER
85:	FOREIGN MATTER INTRUSION PREVENTION PLATE
91:	DEAD PLATE
92a:	ROD AND DEAD PLATE HEIGHT IN- DICATOR
92b:	ROCK NUT
92c:	SEALING MECHANISM
93a:	SEALING RING
93b:	GROUND SEAL
94a:	ROD AND SEALING RING LEVEL METER
94b:	ROCK NUT
94c:	DISC SPRING
94d:	SEALING MECHANISM

Embodiments for Carrying out the Invention

[0026] Now, embodiments of the present invention are described as the examples of cooling facility of sintered ore, hot grain/lump material. In the description and the drawings, components having substantially the same function and structure are marked with the same reference numbers and signs for omitting redundancy.

Embodiment 1

[0027] A basic structure of a cooling facility of sintered ore in accordance with Embodiment 1 is the same as the structures shown in Figs. 9 to 11 mentioned above.

[0028] The cooling facility of the sintered ore in accordance with Embodiment 1 includes the carriage 1 provided along the circular carriage path A shown in Fig. 9 so as to be freely movable. The sintered ore is loaded into the carriage 1 and cooled by means of cooling air while it is carried from the material feed zone 8 to the material discharge zone 9 through the cooling zone C.

[0029] The carriage 1 comprises the plural pan carriages 7, the inner circular sidewall 3 and the outer circular sidewall 4, as shown in Fig. 10. The plural pan carriages 7, linked each other, are provided on the pair of right and left guide rails 6a laid along the carriage path A through the guide wheels 5a so as to be freely movable. The inner circular sidewall 3 and the outer circular sidewall 4 are connected to each other by means of the connection beam 2 and provided on the pan carriage 7. The inner circular sidewall 3 and the outer circular sidewall 4 include the side wheel 5b guided by the side rail 6b. Each of the pan carriages 7 is connected to the horizontal axis between the circular sidewalls 3 and 4 at its front part so as to be able to freely incline downward on the axis.

[0030] In the material discharge zone 9, the guide rails 6a are bent downward to incline the pan carriage 7 downward through the guide wheels 5a, so that the loaded sintered ore can be discharged downward.

[0031] Each of the pan carriages 7 comprises, as

shown in Fig. 12, the pan carriage main body 11 including the guide wheels 5a on the both sides, and the cool-air box 12 provided at a bottom part of the pan carriage main body 11. On the upper surface of the cool-air box 12, provided is the air-vent board 13 with which free ventilation is achieved. Moreover, the cool-air box 12 is provided with the openings such as the opening 14 under the inner circular sidewall 3. The inner circular sidewall 3 is provided along the carriage path A with the movable circular duct 21 whose upper surface is open. The cool-air box 12 of the pan carriage 7 and the movable circular duct 21 are communicated with each other through the connection air duct 26 connected to the opening 14. In the movable circular duct 21, an inner sidewall part 22 and an outer sidewall part 23 are formed into a double-wall structure by means of inner plates 22a and 23a and outer plates 22b and 23b, respectively, so that the inner circumferential circular water seal chamber 24a and the outer circumferential circular water seal chamber 24b are formed with upward opening, between the inner sidewall part 22 and the outer sidewall part 23 of the movable circular duct 21, and a circular movable air path 25 is formed.

[0032] The stationary circular duct 31 is provided so as to cover an upper part of the movable circular duct 21 all over and to form a circular stationary air path 37 communicating with the movable air path 25. In the stationary circular duct 31, the top cover plate 40 and the both sidewall parts 32 and 33 are formed into the shape of "C" having an opening on its bottom side in cross section. The top cover plate 40 in the cooling zone C is connected to the plural middle air ducts 38 from the arc-shaped air header 39 to supply the stationary air path 37 with cooling air. In the feed and discharge zone B (the material feed zone 8 and the material discharge zone 9), no middle air duct 38 is connected.

[0033] The stationary circular duct 31 is connected to the movable circular duct 21 through the water sealing device 28, as shown in Figs. 12 and 13. The water sealing device 28 comprises the inner circumferential circular water seal chamber 24a, the outer circumferential circular water seal chamber 24b and the water sealing plates 34a and 34b, which are suspended from the both sidewall parts 32 and 33 of the stationary circular duct 31 through the fitting flange 35 so that their lower ends sink under the surface of the water in the circular water seal chambers 24a and 24b on the both sides. The cover plates 36a and 36b are cover plates projectingly provided above and outside the water sealing plates 34a and 34b so as to cover the outside of the circular water seal chambers 24a and 24b.

[0034] In an upper part of the carriage path A, provided is a stationary hood 51 formed from the inner and outer circumferential stationary plates 51a and 51b, which are provided at the upper end parts of the inner and outer circular sidewalls 23 and 24 through sealing devices, and a stationary top plate 51c for connecting the upper end parts of the inner and outer circumferential stationary

plates 51a and 51b. An exhaust duct 52 is connected to a predetermined place of the stationary hood 51.

[0035] A waste heat recovery zone D may be provided in a part of the cooling zone C in Embodiment 1, as shown in Fig. 15. In the waste heat recovery zone D, heat is recovered from the hot air which is used for cooling sintered ore, and then, the air is sent to the stationary circular duct 31 again for cooling.

[0036] Embodiment 1 has the following structure additionally to the above.

(A) The labyrinth sealing part (the dead plate 42 and the labyrinth sealing plates 43a and 43b), which has been conventionally provided between the upper spaces of the water seal chambers 24i and 24i on the movable air path 25 side and the movable air path 25, is not provided and an upper part of the upper spaces of the water seal chambers 24i and 24i on the movable air path 25 side and an upper part of the movable air path 25 is arranged to be communicated with each other to enable the air to circulate therethrough, as shown in Figs. 1 and 2. Figs. 1 and 2 are sectional views of an integral part of Embodiment 1 in accordance with the invention.

(B) The partition plate 47 and the labyrinth sealing plate 43c, which have been conventionally provided in the movable air path 25, are not provided and the movable air path 25 is arranged to communicate in the circumferential direction, as shown in Fig. 3.

(C) An air damper 81 is provided in each of the connection air ducts 26.

[0037] The air damper 81 is in a closed state in the material feed zone B to close the connection air duct 26, as shown in Fig. 1, so as to prevent the cooling air from flowing out. Moreover, the air damper 81 is in an open state in the cooling zone C to open the connection air duct 26, as shown in Fig. 2, so as to supply the cool-air box 12 with the cooling air. The air damper 81 is opened and closed automatically under mechanical or electrical control. A butterfly type air damper is used for the air damper 81 in Embodiment 1. The invention, however, is not limited to the above. It is possible to use a swing type air damper or another type air damper.

