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## ABSTRACT

A bottom ash discharging device for coal-fired boiler comprises a clinker case (9), installed between the bottom ash hopper outlet (4) of the coal-fired boiler and the bottom ash conveyer(1), and impact bar (2), composed of a plurality of heat-resistant metal rods supporting inside the clinker case (9), and a clinker crusher (3), installed above the impact bar (2), for crushing the clinker, wherein, further comprises a guiding device that limiting the clinker to drop into the clinker crushing area of the clinker crusher(3), installed between the bottom ash hopper outlet (4) and the clinker crusher(3), the low ends of the guiding plate is closer than the baffle plate to the clinker crushing body (7), and the bottom edges of the guiding plate are lower than the top edge of the baffle plate. This invention is to solve the technical problems that the clinker dropping from the bottom ash hopper outlet to the rear area of the clinker crusher so as to affect its normal working, and the invention can especially apply for discharging clinker from various coal-fired boilers.

## CLAIMS

1. A bottom ash discharging device for coal-fired boiler comprising  
  
a clinker case (9), installed between the bottom ash hopper outlet (4) of the coal-fired boiler and the bottom ash conveyer(1); and  
  
an impact bar (2), composed of a plurality of heat-resistant metal rods and is disposed inside the clinker case (9); and  
  
a clinker crusher (3), installed above the impact bar (2), for crushing the clinkers;  
  
wherein, further comprises an ash guiding device that limiting the clinkers to drop into the clinker crushing area of the clinker crusher(3), installed between the bottom ash hopper outlet (4) and the clinker crusher(3), with the upper end connected to the bottom ash hopper outlet (4).
2. The device of claim 1 wherein the guiding device is guiding plate (14), installed around the bottom ash hopper outlet (4).
3. The device of claim 2 wherein the clinker crusher (3) includes at least a pair of driving devices (25) with relative movement for crushing the bottom ash and driving the device(25) itself; and an clinker crushing body (7) is installed on the front end of each clinker crushing component (25); and a baffle plate (27) extending upwardly is installed on the rear end of each clinker crushing component (25); the guiding plate (14) is closer than the baffle plate to the clinker crushing body (7).
4. The device of claim 3, wherein the bottom edges of the guiding plate is lower than the top edge of the baffle plate (27).
5. The device of any of claims 1-4, wherein the impact bar (2) is dismountable and fixed on the clinker case.

6. The device of claim 5, wherein two ends of the heat-resistant metal rod (6) supported on the clinker case (9) through fixing on the supporting beam (5), at least one end of the heat-resistant metal rod (6) is dismountable and fixed on the clinker case (9) through a stop means for restricting the axial movement of the heat-resistant metal rod (6).

7. The device according to claim 6, wherein the stop means comprises

at least one opening, formed on the side wall of the clinker case (9) that adapted for pulling out the heat-resistant metal rod (6); and

a cover, installed outside of the clinker case (9), for fixing the heat-resistant metal rod (6), and at least one hole, formed on the cover plate (10) to allow the end of at least one said heat-resistant metal rod (6) to pass through; and

at least one small hole whose orientation is perpendicular with that of said heat-resistant metal rod, formed on the segment of at least one heat-resistant metal rod (6), which exposes to outside of the clinker case (9); and

at least one pin, which passes through at least one small hole and is disposed therein, which cooperates with the cover for restricting the axis movement of heat-resistant metal rod.

8. The device of claim 6, wherein the stop means comprises

at least one opening, formed on the side wall of the clinker case (9) that adapted for pulling out the heat-resistant metal rod (6); and

a cover, installed outside of the clinker case (9), for fixing the heat-resistant metal rod (6); and, there are holes on the cover for allowing the end of the heat-resistant metal rod to pass through the plate; and

at least one screw hole (11), formed on one end of at least one said heat-resistant metal rod (6), and combining with dowels that passing through the cover holes for fixing the heat-resistant

metal rod (6).

9. The device of claim 3, wherein a plurality of cone-shaped clinker crushing jaw (8) are formed vertically on the extrusion end of the clinker crushing body (7).

