April 23, 1935. A. CHRISTENSEN 1,998,492

AIR SEALED JOINT FOR ROTARY INCINERATOR DRUMS

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Fig. 1.

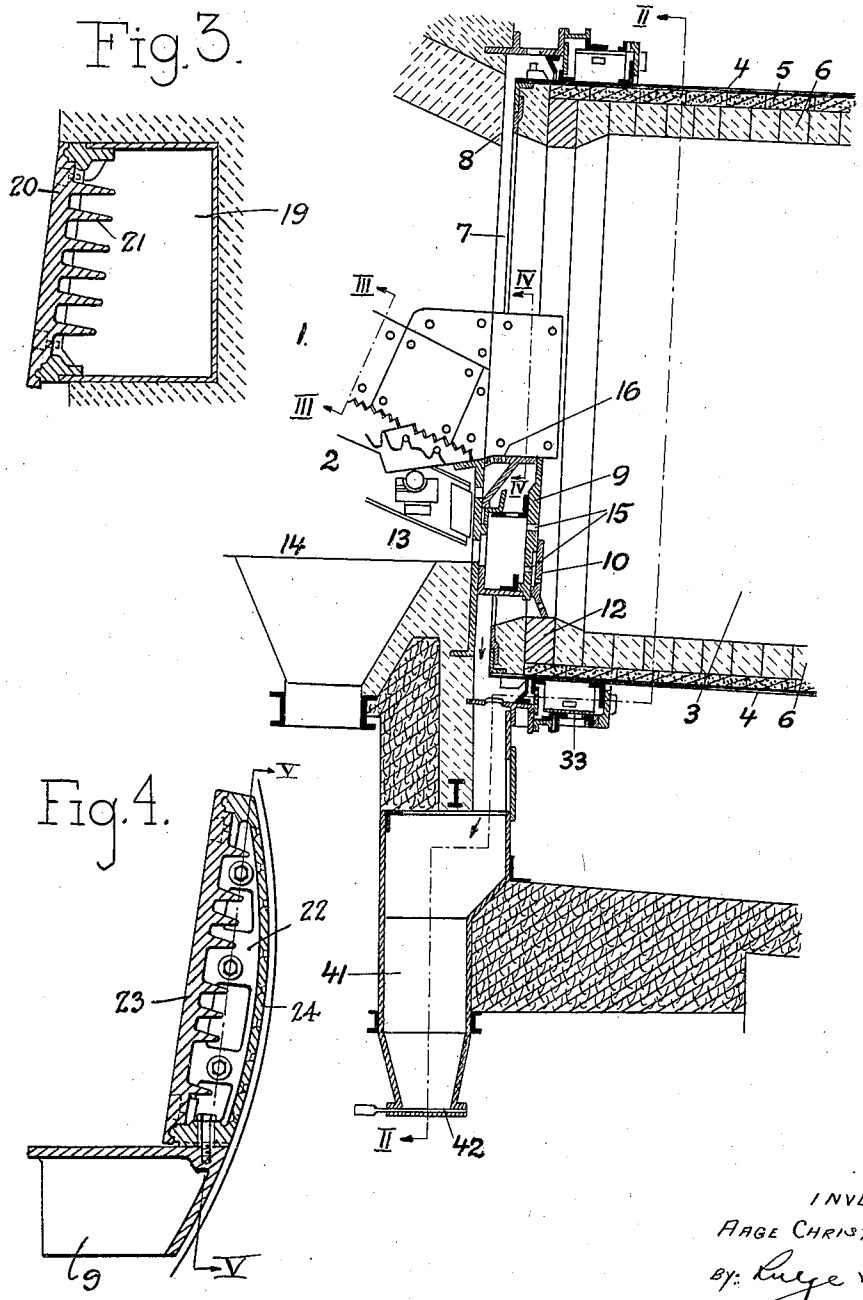


Fig. 3.

Fig. 4.