[0038] Such a structure causes the movable air path 25 and the upper spaces of the water seal chambers 24i and 24i to form an entirely communicated circular duct having no partition in the circumferential direction and an operation of the air damper 81 to properly prevent air leakage in the feed and discharge zone B. Accordingly, no difference in pressure between the feed and discharge zone B and the cooling zone C is made, so that no air flows in the movable air path 25 from the cooling zone C toward the feed and discharge zone B.

[0039] Further, the movable air path 25 and the upper spaces of the water seal chambers 24i and 24i are formed into an entirely communicated circular duct having no partition in the circumferential direction while the pres-

sure in the movable air path 25 and the upper spaces of the water seal chambers 24i and 24i is the same in the circumferential direction.

[0040] Furthermore, no difference in pressure between the movable air path 25 and the upper spaces of the water seal chambers 24i and 24i in the circumferential direction causes no air flow to the circumferential direction in the movable air path 25 and the upper spaces of the water seal chambers 24i and 24i. Accordingly, no air flow occurs in the feed and discharge zone B from the upper spaces of the water seal chambers 24i and 24i toward the movable air path 25.

[0041] This results in prevention of a trouble such as corrosion of the pan carriage 7 and the like and decrease in cooling efficiency due to scatter of sealing water from the circular water seal chambers 24a and 24b. Moreover, the air damper 81 provided in the connection air duct 26 is easy to be maintained and controlled more than the conventional labyrinth sealing part (the dead plate 42 and the labyrinth sealing plates 43a, 43b and 43c), so that performance in maintenance is excellent. In addition, the middle air duct 38 can be provided also on an entrance side and an exit side of the feed and discharge zone B and on an exit side of the waste heat recovery zone D although it cannot be provided in the above places conventionally due to the dead plate 42. This allows the cooling performance to be improved while the scale of the system is kept as it is.

[0042] In the waste heat recovery zone D, the heat recovery is performed for the air having high temperature due to cooling of sintered ore, and then, the air is fed again as the cooling air. This often causes a foreign matter such as dust of the sintered ore to be intruded into the cooling air. Intrusion and accumulation of such a foreign matter in the circular water seal chambers 24a and 24b causes deterioration of the water sealing performance due to damage of the water sealing plates 34a and 34b and the like. Accordingly, it is preferable to provide a foreign matter intrusion prevention plate (an obstacle plate) 85, which is for preventing the foreign matter intruded into the cooling air from intruding into the circular water seal chambers 24a and 24b from a space between upper ends of the inner plates 22a and 23a of the circular water seal chambers 24a and 24b and the fitting flange 35 through the upper spaces of the water seal chambers 24i and 24i, in upper parts of the upper spaces of the water seal chambers 24i and 24i, as shown in Fig. 4. The foreign matter intrusion prevention plate 85 can be similarly provided in a place other than the waste heat recovery zone D, of course, in the case where a foreign matter is intruded into the cooling air to be supplied.

[0043] Further, in the case where a foreign matter such as dust is intruded into the circular water seal chambers 24a and 24b, and thereby, piled therein, preferably provided is a sucking device (not shown) for sucking and collecting the foreign matter from the circular water seal chambers 24a and 24b. The sucking device may be provided in the feed and discharge zone B where a room is

left.

[0044] Further, in the case of an improper positional relation between the side rail 6b and the side wheel 5b, which are provided for guiding and holding the running pan carriage 7 from the side, the pan carriage 7 runs off the circle. This causes the movable circular duct 21 connected to the pan carriage 7 through the connection air duct 26 to also run off in rotation. As a result, a great difference in relative relation occurs between the circular water seal chambers 24a and 24b provided on the movable circular duct 21 side and the water sealing plates 34a and 34b provided on the stationary circular duct 31 side, so that the water sealing performance is lowered. In order to prevent the lowering, a gap between the side rail 6b and the side wheel 5b, which causes running off, should be adjusted. The gap, however, can be only adjusted in a standstill state because of a conventional stationary type for liner adjustment. Accordingly, adjustment simultaneous with confirmation of a rotational state cannot be carried out during running, so that accurate adjustment has been difficult.

[0045] In view of the above, the side wheel 5b is arranged so that it can be adjusted by means of a screw jack in Embodiment 1. This allows a position of the side wheel 5b to be adjusted even during running, and thereby, rotation of the circular water seal chambers 24a and 24b to be kept at a high degree of circle. The water sealing performance is thus prevented from being lowered.

Embodiment 2

[0046] Embodiment 2 is basically similar in structure to Embodiment 1 mentioned above. In Embodiment 1, however, the movable air path 25 is made to communicate in the circumferential direction and the partition plate having been conventionally provided in the movable air path 25 is removed. On the other hand, a part of the conventional partition plate 47 is notched so that a function of guiding the cooling air would be left while the movable air path 25 would be made to communicate in the circumferential direction in Embodiment 2.

[0047] That is to say, in Embodiment 2, a partition plate 47a formed by notching an upper part of the conventional partition plate 47 is provided so that the movable air path 25 would communicate in the circumferential direction, as shown in Figs. 5 and 6, which are sectional views of an integral part of Embodiment 2.

[0048] The upper part of the conventional partition plate 47 is notched in Figs. 5 and 6. A notched hole, however, may be formed in a part of the conventional partition plate 47.

Embodiment 3

[0049] Embodiment 3 basically has a structure similar to that of Embodiment 1 mentioned above. The air damper 81, however, is provided in the connection air duct 26 as a means for closing the connection air duct 26 in the

feed and discharge zone B in Embodiment 1 while a connection air duct closing plate is mounted to the stationary circular duct 31 in the feed and discharge zone B so as to close an inlet of the connection air duct 26 by means of the connection air duct closing plate in Embodiment 3.

[0050] That is to say, in Embodiment 3, a connection air duct closing plate (a dead plate) 91 is mounted to the lower end of a rod and dead plate height indicator 92a, which is fixed to the top cover plate 40 of the stationary circular duct 31 by means of a rock nut 92b, in the feed and discharge zone B so as to close the inlet of the connection air duct 26 by means of the dead plate 91, as shown in Figs. 7 and 8. Figs. 7 and 8 are sectional views of integral parts of Embodiment 3. The inlet of the connection air duct 26 is arranged to be sealed with a sealing ring 93a and a ground seal 93b, which are mounted to the upper end of a rod and sealing ring level meter 94a fixed to the connection air duct 26 by means of a rock nut 94b and disc spring 94c, in order to improve an effect of prevention of air leakage in closing the inlet of the connection air duct 26 by means of the dead plate 91.