10. The device of claim 9, wherein the cone angle of the clinker crushing jaw (8) is 60°-90°.

11. The device of claim 10, wherein the shape of the clinker crushing jaw (8) is in the form of rectangular pyramid.

12. The device of claim 3, wherein the driving device is a hydraulic cylinder, and each clinker crushing body (7) is driven by two hydraulic cylinders with parallel connection settings.

13. The device of claim 12, wherein a pushing rod (23) is installed between the clinker crusher component (25) and the hydraulic cylinder for the transmission of driving force between the hydraulic cylinder and the clinker crusher component.

14. The device of claim 3, wherein an ash discharging device is installed on the rear end of the clinker case (9) that on the return side of the clinker crusher component underneath the impact bar.

15. The device of claim 14, wherein the ash discharging device is an ash discharging door installed on the clinker case.

16. The device of claim 14, wherein the ash discharging device is an ash silo (15) with an ash discharging door, which is formed on the clinker case.

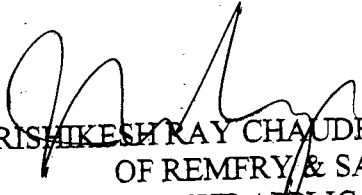
17. The device of claim 14, wherein the clinker case comprising:

an observation window (17) and/or a camera window (18), for observing the state of the accumulation of large clinker dropped on the impact bar (2); and

an observation hole (16) that is for observing the state of ash storage in the ash storage

device.

Dated this 05/03/2012

  
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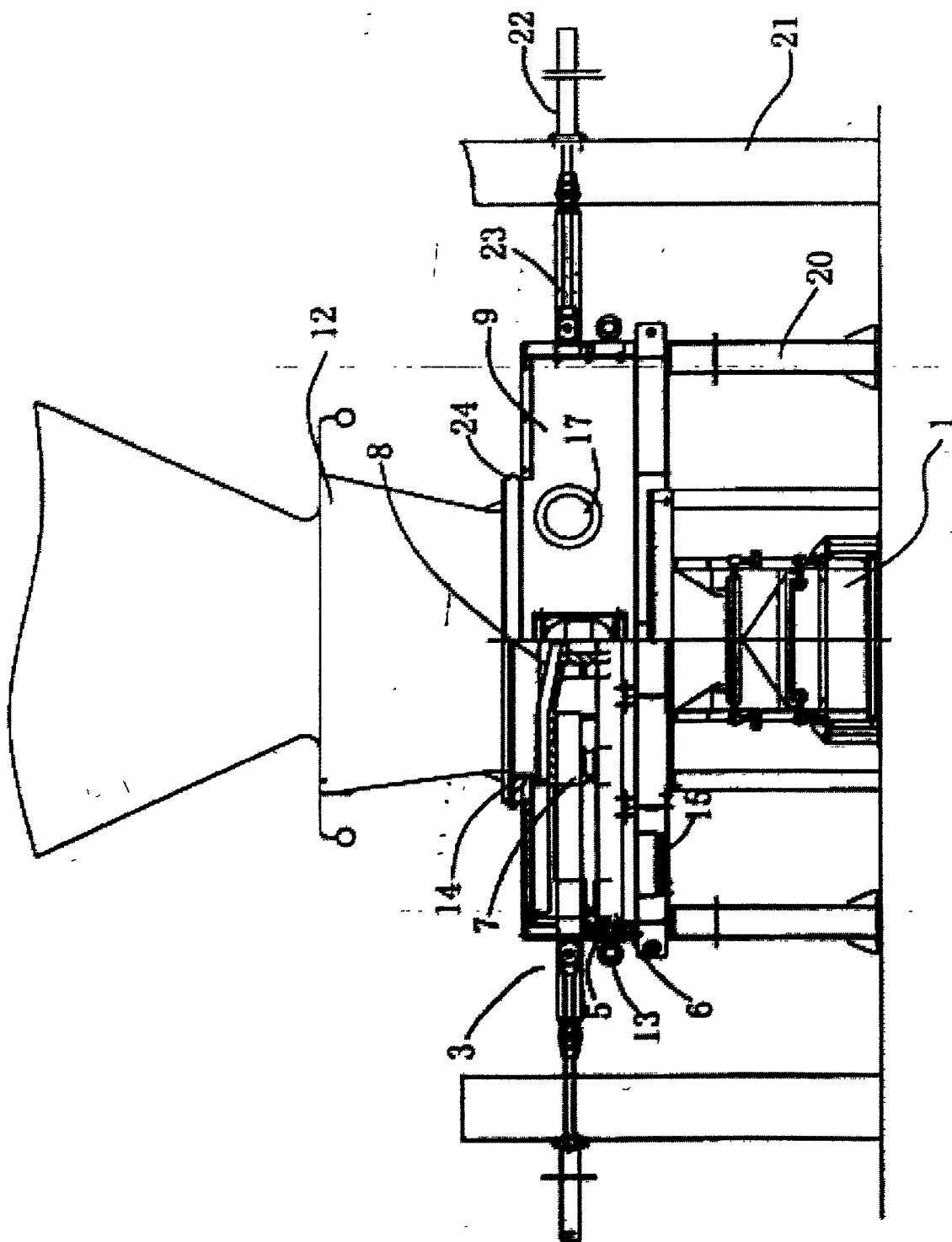
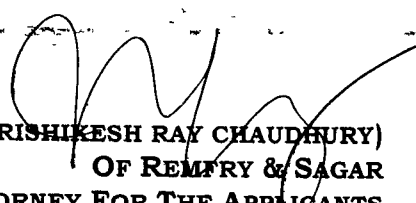