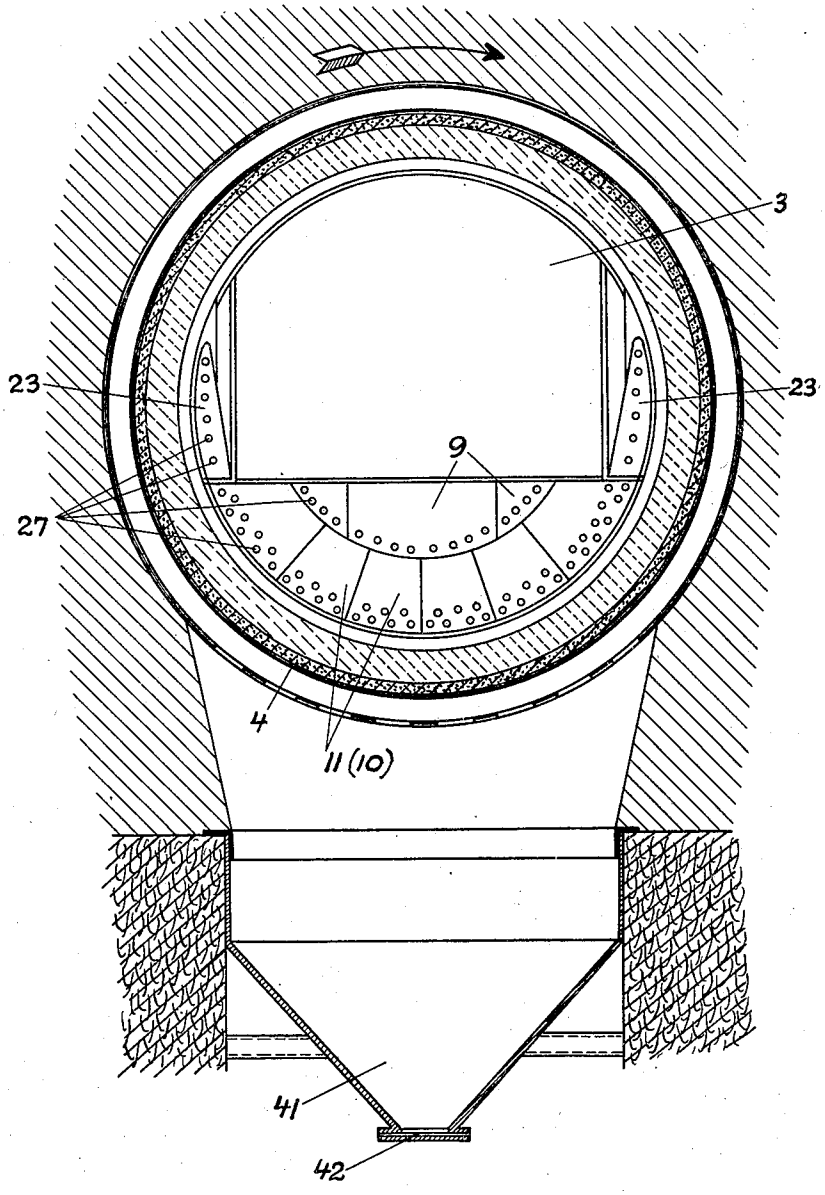
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AIR SEALED JOINT FOR ROTARY INCINERATOR DRUMS

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Fig. 2.



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Fig. 5.

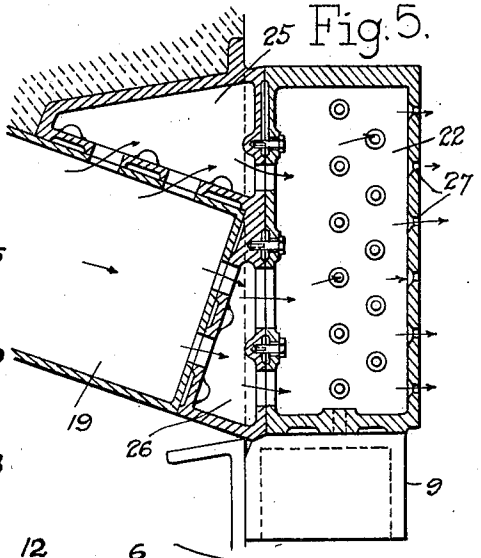
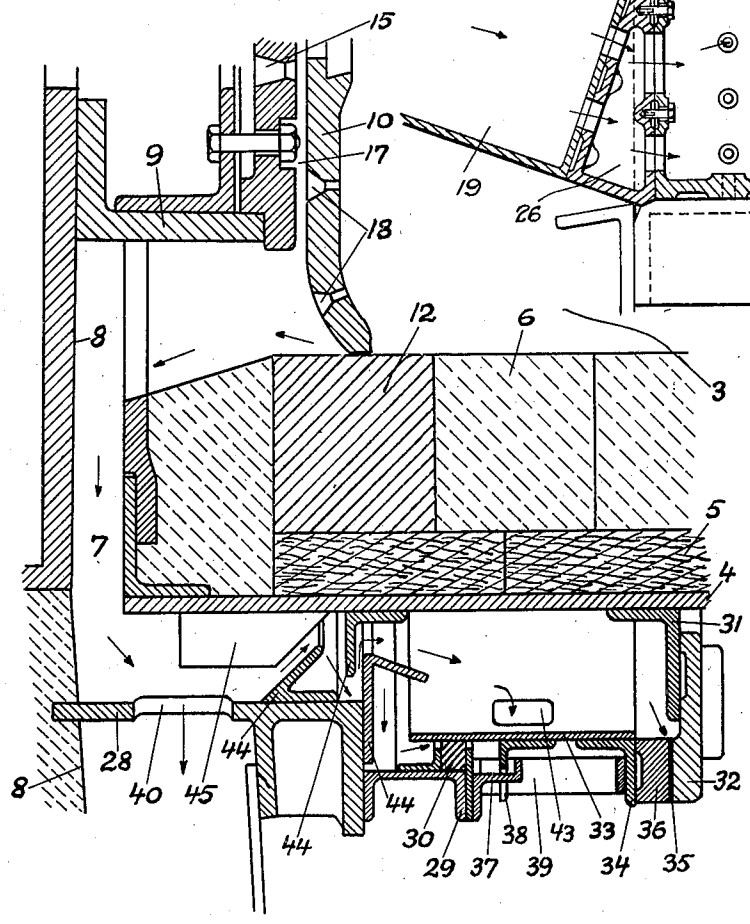