[0051] 92c in Fig. 7 denotes a sealing mechanism provided between the rod 92a and the top cover plate 40. 94d in Fig. 7 denotes a sealing mechanism provided between the rod 93a and the connection air duct 26.

[0052] A position in height of the dead plate 91 can be adjusted to a proper position by means of the rod 92a and the lock nut 92b. A position in height of the sealing ring 93a can be adjusted to a proper position by means of the rod 94a and the lock nut 94b.

[0053] Moreover, an inlet guide roll 95 is provided at a forward top end of the dead plate 91 toward the feed and discharge zone B, as shown in Fig. 8. This allows the dead plate 91 to smoothly close the inlet of the connection air duct 26 as the connection air duct 26 moves.

[0054] As a result, forming a complete communication circular duct with no partition plate in the movable air chamber 25 allows an effect similar to that of Embodiment 1 to be achieved even in Embodiment 3.

[0055] In Embodiments 1 to 3, provided is the waste heat recovery zone D. It goes without saying, however, that the invention is also applicable in the case where no waste heat recovery zone D is provided.

[0056] Further, the stationary circular duct 31 is arranged to cover the movable circular duct 21 from the upper side in Embodiments 1 to 3. The invention, however, is also applicable in the case where the movable circular duct 21 covers the stationary circular duct 31 from the upper side as described in Patent Reference 1.

[0057] Furthermore, preventing deterioration of the water sealing function by means of a bracket structure in which a position of the side wheel 5b can be adjusted by means of a screw jack is extremely effective in Embodiments 1 to 3 in which there is no sealing function of the labyrinth sealing part. The bracket structure in which a position of the side wheel 5b can be adjusted can be applied to a sintered ore cooling facility comprising a similar water sealing mechanism (Patent References 1 to 3,

for example) other than Embodiments 1 to 3.

[0058] In the above description, exemplified is a cooling facility for sintered ore. The invention, however, may be also applicable to a cooling facility for another hot grain/lump material such as a pellet and a hot clinker.

[0059] Preferred embodiments of the invention have been described above with reference to the attached drawings. The invention, however, is not limited to the embodiments. It is clear that a person skilled in the art can conceive a variety of modifications and revisions within a range of the technical idea described in Claims. The modifications and revisions are also included in the technical range of the invention, naturally.

Claims

1. A cooling facility for hot grain/lump material, in which air supplied from an air supply apparatus to plural carriages (7) arranged along a circular carriage path so as to be movable, is used to cool the hot grain/lump material, wherein:

the air supply apparatus includes a movable circular duct (21) arranged along the carriage path and connected to each of the carriages (7) through a connection air duct (26), a stationary circular duct (31) arranged along the carriage path and fitted into the movable circular duct (21) through a water sealing device (28) so as to be freely movable, and a connection air duct closing mechanism (81, 91) for closing the connection air duct (26), wherein the movable circular duct (21) and the stationary circular duct (31) form a circular air path (25, 37);

the water sealing device (28) includes a circular water seal chamber (24a, 24b) arranged along the carriage path and a water sealing plate (34, 34b) having a lower end part thereof sunk in sealing water in the circular water seal chamber (24a, 24b) ;

an atmospheric zone (B) for stopping leakage of air in the carriages (7) is provided in a predetermined position of the carriage path; and the cooling facility is configured to cause the connection air duct closing mechanism (81, 91) to close the connection air duct (26) in the atmospheric zone (B) and to cause the connection air duct closing mechanism (81, 91) to open the connection air duct (26) in the zones (C,D) other than the atmospheric zone (B),

the cooling facility being **characterized in that:**

an upper space of the circular water seal chamber (24i) on a circular air path side is communicated with the circular air path (25) on a movable circular duct side; and

the circular air path (25) on the movable circular duct side has no partition plate for partitioning the circular air path (25) on the movable circular duct side in a circumferential direction so as to make the circular air path (25) on the movable circular duct side communicate in the circumferential direction such that, in use, the pressure in the atmospheric zone (B) and zones (C,D) other than the atmospheric zone (B) is the same.

2. The cooling facility according to Claim 1, **characterized in that** a guiding plate (47a) for guiding cooling air, in which a notch part is provided in order to make the circular air path (25) on the movable circular duct side communicate in the circumferential direction, is provided in the circular air path (25).
3. The cooling facility according to Claim 1 or 2, **characterized in that** the connection air duct closing mechanism (81) includes an air damper, wherein the air damper is closed in the atmospheric zone (B), and the air damper is opened in the zones (C,D) other than the atmospheric zone.
4. The cooling facility according to Claim 1 or 2, **characterized in that** the connection air duct closing mechanism (91) includes a connection air duct closing plate and an inlet of the connection air duct (26) is closed by means of the connection air duct closing plate.
5. The cooling facility according to any one of Claims 1 to 4, **characterized by** comprising a foreign matter intrusion prevention plate (85) for preventing a foreign matter from intruding into the circular water seal chamber (24a, 24b) from the circular air path (25, 27), the foreign matter intrusion prevention plate (85) being provided in an upper part on the circular air path side.
6. The cooling facility according to any one of Claims 1 to 5, **characterized by** further comprising: a side rail (6b) for guiding and holding the carriages (7) in moving from a side of the carriages (7); and a side wheel (5b), the side wheel (5b) having a structure that a position of the side wheel (5b) is adjustable even during movement of the carriages (7).