Fig. 1

  
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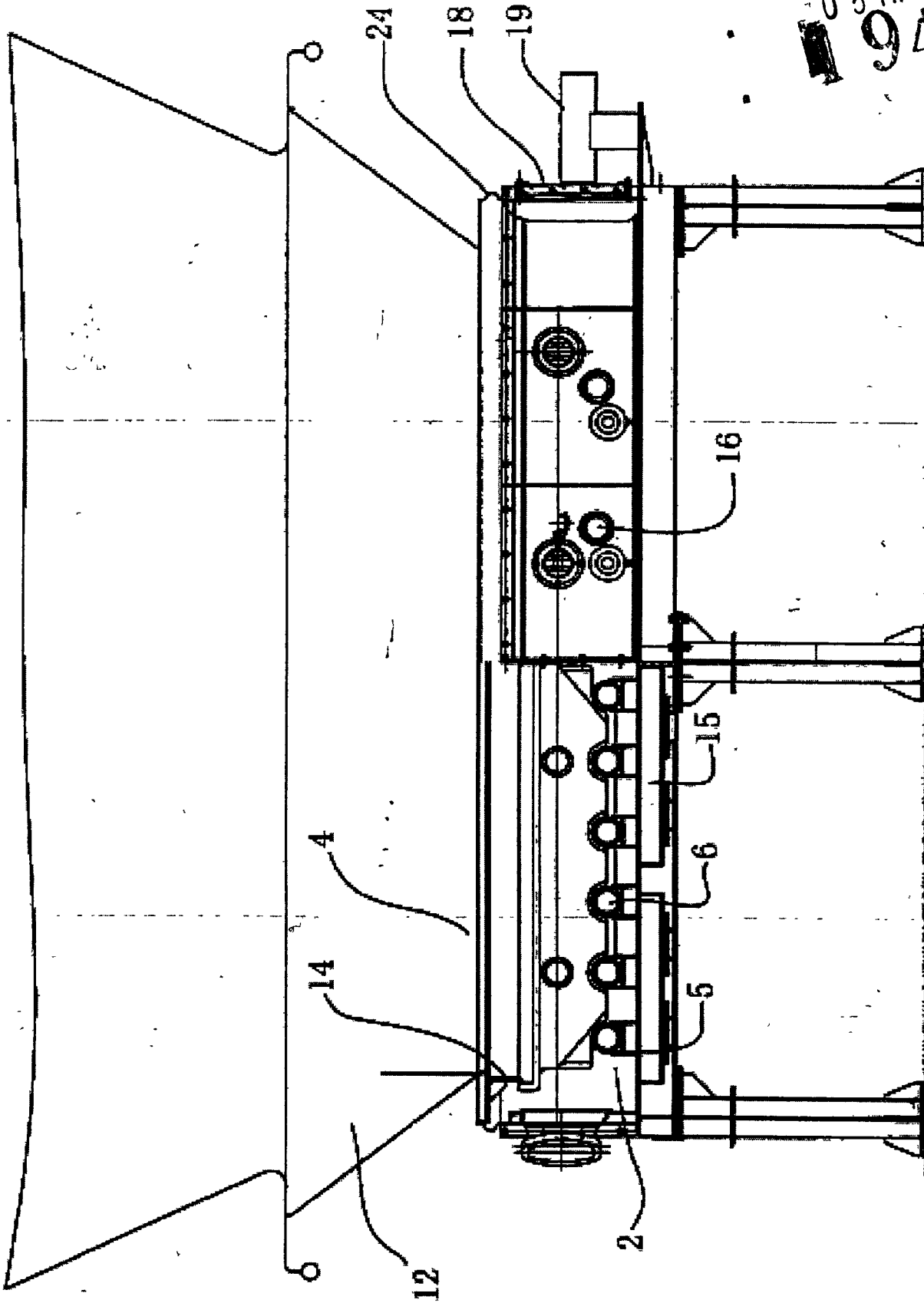
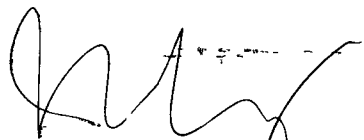
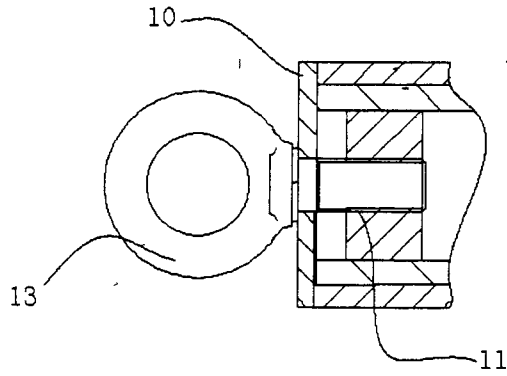