Fig. 6.



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Fig.7.

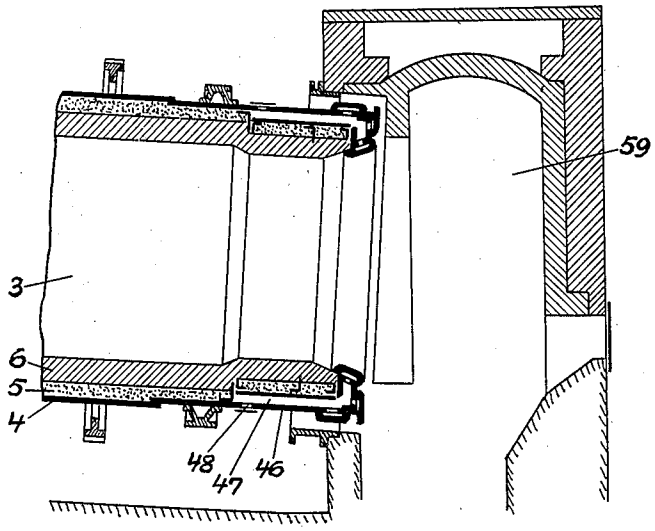
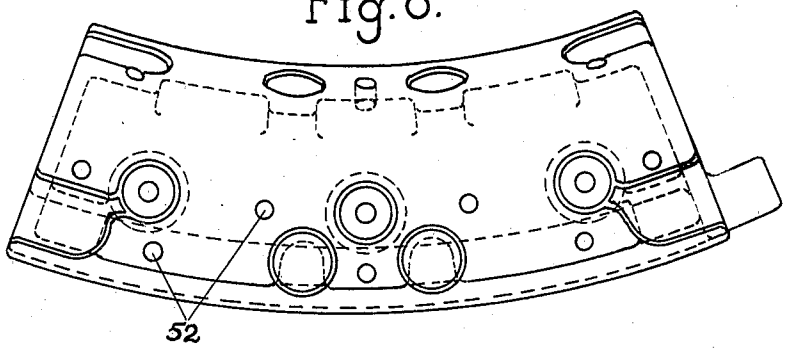


Fig.8.



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Fig. 9.

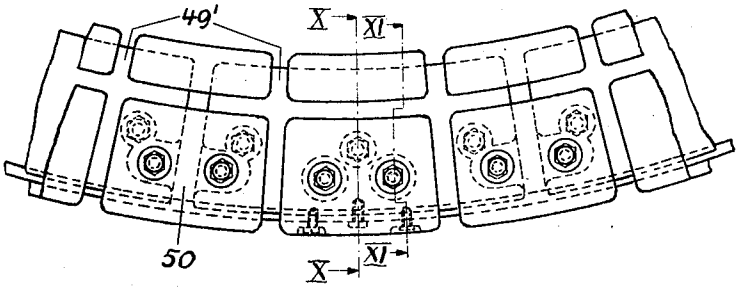


Fig. 10.

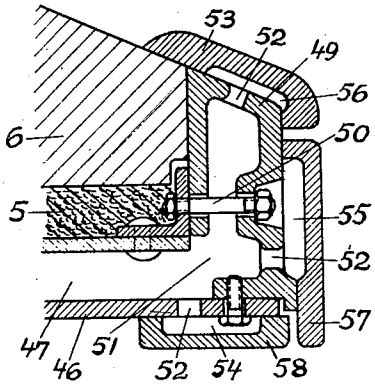
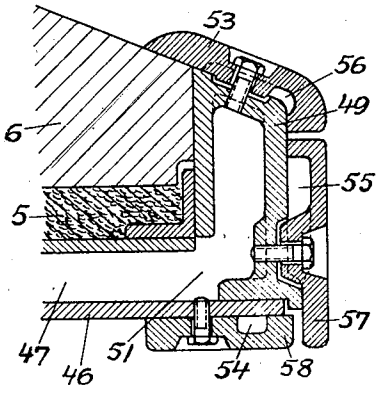


Fig. 11.