Patentansprüche

1. Kühlanlage für heißes Korn-/Klumpen-Material, bei welcher Luft, die von einer Luftzuführvorrichtung an mehrere Schlitten (7) zugeführt wird, die entlang eines kreisförmigen Schlittenpfads angeordnet sind, um bewegbar zu sein, verwendet wird, um das heiße Korn-/Klumpen-Material zu kühlen, wobei:

die Luftzuführvorrichtung einen bewegbaren kreisförmigen Kanal (21), der entlang des Schlittenpfads angeordnet und mit jedem der Schlitten (7) durch einen Verbindungsluftkanal (26) verbunden ist, einen stationären kreisförmigen Kanal (31), der entlang des Schlittenpfads angeordnet und in den bewegbaren kreisförmigen Kanal (21) durch eine Wassersperrvorrichtung (28) gepasst ist, um frei bewegbar zu sein, und einen Verbindungsluftkanal-Schließmechanismus (81, 91) zum Verschließen des Verbindungsluftkanals (26) umfasst, wobei der bewegbare kreisförmige Kanal (21) und der stationäre kreisförmige Kanal (31) einen kreisförmigen Luftpfad (25, 37) ausbilden;

die Wassersperrvorrichtung (28) eine kreisförmige Wassersperrkammer (24a, 24b), die entlang des Schlittenpfads angeordnet ist, und eine Wassersperrplatte (34, 34b) umfasst, die einen unteren Endteil von ihr in Sperrwasser in der kreisförmigen Wassersperrkammer (24a, 24b) versenkt aufweist;

eine atmosphärische Zone (B) zum Stoppen einer Leckage von Luft in die Schlitten (7) an einer vorbestimmten Position des Schlittenpfads vorgesehen ist; und

die Kühlanlage ausgestaltet ist, um den Verbindungsluftkanal-Schließmechanismus (81, 91) dazu zu bringen, den Verbindungsluftkanal (26) in der atmosphärischen Zone (B) zu verschließen, und den Verbindungsluftkanal-Schließmechanismus (81, 91) dazu zu bringen, den Verbindungsluftkanal (26) in den anderen Zonen (C, D) als die atmosphärische Zone (B) zu öffnen,

wobei die Kühlanlage **dadurch gekennzeichnet ist, dass:**

ein oberer Raum der kreisförmigen Wassersperrkammer (24i) auf einer Seite des kreisförmigen Luftpfads mit dem kreisförmigen Luftpfad (25) auf einer Seite des bewegbaren kreisförmigen Kanals in Verbindung ist; und

der kreisförmige Luftpfad (25) auf der Seite des bewegbaren kreisförmigen Kanals keine Trennplatte zum Abtrennen des kreisförmigen Luftpfads (25) auf der Seite des bewegbaren kreisförmigen Kanals in einer Umfangsrichtung aufweist, um den kreisförmigen Luftpfad (25) auf der Seite des bewegbaren kreisförmigen Kanals dazu zu bringen, in der Umfangsrichtung in Verbindung zu stehen, derart dass, bei Verwendung, der Druck in der atmosphärischen Zone (B) und den anderen Zonen (C, D) als die atmosphärische Zone (B) der gleiche ist.

2. Kühlanlage nach Anspruch 1, **dadurch gekenn-**

zeichnet, dass eine Leitplatte (47a) zum Leiten von Kühlluft, in welcher ein Kerbteil vorgesehen ist, um den kreisförmigen Luftpfad (25) auf der Seite des bewegbaren kreisförmigen Kanals dazu zu bringen, in der Umfangsrichtung in Verbindung zu stehen, in dem kreisförmigen Luftpfad (25) vorgesehen ist.

3. Kühlanlage nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Verbindungsluftkanal-Schließmechanismus (81) einen Luftdämpfer umfasst, wobei der Luftdämpfer in der atmosphärischen Zone (B) geschlossen ist, und der Luftdämpfer in den anderen Zonen (C, D) als die atmosphärische Zone geöffnet ist.

4. Kühlanlage nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Verbindungsluftkanal-Schließmechanismus (91) eine Verbindungsluftkanal-Schließplatte umfasst, und ein Einlass des Verbindungsluftkanals (26) mittels der Verbindungsluftkanal-Schließplatte verschlossen ist.

5. Kühlanlage nach einem der Ansprüche 1 bis 4, **gekennzeichnet durch** Umfassen einer Fremdstoffeindringverhinderungsplatte (85) zum Verhindern, dass ein Fremdstoff in die kreisförmige Wassersperrkammer (24a, 24b) aus dem kreisförmigen Luftpfad (25, 27) eindringt, wobei die Fremdstoffeindringverhinderungsplatte (85) in einem oberen Teil auf der Seite des kreisförmigen Luftpfads vorgesehen ist.

6. Kühlanlage nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** sie ferner umfasst: eine Seitenschiene (6b) zum Führen und Halten der Schlitten (7) beim Bewegen von einer Seite der Schlitten (7); und ein Seitenrad (5b), wobei das Seitenrad (5b) eine Struktur aufweist, dass eine Position des Seitenrads (5b) sogar während einer Bewegung der Schlitten (7) anpassbar ist.

Revendications

1. Installation de refroidissement pour matériau particulaire / en morceaux, dans laquelle de l'air fourni en provenance d'un appareil d'alimentation en air vers plusieurs chariots (7) disposés le long d'un trajet de chariot circulaire de façon à être mobile, est utilisé pour refroidir le matériau particulaire / en morceaux, dans laquelle :

l'appareil d'alimentation en air comprend un conduit circulaire mobile (21) disposé le long du trajet de chariot et relié à chacun des chariots (7) par un conduit d'air de raccordement (26), un conduit circulaire fixe (31) disposé le long du trajet de chariot et monté dans le conduit circu-

laire mobile (21) par un dispositif d'étanchéité à l'eau (28) de sorte à être librement mobile, et un mécanisme de fermeture de conduit d'air de raccordement (81, 91) pour fermer le conduit d'air de raccordement (26), dans laquelle le conduit circulaire mobile (21) et le conduit circulaire fixe (31) forment un trajet d'air circulaire (25, 37) ; le dispositif d'étanchéité à l'eau (28) comprend une chambre à joint hydraulique circulaire (24a, 24b) disposée le long du trajet de chariot et une plaque d'étanchéité à l'eau (34, 34b) ayant une partie d'extrémité inférieure de celle-ci enfoncée dans l'eau d'étanchéité dans la chambre à joint hydraulique circulaire (24a, 24b) ; une zone atmosphérique (B) pour arrêter les fuites d'air dans les chariots (7) est placée dans une position prédéterminée du trajet de chariot ; et l'installation de refroidissement est configurée pour amener le mécanisme de fermeture de conduit d'air de raccordement (81, 91) à fermer le conduit d'air de raccordement (26) dans la zone atmosphérique (B) et pour amener le mécanisme de fermeture de conduit d'air de raccordement (81, 91) à ouvrir le conduit d'air de raccordement (26) dans les zones (C, D) autres que la zone atmosphérique (B),

l'installation de refroidissement étant **caractérisée en ce que** :

un espace supérieur de la chambre à joint hydraulique circulaire (24i) sur un côté trajet d'air circulaire communique avec le trajet d'air circulaire (25) sur un côté conduit circulaire mobile ; et le trajet d'air circulaire (25) sur le côté conduit circulaire mobile ne comporte pas de plaque de séparation pour séparer le trajet d'air circulaire (25) sur le côté conduit circulaire mobile dans une direction circonférentielle pour que le trajet d'air circulaire (25) sur le côté conduit circulaire mobile communique dans la direction circonférentielle de sorte que, lors de l'utilisation, la pression dans la zone atmosphérique (B) et les zones (C, D) autres que la zone atmosphérique (B) soit la même.