Fig.2


  
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Revised FIG.3

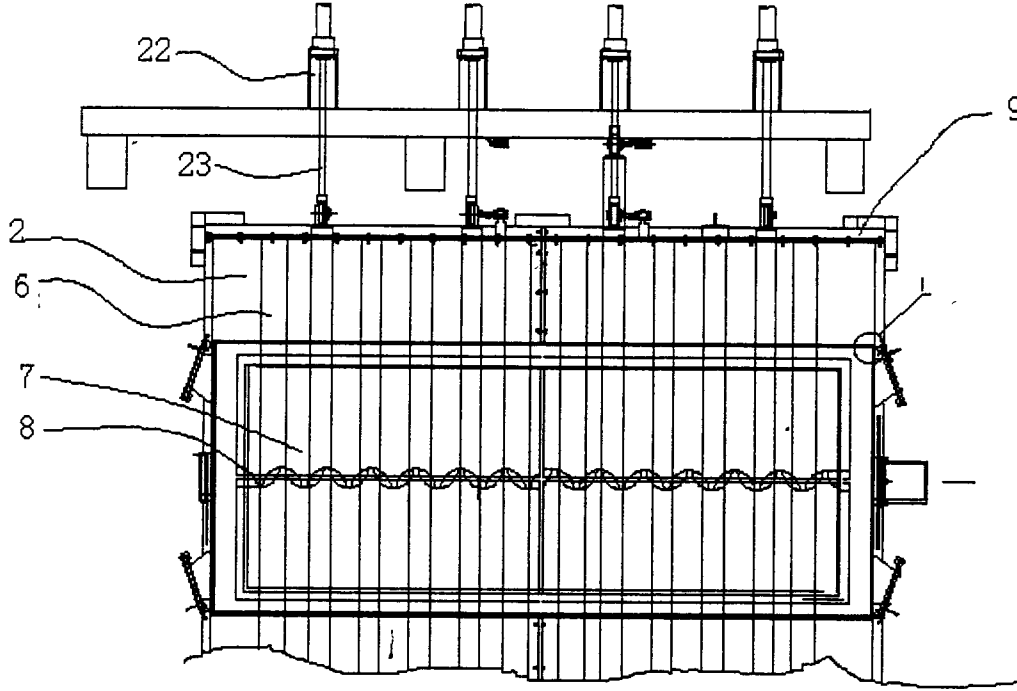
  
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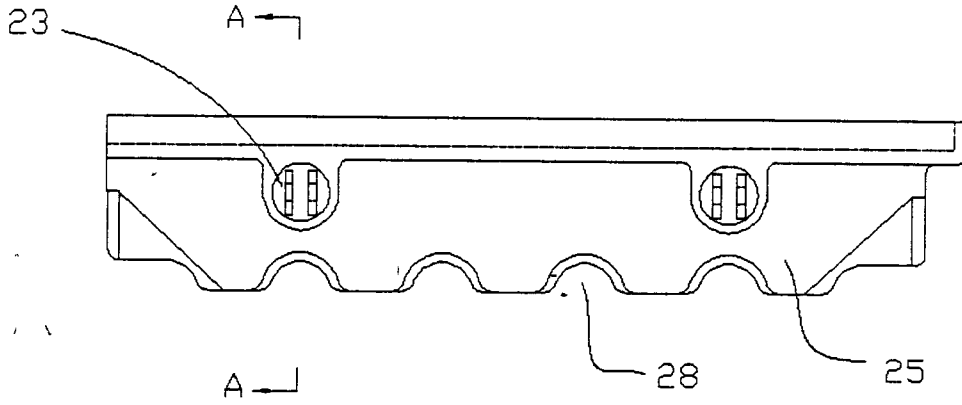
Revised FIG.4

  
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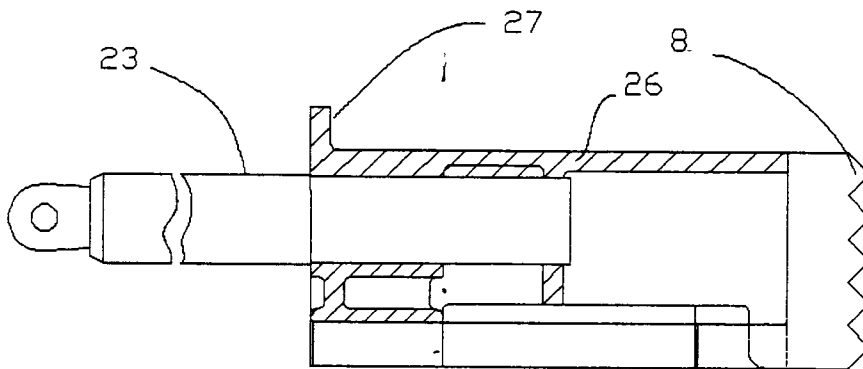
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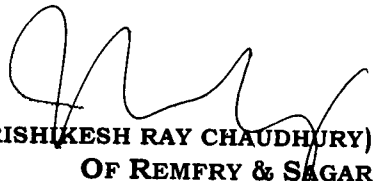
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Revised FIG.5