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Patented Apr. 23, 1935 1,998,492

UNITED STATES PATENT OFFICE

1,998,492

AIR-SEALED JOINT FOR ROTARY INCINERATOR DRUMS

Aage Christensen, Copenhagen, Denmark

Application November 5, 1932, Serial No. 641,404
In Great Britain May 25, 1932

20 Claims. (Cl. 110—1)

The invention relates to the construction of the joints between a rotary-furnace drum and the adjacent stationary parts of a furnace for heat-treatment of material of any nature, especially for combustion of town refuse and similar waste products. The joints between such, partly movable and partly stationary, furnace parts are exposed to considerable wear and tear, and have to satisfy important conditions, if the furnace is to work correctly. In order to avoid unnecessary friction, and in order to compensate for variations in length due to the unavoidable changes in temperature, relatively wide joints must always be left open between the moving drum and the stationary parts of the furnace. It is now necessary, on the one hand, to tighten these joints against the penetration of solid substances, for instance ash or other fine particles of refuse and, on the other hand, to prevent the escape, through the joints, of gases or ill-smelling vapours from the interior of the furnace, or the entrance of air into the furnace, whereby the combustion process would become uncontrollable and would be disturbed. The joints between a rotary drum and the fixed furnace parts, at the entrance end as well as at the discharge end of the drum, will be exposed to an especially heavy mechanical wear, as the material accumulates at these points to a certain extent, and a considerable friction will therefore be produced on account of the rotary motion. Finally the transition points concerned are always situated at the hot parts of the furnace and are very seriously attacked by hot slag and the like.

According to the invention, the points of transition are now to be constructed in such a manner that the said drawbacks will be almost entirely avoided, and the resulting injuries reduced to a minimum. In order to prevent, according to the invention, any leakage of solid particles at the transition between the stationary furnace chamber and the rotary drum, the end of the said chamber next to the rotary drum is fitted, at its bottom part, with an easily exchangeable, suitably metallic, body in continuation of the furnace grate, which body extends some distance into the rotary drum and, at the end facing the drum, supports an exchangeable packing plate, the packing edge of which fits against the inner surface of the rotary drum. By means of this body the joint between the rotary drum and the stationary part of the furnace will be covered at the point where the material slides over the joint, and at the same time the entrance of material from the drum into the joint will be prevented by the packing plate provided. By constructing the body and the packing plate as easily exchangeable parts, due consideration is given to the fact that these parts, as mentioned above, are exposed to a particularly intense wear, especially because the rotary drum is generally less inclined than the furnace grate in front thereof, so that the material entering the drum may easily accumulate there, whereby the wear at the points of transition will be increased.

In order to increase the resistive power of the metallic body covering the joint according to the invention the same is constructed as a hollow body fitted with the necessary openings for inside cooling by means of air, water or the like. In this manner it is always possible, by suitable regulation of the cooling medium, to maintain at a certain maximum temperature the body projecting into the drum, whereby the life of the said body will be increased considerably. In order also to cool the packing plate, which is similarly very highly exposed, a free space is left between the hollow body and the packing plate, which space communicates with the interior of the hollow body by way of suitable openings affording passage for the cooling medium. If air for instance is used as the cooling medium, the interior of the hollow body can in very simple manner be connected to the space below the furnace grate, so that a part of the undergrate blast can pass from the said space into the hollow body and from there into the cavity between the said body and the packing plate. The air thus used for cooling may then enter into the rotary drum by way of openings in the packing plate, or may be directed to the fire in the stationary part of the furnace by way of special ducts.

Also the side walls of the fixed furnace part in front of the rotary drum are considerably exposed to injury from the hot material sliding down. In order also to protect this part of the walls and, at the same time, to prevent the passage of solid particles through the joint, suitably cooled bodies are also provided at the side walls in front of the rotary drum, which bodies similarly project somewhat into the drum. These lateral hollow bodies may then be connected mutually and to the first mentioned hollow body by means of openings, so that a continuous flow of cooling medium passes through all of the hollow bodies. Even when the greatest care is used, however, the cooled furnace parts may gradually be destroyed, and especially the packing plate at the front end

of the stationary furnace part will be very severely worn by the motion of the rotary drum and the material contained therein, so that from time to time an exchange of this member will be required. In order to facilitate and cheapen this renewal, the packing plate according to the invention is composed of individual segmental parts, so that at any time only a few of these mutually similar parts have to be exchanged.