2. Installation de refroidissement selon la revendication 1, **caractérisée en ce qu'une** plaque de guidage (47a) pour guider l'air de refroidissement, dans laquelle une partie encoche est prévue pour que le trajet d'air circulaire (25) sur le côté conduit circulaire mobile communique dans la direction circonférentielle, est disposée dans le trajet d'air circulaire (25).
3. Installation de refroidissement selon la revendication 1 ou 2, **caractérisée en ce que** le mécanisme de

fermeture de conduit d'air de raccordement (81) comprend un clapet à air, dans laquelle le clapet à air est fermé dans la zone atmosphérique (B), et le clapet à air est ouvert dans les zones (C, D) autres que la zone atmosphérique.

4. Installation de refroidissement selon la revendication 1 ou 2, **caractérisée en ce que** le mécanisme de fermeture de conduit d'air de raccordement (91) comprend une plaque de fermeture de conduit d'air de raccordement et **en ce qu'une** entrée du conduit d'air de raccordement (26) est fermée au moyen de la plaque de fermeture de conduit d'air de raccordement.
5. Installation de refroidissement selon l'une quelconque des revendications 1 à 4, **caractérisée en ce qu'elle** comprend une plaque de prévention d'intrusion de matière étrangère (85) pour empêcher une matière étrangère de pénétrer dans la chambre à joint hydraulique circulaire (24a, 24b) depuis le trajet d'air circulaire (25, 27), la plaque de prévention d'intrusion de matière étrangère (85) étant disposée dans une partie supérieure sur le côté trajet d'air circulaire.
6. Installation de refroidissement selon l'une quelconque des revendications 1 à 5, **caractérisée en ce qu'elle** comprend en outre : un rail latéral (6b) de guidage et de maintien des chariots (7) se déplaçant depuis un côté des chariots (7) ; et une roue latérale (5b), la roue latérale (5b) ayant une structure telle qu'une position de la roue latérale (5b) est réglable même lors du déplacement des chariots (7).