Revised FIG.6

  
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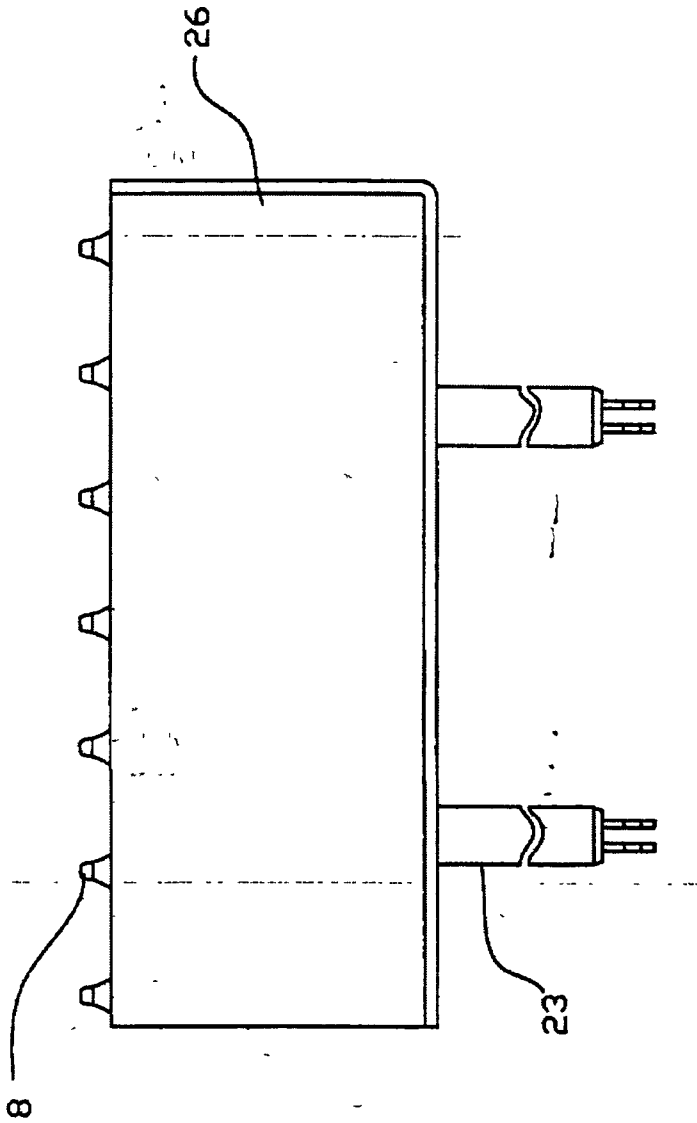
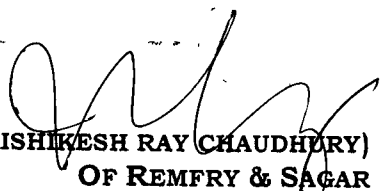