The rotary drums of the furnaces concerned must always be fitted with a refractory lining, which must be capable of resisting, on the one hand, the mechanical influences and, on the other hand, above all the thermal effects. While in the greater part of the rotary drum the mechanical attack is not very considerable, the same will be very serious at the point where the lining comes opposite the packing plate. There the fine, and under certain circumstances very hard, parts of the material will be inclined to enter into the narrow fissure between the packing plate and the lining, so that jammings will occur here, whereby a very great friction will be produced between the jammed particles of material and the lining. By this friction the lining at these points will be very considerably attacked and worn away. In order therefore to make this part of the furnace especially resistive according to the invention, the lining at the point where the same moves past the packing plate is made from carborundum or some similar hard substance.

As already mentioned in the preamble, the joint between the moving and the fixed part of the furnace has to be tightened against the passage of gases. In order to attain this tightness according to the invention, an annular frame is attached in gas-tight manner between the rotary drum and the rear wall of the adjacent furnace chamber, which frame concentrically encircles, at a certain distance therefrom, the front end of the rotary drum, a stuffing box-like packing device being inserted between the front face of the said frame and an annular disk attached to the rotary drum.

The stuffing box-like packing is formed by the provision, between the fixed annular frame and the annular disk on the rotary drum, of a cylindrical ring concentric to the rotary drum and at some distance therefrom, which ring cannot rotate, but can slide somewhat in the direction of the cylinder axis, and which by means of the pressure exerted by a plate spring or the like effects tightness, on the one hand by means of a packing attached to the fixed frame and, on the other hand, by means of a packing surface provided, at right angles to the axis, on the disk rotating together with the rotary drum. The packing surface may be made from metal or any packing substance, for instance leather.

As it cannot always be entirely avoided that individual solid particles of the material, in spite of the packing provided, penetrate through the packing plate and into the annular frame and thus find their way to the stuffing box-like packing, the bottom side of the annular frame is fitted with apertures opening into a receptacle closed in gas-tight manner. By way of these openings any solid particles having found their way through may enter into the gas-tight receptacle, whence they may be removed from time to time by opening of a gas-tight valve. In order to discharge into the gas-tight receptacle by way of the openings the material which has penetrated into the annular frame, scrapers are provided on the drum, which scrapers push the material towards the openings when the drum is rotating.

According to the invention still further means are provided in order to avoid with certainty the entrance of solid particles into the gas-tight packing. For this purpose suitable attachments are provided between the annular frame and the stuffing box-like packing, which attachments by suitable interengagement form a labyrinth-like path and, thereby, efficiently prevent the passage of solid particles to the gas-tight packing. Any impurities still entering may be removed by way of openings provided at the bottom part of the cylindrical ring.

As already mentioned the outlet end of the rotary drum is similarly exposed to considerable mechanical and thermal attacks, so that here too the rotary drum may easily be damaged. In order to reduce these injuries to a minimum, the discharge end of the rotary drum is fitted with a cooling jacket consisting of a cylindrical part and a frame-like part protecting the face of the drum end. According to the invention an easily exchangeable metallic hollow body is used for this purpose, the said body being fitted with suitable inlet and outlet openings affording passage for a cooling medium. By the provision of the cooling jacket the temperature of the discharge end is greatly reduced, so that injurious effects will no longer be able to occur so easily. If during the course of the operation the cooling jacket is injured, the same may easily be exchanged and be replaced by a new jacket, without any lengthy derangement of service. In order even then to reduce to a minimum the cost of the repair and the duration of the derangement of service, the cooling jacket according to the invention consists of a greater number of segmental parts, which then may be exchanged one at a time. In order to give the individual segmental parts of the cooling jacket an opportunity to expand on account of heat, and to attain also a lateral cooling of the individual parts, the segmental parts are suitably disposed at some distance from one another.

As the attachment of the cooling jacket directly on to the rotary drum is still a relatively difficult process, the cooling jacket according to the invention is covered, in its turn, by easily exchangeable protective plates. Hereby the advantage is attained that the cooling jacket itself is not exposed to injuries, but only the protective plates, which in the easiest imaginable manner are attached to the metallic cooling jackets by means of screws.

The protective plates covering the cooling jacket are cup-shaped, in such a manner that hollow spaces or cavities are formed between the protective plates and the cooling jacket, which cavities by way of openings communicate with the interior of the cooling jacket. In this manner the protective plates as well as the cooling jacket can be traversed by the cooling medium, and be protected against excessive heating. Furthermore, the protective plates consist suitably of individual parts disposed at some distance from one another, so that always only small elements have to be exchanged, and no stresses likely to cause any premature destruction will occur inside of the protective plates.

The individual parts of the protective plates may be made without sidewalls, so that the cooling medium, for instance air, may freely escape. When a liquid cooling medium, for instance water, is used, means for leading the water away

after the same has effected the cooling must naturally be provided in a different manner. Correspondingly if the cooling jacket is not fitted with protective plates, the segmental parts of the cooling jacket are made without side walls.