FIG. 1

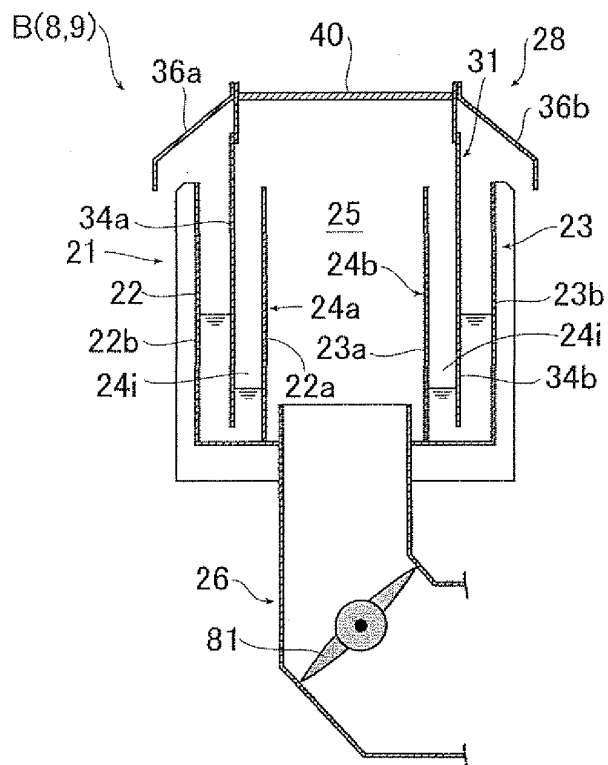


FIG. 2

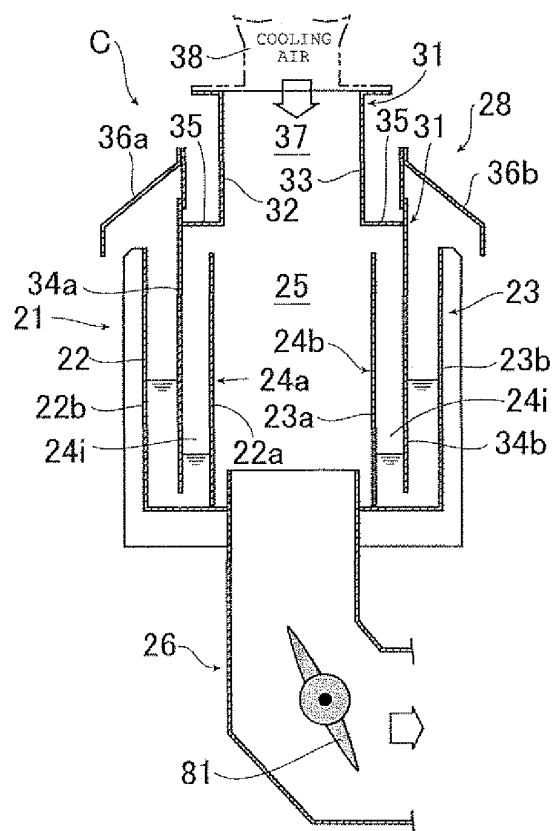


FIG. 3

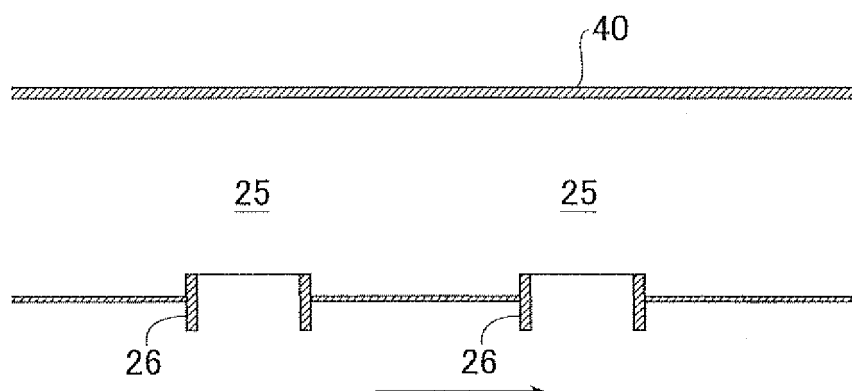


FIG. 4

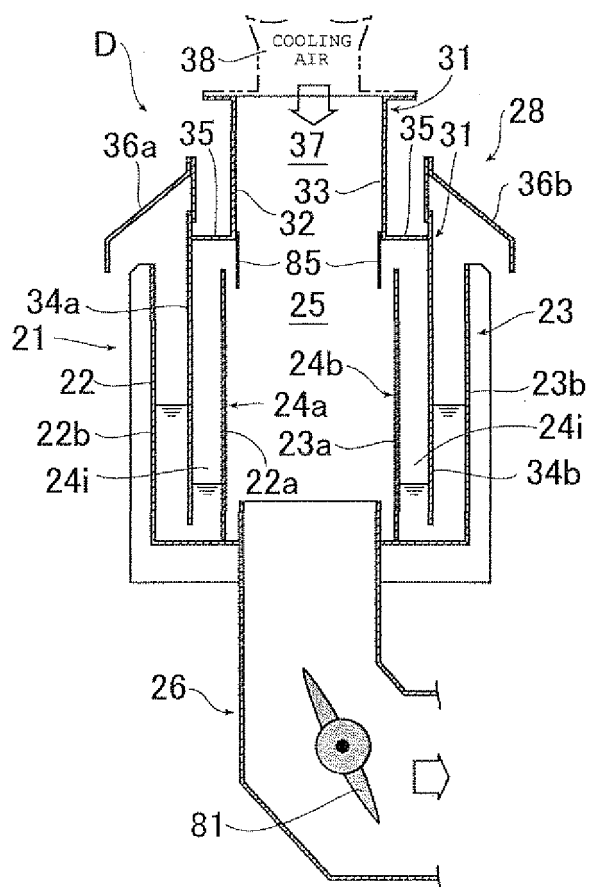


FIG. 5