Fig.7

  
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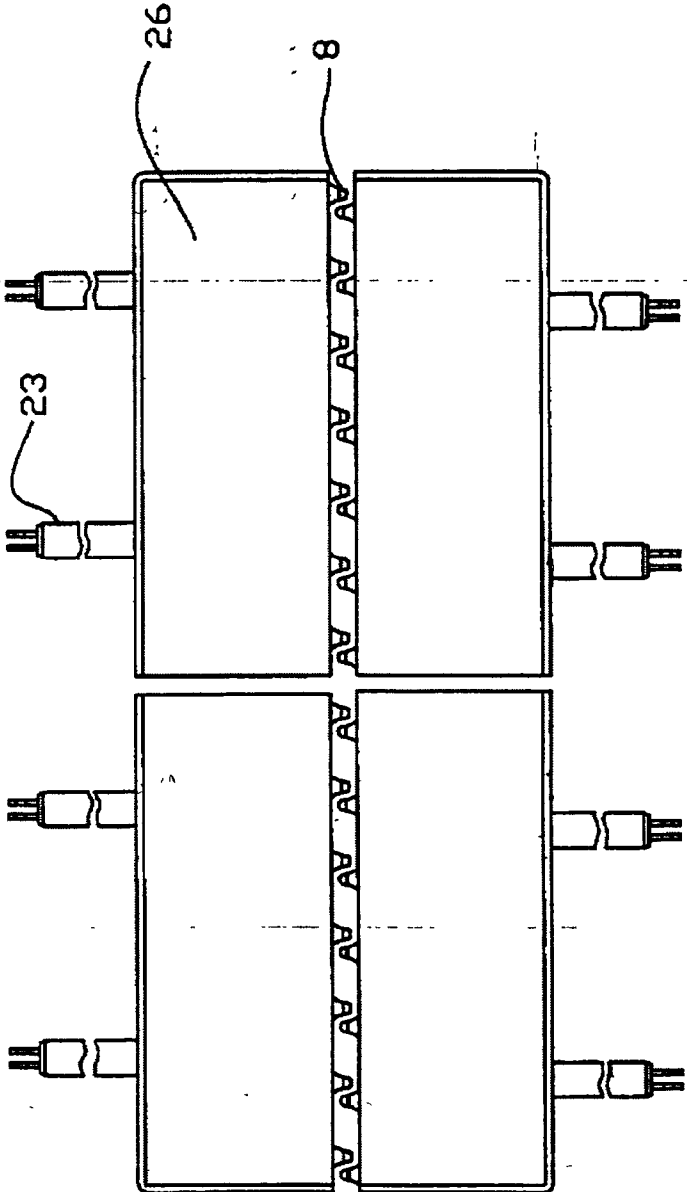
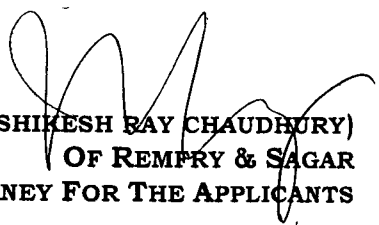