In the drawings various constructions of the invention are illustrated by way of example. Fig. 1 shows a vertical longitudinal section at the point of transition from the stationary furnace chamber to the inlet end of the rotary drum with a packing, in accordance with the invention, against the entrance of solid particles into the joint and with a device providing tightness against leakage of gas. Fig. 2 shows a vertical cross-section along the line II—II in Fig. 1. Fig. 3 shows, on a larger scale, a cross-section of the side wall of the furnace chamber along the line III—III in Fig. 1. Fig. 4 a corresponding section of the side wall along the line IV—IV of Fig. 1. Fig. 5 shows a longitudinal section along the line V—V of Fig. 4, while Fig. 6, to a larger scale, reproduces the lower packing device according to Fig. 1. Fig. 7 shows a vertical longitudinal section of the outlet end of the rotary drum. Fig. 8 represents a front elevation of a portion of the discharge end of the rotary drum, illustrating a construction which is suitable in cases where no special protective plates are provided, while Fig. 9 shows a corresponding view with protective plate. Figs. 10 and 11, finally show, on a larger scale, cross-sections along the lines X—X and XI—XI, respectively, of Fig. 9.

In Figs. 1 to 6, 1 is the end of the furnace chamber, in which the ignition grate 2 is provided. In continuation thereof the rotary drum 3 with a somewhat smaller inclination than the grate 2 is provided, and this drum consists of an outer mantle 4 with insulation 5 and an inner refractory lining 6. Between the fixed furnace chamber 1 and the rotary drum 3 the joint 7 is formed. The rear wall 8 of the furnace chamber 1 is formed, at the bottom, by a metallic hollow body 9, which projects some distance into the rotary drum 3. At the hollow body 9, which as shown, is attached by bolts to the rear wall of the furnace chamber so as to be readily detachable, a packing plate 10 is attached, similarly in easily detachable manner, which plate, as shown by Fig. 2, consists of individual segmental parts 11. The bottom part of the packing plate 10 is bent towards the inner face of the rotary drum, and fits against the inner periphery thereof. The part of the rotary drum which during the motion of the drum passes along the packing plate 10, is lined with carborundum blocks 12. The hollow body 9 is formed as an air chamber, and communicates by way of openings 13 with the part 14 of the furnace chamber below the grate 2, by way of which chamber the air for combustion is introduced. The air chamber 9 is further provided with openings 15 and 16, through which the air can enter into the interior of the rotary drum, some of the openings 15 being covered by the packing plate 10, while a space 17 is left open, so that also the packing plate will be cooled by the air jets passing through. In order to carry away the cooling air from the packing plate, the latter also is provided with openings 18 for the air.

Also the side walls of the furnace chamber 1 are fitted with corresponding air chambers at the place where the material slides along the same, above the air chamber 9. Figs. 3 to 5 show the arrangement of the chambers, in longitudinal and transverse section. The air chamber 19 situated inside of the furnace chamber is formed by a plate 20 situated in front thereof, which is fitted with ribs 21 for increasing the cooling surface on the side facing the interior of the air chamber. In continuation of the chamber 19 a further air chamber 22 projecting into the rotary drum 3 is formed, which chamber is covered with a similarly ribbed plate 23, and the outer limiting wall 24 of which fits the inner periphery of the rotary drum. In the corner spaces left between the air chambers 19 and 22, further air spaces 25 and 26 are formed, the arrangement and interconnection of which may be seen from Fig. 5.

The air chambers 19, 22, 25 and 26 are connected mutually as well as with the chamber 9 by suitable openings for the passage of cooling air. The attachment of all the metallic parts belonging to the air chambers is effected in the simplest possible manner by means of screws, so that at any time an exchange of the individual parts will be possible without any difficulty. The outer walls of the lateral cooling chambers are similarly provided with openings 27 for the discharge of the cooling air into the interior of the rotary drum.

The operation of the cooling chambers appears clearly from the drawings. The material to be combusted slides along the cooling chamber 9 into the rotary drum, so that the most exposed part of the transition from the furnace chamber to the rotary drum will be formed by the exchangeable cooling chamber. This part in connection with the packing plate 10 covers at the same time the joint 7 efficiently against any solid particles falling through, the lateral cooling chambers, besides their protection of the brickwork, forming similarly a cover for the joint up to the highest level to which the material will reach at this point. The metallic part of the cooling chambers may suitably be made from cast iron.

In order to tighten the joint 7 against the escape of combustion gases, or the entrance of surplus air from the outside, a special packing is provided according to the invention, the constructional details of which appear plainly from Fig. 6. Concentrically to the inlet end of the rotary drum 3, and at some distance therefrom, a stationary cast-iron frame 28 is attached in gas-tight manner to the rear wall 8 of the furnace chamber 1. On the front face of the frame 28 a channel iron 29 is provided, which in a ring produced by suitable means supports a packing 30 adapted to produce tightness.