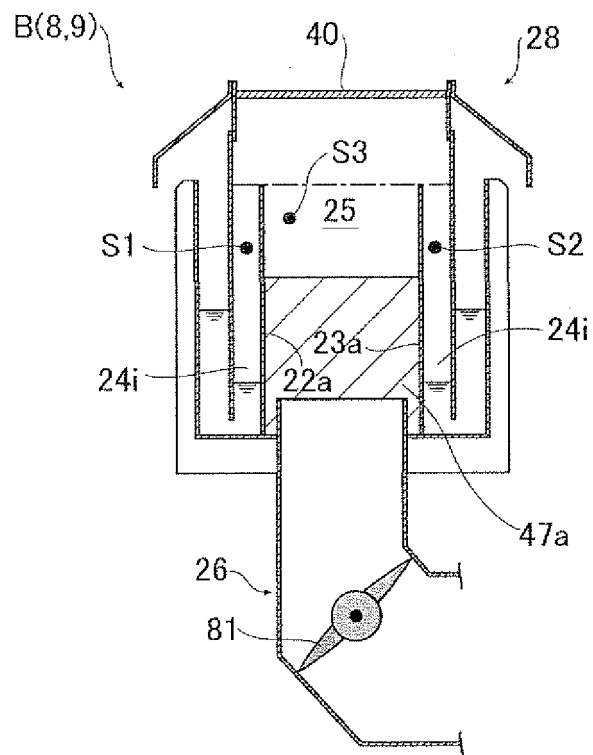


FIG. 6

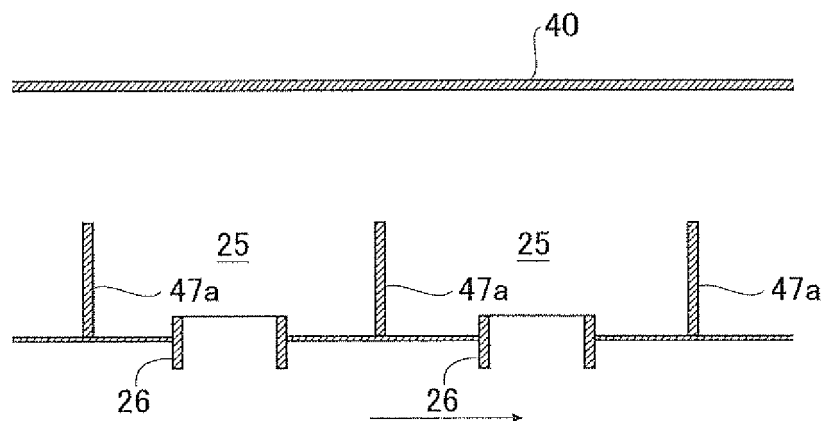


FIG. 7

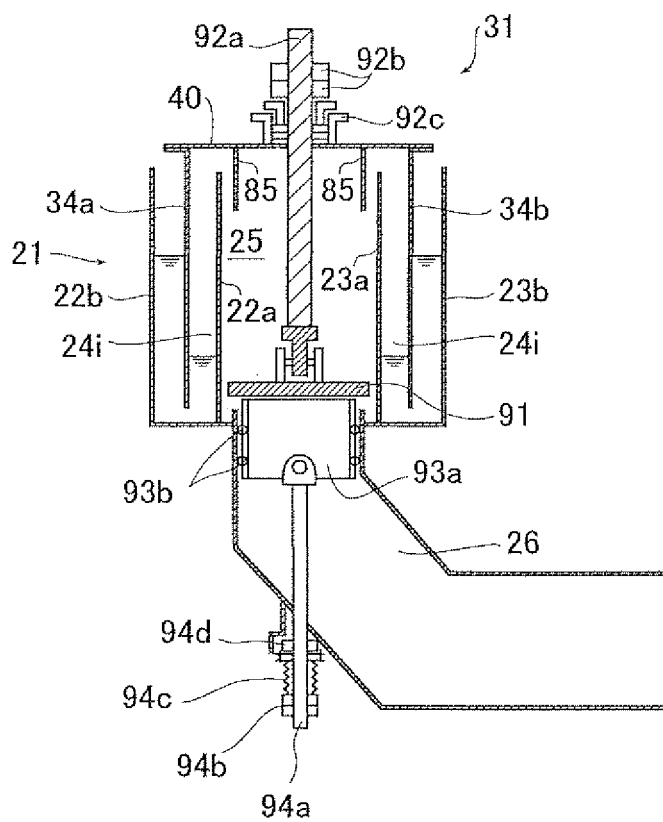


FIG. 8

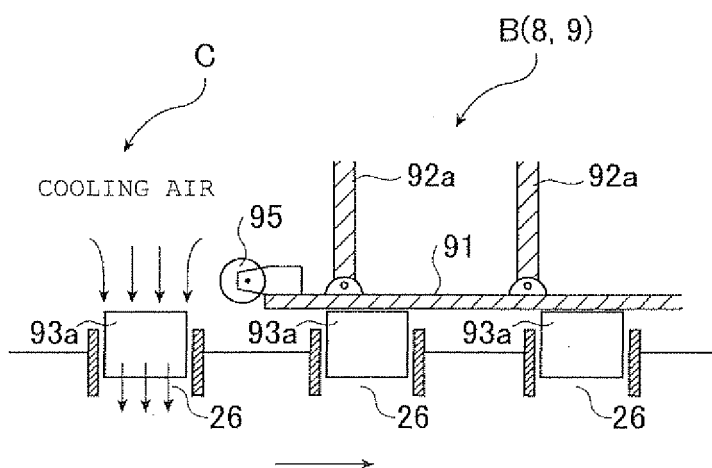
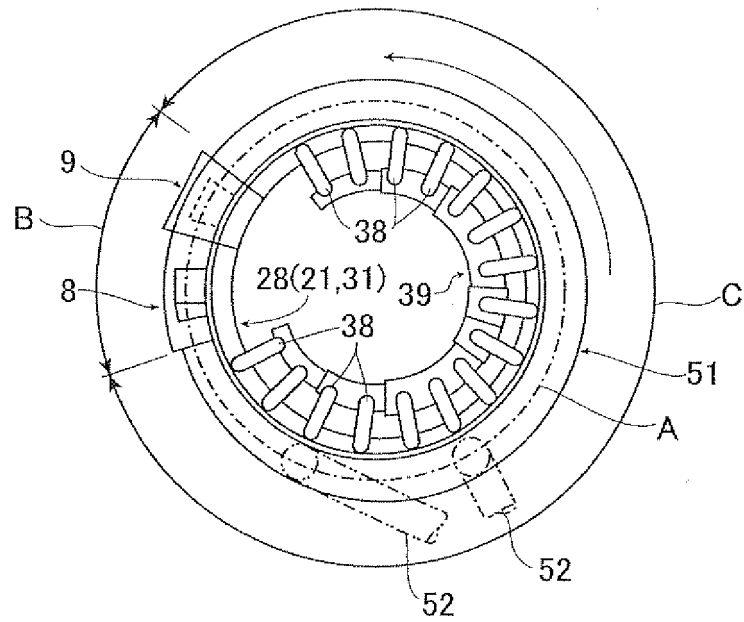