Fig. 8

  
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# **BOTTOM ASH DISCHARGING DEVICE FOR COAL-FIRED BOILER**

## **FIELD OF THE INVENTION**

This invention relates to a device for discharging clinker, specifically to a device that discharging the bottom ash from the coal-fired boilers.

## **BACKGROUND OF THE INVENTION**

Presently, the coal-fired boiler of power plant mainly utilizes the wet bottom ash handling system/device and dry bottom ash handling system/device.

For the wet bottom ash handling system, most of the high temperature big lump and large clinker may drop into water and then become granulated into smaller ones for convenient delivery.

However, there are some disadvantages with the wet bottom ash handling system, provided as below:

(1) The fact that the clinker drops from the bottom of the boiler directly into the cooling water may cause a waste of the combustible material in the clinker and a loss of physical heat, in addition, the generated steam may corrode the components installed at the bottom of the boiler.

(2) There is much water consumption, and the environment is polluted by the discharged waste water, which may lead to high disposal cost.

(3) Said system is complicated and may cause high maintenance and repair cost.

Therefore, dry bottom ash handling technology is the most widely used technology at present. But the use of dry bottom ash handling equipment without granulation by water may generate large clinker, which may destroy the steel belt of the crusher if the clinker directly falls onto the steel belt, and various-size bottom ash may enter the crusher so as to increase the workload of crusher and cause low efficiency and high malfunction rate.

In practice, the bottom ash handling system may stop running, because the crusher is sometimes jammed by clinker or overloaded, or the clinker is too hard to crush, or even its chain

becomes broken.

In order to solve the above problems, China patent literature with publication No.CN2459550Y discloses a dry conveying device for high temperature bottom ash of coal-fired boiler comprising a steel belt conveyer, a hydraulic clinker crusher and impact bar installed above the conveyer, and the impact bar installed underneath the hydraulic clinker crusher, wherein the hydraulic clinker crusher and the impact bar supported by the clinker case, and the upper portion of clinker case is connected with the bottom ash hopper outlet installed at the bottom of coal-fire boiler, and the lower portion of clinker case is connected with the top of the steel belt conveyer.

The impact bar is composed of a plurality of heat-resistant metal rods, two ends of the heat-resistant metal rod supported by the clinker case are respectively connected with a cooling water pipe, the metal rods of the impact bar are used as the guide rail of the clinker crushing body of the hydraulic clinker crusher, the contact portion of the clinker crushing body and the impact bar is wave-shaped, and the clinker crushing body have a form of jaw that engage with each other; the disposal of the clinker crusher and the impact bar at the bottom of coal-fired boiler prevents the large clinker from directly dropping onto the conveying belt, so as to avoid the damage of the conveying belt, and reduce the crushing workload, and increase the service life of the clinker crusher and even the whole device.

However, the above-motioned high temperature dry bottom ash conveying device still has some disadvantages:

(1) In the above-motioned high temperature dry bottom ash conveying device, a portion of bottom ash from the outlet of the bottom ash hopper will not drop into the area where the clinker crushing body of the hydraulic clinker crusher is working, however, it may affect the normal working of the clinker crushing body if too much bottom ash is accumulated in this area.

(2) As the impact bar is fixed on the clinker case, once the impact bar is damaged or destroyed, the device has to be stopped working for repair or replacement, which may have bad influence on the normal power generation of the power plant.

(3) The fact that the clinker crushing body are the form of jaw that engage with each other, i.e. the cross section of the body is n-shaped, and the vertical section is rectangle (referring to

Fig.1), so that large clinker can be easily pushed to the cover instead of being impaled or penetrated by the clinker crushing body when the clinker crusher body is driven by the hydraulic cylinder with relative movement. Therefore, there may be lots of big-sized slag that are not crushed immediately, which may affect the efficiency of crushing.