On the mantle 4 of the rotary drum 3 an angle 31 is provided, which itself carries an annular packing ring 32. Between the disk 32 and the frame 28 and concentrically to the rotary drum 3, a cylindrical ring 33 is supported at some distance from the rotary drum in such a manner that it cannot move in the direction of the rotation of the drum, while a certain mobility in the direction of the drum axis is permissible. The ring 33 is supported on the packing 30 and carries on its front side, by means of an angle iron 34 an element 36 fitted with a packing surface 35, which element with its packing surface slides on the packing ring 32. The rotary motion of the ring 33 is prevented by angular brackets 38 attached to the ring 33 and engaging in pawl-like manner the brackets 37 attached to the frame 28. In the direction of the axis of the rotary drum the ring 33 is freely movable, a plate spring 39 inserted between the frame 28 and the member 34 effecting the requisite pressure of the ring 33

with its packing surface **35** against the packing ring **32**.

In order to be able to remove any solid constituents that in spite of the packing plate **10** may have penetrated into the lower packing device, openings **40** are provided in the bottom part of the frame **28**, which openings lead to a vessel **41**, closed in gas-tight manner towards the outside and terminating in a flap **42**. Further, the bottom surface of the cylindrical ring **33** is provided with openings **43**, which similarly serve to remove any solid particles that may have entered. In order to prevent, as far as possible, the entrance of these particles into the packing device itself, there is further inserted, in front thereof, a labyrinth-like device formed by interlocking angles and plates **44**. Arrows in Fig. 6 show the path that may be followed by any solid particles entering from the interior of the rotary drum. In order to remove, efficiently by way of the apertures **40**, the particles deposited in the bottom part of the frame **28**, the outer periphery of the drum **3** is fitted at this point with scrapers **45**, which push the solid particles towards the apertures **40**.

Fig. 6 shows plainly how efficiently a gas-tight joint is attained, by the arrangement according to the invention, at the point of transition from the furnace chamber to the rotary drum. By the movable attachment of the cylindrical ring **33**, which effects the tightness, care is taken to maintain the tightness in spite of any displacement of the rotary drum owing to external influences or to the action of heat.

Figs. 7 to 11, finally, show also the discharge end of the rotary drum with cooling chambers provided in accordance with the invention. At this end the rotary drum **3** is fitted with a cooling jacket **46**, which forms an annular chamber **47** encircling the end of the rotary drum. By way of openings **48**, which can be adjusted by an annular slide valve, the chamber **47** communicates with the outer air, so that cooling air can enter here. For the purpose of protecting the end face of the drum, an annular frame-like body **49** is attached by means of screws **50**, in easily exchangeable manner, partly to the drum itself and partly to the mantle **46** of the cooling chamber **47**, the interior of the said body communicating by way of an opening **51**, with the chamber **47** and being provided with outlet openings **52** for the cooling air. By the suction prevailing in the adjoining chimney **59**, the outer air is directed through the openings **48** into the chamber **47**, and from there into the interior of the body **49**, whence the air escapes to the chimney by way of the openings **52**. According to Fig. 9, the protective device **49** for the end face of the drum may be formed by individual segmental parts **49'**, which for the purpose of compensating for thermal expansions are placed at some distance from one another so as to form joints **50'**. If no further protection of the member **49** be provided, the individual segmental parts **49'** are closed on the sides, so that the cooling air can escape only by way of the openings **52**.

A further protection of this part of the furnace is provided by shell-shaped plates **53**, **57** and **58**, which in easily exchangeable manner are attached to the mantle **46** and the member **49** respectively. Owing to the arched shape, cavities **54**, **55**, **56** are left open between the individual parts, which cavities, by way of the openings **52**, communicate with the cooling chamber **47** and, respectively, the interior of the said parts. The cooling air flows out through these openings, and cools in this manner also the parts **53**, **57**, **58**. Also these parts, as shown by Fig. 9, may suitably be composed of smaller individual parts, and they too are placed at some distance from one another. The parts **49** are now left open on the side faces, so that the cooling air can here freely enter into the space below the protective plates situated above, while the protective plates **53**, **57**, **58** are suitably closed at the sides.

By the provision of small individual protective parts of standard shape at the highly exposed outlet end of the rotary drum, the advantage is attained that any injury to this part of the furnace can be repaired in a most simple and cheap manner, without any lengthy derangements of service being caused thereby. The introduction of the cooling air into the furnace parts concerned, at the entrance end as well as at the outlet end of the rotary drum, may either be effected solely by the chimney draft or by special fan devices.

Having thus described my invention, what I claim is:—

1. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, and a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum.

2. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a hollow body removably secured to the lower portion of the chamber wall, said body being provided with openings in its walls for the passage of a cooling fluid and extending into the rotary drum, and a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum.

3. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a hollow body removably secured to the lower portion of the chamber wall, said body being provided with openings in its walls for the passage of a cooling fluid and extending into the rotary drum, and a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said packing plate being spaced from the hollow body and provided with openings communicating with the interior of the hollow body.

4. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an air-cooled member disposed on the side walls of the chamber adjacent to the

rotary drum, said members extending into the drum.

5. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, and a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said packing plate comprising a plurality of individual removable segmental members.

6. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, said rotary drum having a ring of abrasive material forming a part of its lining, and a removable packing plate carried by said body and having its periphery in contact with the inner surface of said abrasive ring.

7. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, and a stuffing box packing device disposed between said frame and said ring.

8. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, a ring of packing material carried by said frame, a cylindrical ring disposed in concentric relation to the rotary drum between said frame and said annular ring, said cylindrical ring being spaced from the drum and movable in the direction of its axis, and a spring in engagement with said cylindrical ring for retaining it in contact with said annular ring.

9. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, a stuffing box packing device disposed between said frame and said ring, a hermetically sealed container disposed below the joints between the chamber and drum, and said annular frame being provided with openings in the lower portion thereof in communication with said container.

10. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, a stuffing box packing device disposed between said frame and said ring, a hermetically sealed container disposed below the joints between the chamber and drum, said annular frame being provided with openings in the inner portion thereof in communication with said container, and scrapers secured to the exterior of said drum for conveying material toward said openings.

11. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, a stuffing box packing device disposed between said frame and said ring, and members disposed between said frame and said packing device and forming baffles for preventing the passage of solid particles into the stuffing box.

12. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, an annular ring secured to the rotary drum at the exterior thereof, an annular frame hermetically secured to the wall of said chamber and encircling the end of the rotary drum in spaced relation thereto, a ring of packing material carried by said frame, a cylindrical ring disposed in concentric relation to the rotary drum between said frame and said annular ring, said

cylindrical ring being spaced from the drum and movable in the direction of its axis, and a spring in engagement with said cylindrical ring for retaining it in contact with said annular ring, said cylindrical ring being perforated at its lower portion thereby to permit removal of material therefrom.

13. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said rotary drum being provided at its discharge end with a cooling jacket comprising a cylindrical member encircling the drum and a protecting frame concentric with the drum and disposed adjacent to the end of the drum.

14. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, a cooling jacket encircling said drum at its discharge end and comprising a removable metallic hollow body having inlet and outlet openings for the passage of a cooling medium and a protecting frame disposed in concentric relation with the drum adjacent to the end of said drum.

15. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, a cooling jacket encircling the discharge end of the rotary drum and comprising a plurality of removable segmental members, and a protecting frame disposed in concentric relation with the drum adjacent to the end of said drum.

16. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, a cooling jacket encircling the discharge end of the rotary drum and comprising a plurality of removable segmental members, and a protecting frame disposed in concentric relation with the drum adjacent to the end of said drum, said segmental members being spaced apart one from the other.

17. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said rotary drum being provided at its discharge end with a cooling jacket comprising a cylindrical member encircling the drum, a protecting frame concentric with the drum and disposed adjacent to the end of the drum, and removable protecting plates enclosing said cooling jacket.

18. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said rotary drum being provided at its discharge end with a cooling jacket comprising a cylindrical member encircling the drum, a protecting frame concentric with the drum and disposed adjacent to the end of the drum, removable protecting plates enclosing said cooling jacket, said protecting plates being provided with cavities in the sides thereof adjacent to the cooling jacket, and said cooling jacket having openings in its walls communicating with said cavities.

19. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said rotary drum being provided at its discharge end with a cooling jacket comprising a cylindrical member encircling the drum, a protecting frame concentric with the drum and disposed adjacent to the end of the drum, and removable protecting plates enclosing said cooling jacket, said removable plates being spaced apart.

20. In a furnace having a stationary chamber, a grate within said chamber, and a rotary drum adjacent to said chamber, an air-sealed joint between the wall of said chamber and said rotary drum and comprising a body removably secured to the lower portion of the chamber wall, said body forming a continuation of the furnace grate and extending into the rotary drum, a removable packing plate carried by said body and having its periphery in contact with the inner surface of the drum, said rotary drum being provided at its discharge end with a cooling jacket comprising a cylindrical member encircling the drum, a protecting frame concentric with the drum and disposed adjacent to the end of the drum, removable protecting plates enclosing said cooling jacket, said protecting plates being provided with cavities in the sides thereof adjacent to the cooling jacket, and said cooling jacket having openings in its walls communicating with said cavities, said cavities being open to the atmosphere.

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