FIG. 9



A: CARRIAGE PATH
 B: FEED AND DISCHARGE ZONE
 (8: MATERIAL FEED ZONE, 9: MATERIAL DISCHARGE ZONE)
 C: COOLING ZONE

FIG. 10

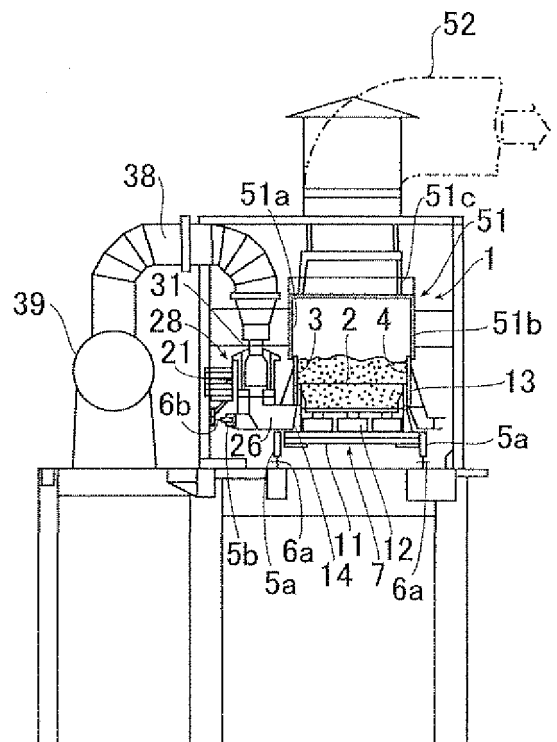


FIG. 11

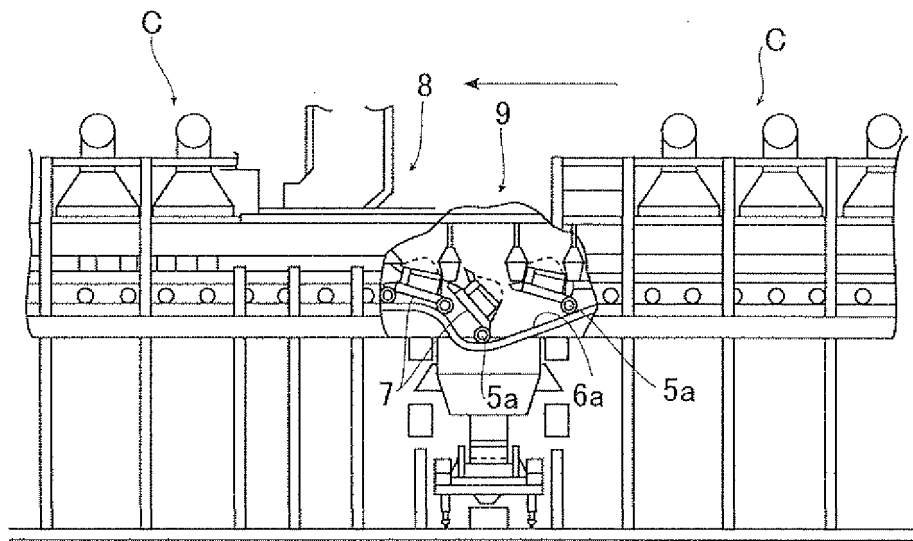


FIG. 12

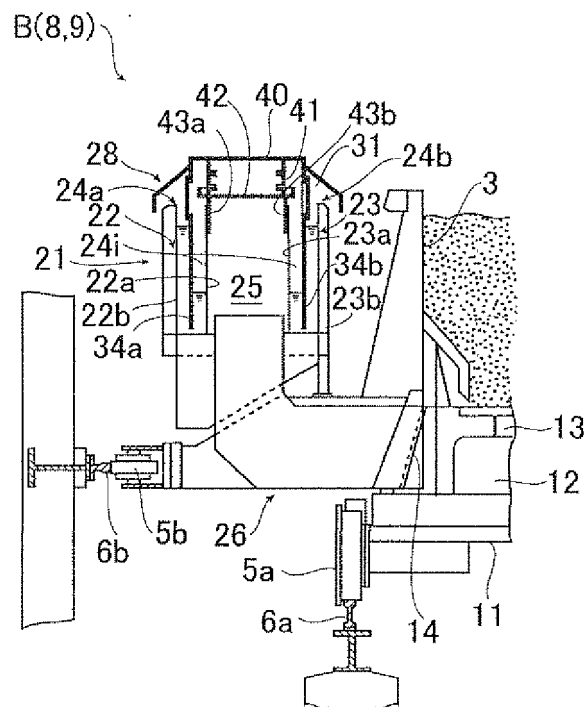


FIG. 13

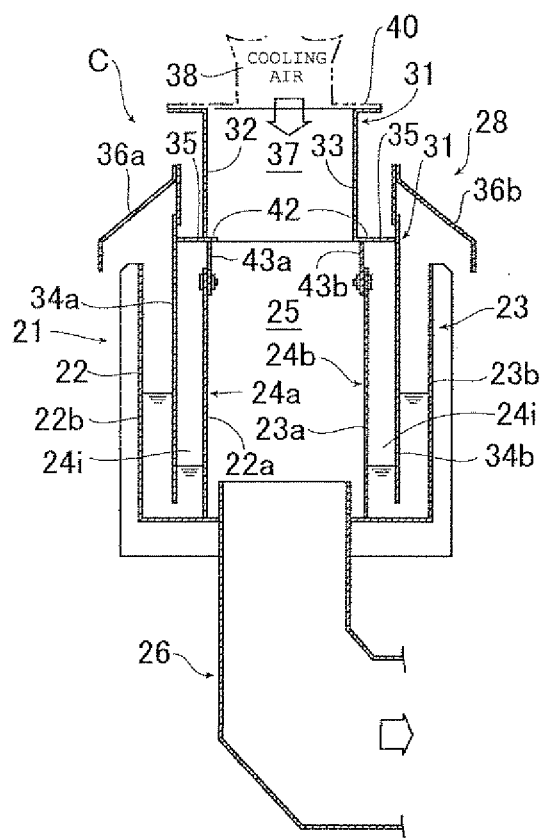


FIG. 14

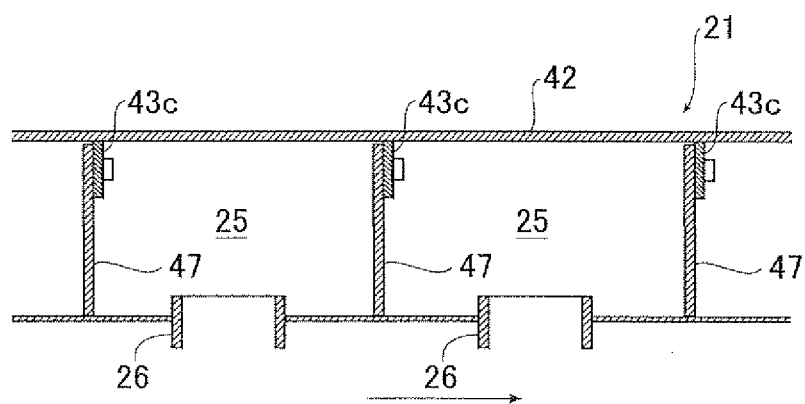


FIG. 15

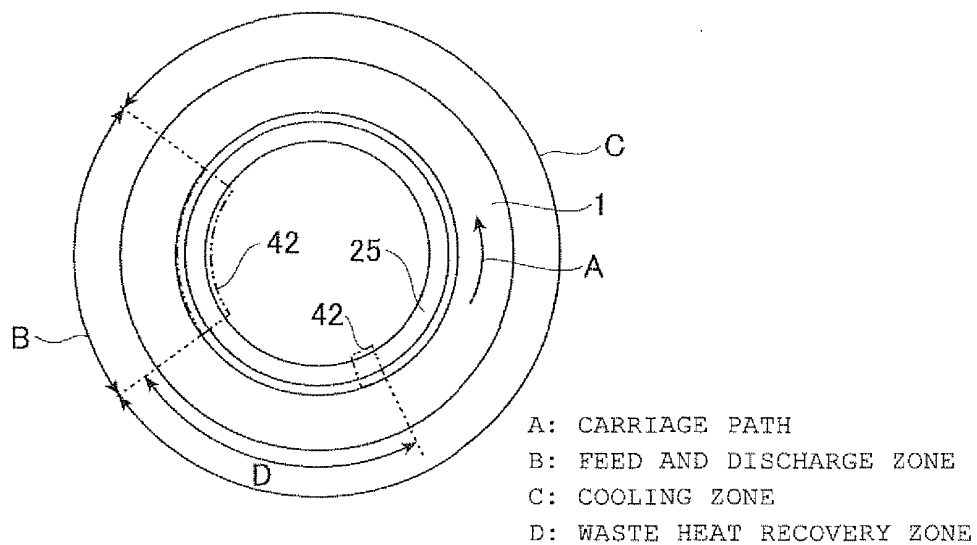
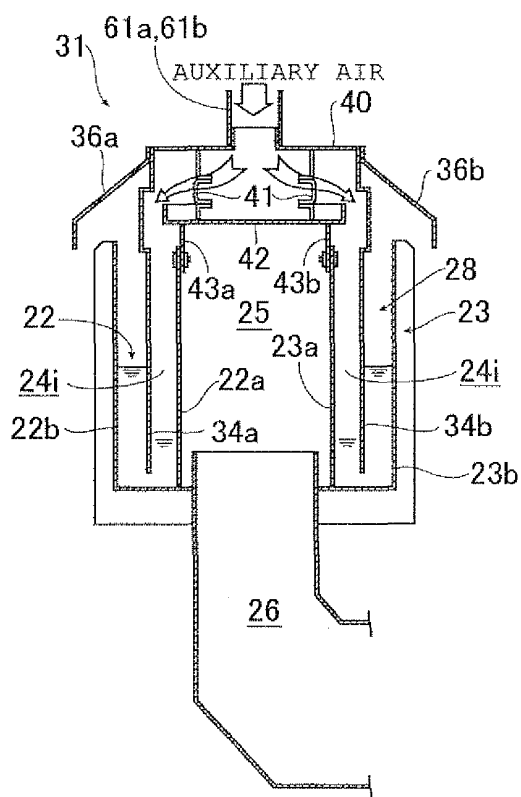


FIG. 16



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4139380 A [0013]
- JP 6257955 A [0013]
- JP 2000310489 A [0013]
- JP H0461296 U [0014]