## **SUMMARY OF THE INVENTION**

In order to overcome the disadvantages of the prior art, the first object of the present invention is to provide a device for discharging bottom ash from bottom of coal-fired boiler with a guiding device to avoid clinker dropping out of the crushing area of the clinker crushing body.

The second object of the present invention is to provide an impact bar that is not need to stop the coal-fired boiler for replacing and repairing.

The third object of the present invention is to provide a clinker crushing body that is can easily impale and crush large clinker.

The fourth object of the present invention is to provide a bottom ash discharging device for storing and discharging fly ash.

For solving the above-mentioned technical problems, the present invention provides a bottom ash discharging device for coal-fired boiler that comprising:

A bottom ash discharging device for coal-fired boiler comprises a clinker case, installed between the bottom ash hopper outlet of the coal-fired boiler and the bottom ash conveyer; and an impact bar, composed of a plurality of heat-resistant metal rods supporting inside the clinker case; and a clinker crusher, installed above the impact bar, for crushing the clinkers; wherein, further comprises an ash guiding device that limiting the clinkers to drop into the clinker crushing area of the clinker crusher, installed between the bottom ash hopper outlet and the clinker crusher, with the upper end connected to the bottom ash hopper outlet.

The guiding device is guiding plate, installed around the bottom ash hopper outlet.

The clinker crusher includes at least a pair of driving devices with relative movement for crushing the bottom ash and driving the device itself; and a clinker crushing body is installed on the front end of each clinker crushing component; and a baffle plate extending upwardly is installed on the rear end of each clinker crushing component; the guiding plate are closer than the baffle plate to the clinker crushing body.

The bottom edges of the guiding plate are lower than the top edge of the baffle plate (27).

The impact bar (2) is dismountable and fixed on the clinker case.

Two ends of the heat-resistant metal rod (6) supported on the clinker case (9) through fixing on the supporting beam (5), at least one end of the heat-resistant metal rod (6) is dismountable and fixed on the clinker case (9) through a stop means for restricting the axial movement of the heat-resistant metal rod (6).

The stop means comprises openings, installed on the side wall of the clinker case (9) that adapted for pulling out the heat-resistant metal rod (6); and a cover, installed outside of the clinker case (9), for fixing the heat-resistant metal rod (6), there are holes on the cover for allowing the end of the heat-resistant metal rod to pass through the cover; and small holes vertical to the shaft of heat-resistant metal rod installed outside the clinker case, formed on the segment of at least one heat-resistant metal rod (6), which exposes to outside of the clinker case (9); and dowels pass through the holes, and combine with the cover for limiting the axis movement of heat-resistant metal rod.

The stop means comprises openings, formed on the side wall of the clinker case (9) that adapted for pulling out the heat-resistant metal rod (6); and a cover, installed outside of the clinker case (9), for fixing the heat-resistant metal rod (6), there are holes on the cover for allowing the end of the heat-resistant metal rod to pass through the plate; and screw holes (11), formed on the end fixed on stop means of heat-resistant metal rod, and combining with dowels that passing through the cover holes for fixing the heat-resistant metal rod (6).

A plurality of cone-shaped clinker crushing jaws (8) are formed vertically on the extrusion end of the clinker crushing body (7).

The cone angle of the clinker crushing jaw (8) is 60°-90°.

The shape of the clinker crushing jaw (8) is in the form of rectangular pyramid.

The driving device is a hydraulic cylinder, and each clinker crushing body (7) is driven by two hydraulic cylinders with parallel connection settings.

A pushing rod (23) is installed between the clinker crusher component (25) and the hydraulic cylinder for the transmission of driving force between the hydraulic cylinder and the clinker crusher component.

An bottom ash discharging device is installed on the rear end of the clinker case (9) that on the return side of the clinker crusher component underneath the impact bar.

The bottom ash discharging device is an ash discharging door installed on the clinker case.

The bottom ash discharging device is a bottom ash hopper (15) with an ash discharging door, which is formed on the clinker case.

The clinker case comprises: an observation window (17) and/or a camera window (18), for observing the state of the accumulation of large clinker dropped on the impact bar (2); and an observation hole (16) that is for observing the state of ash storage in the ash storage device.

The present invention has the following advantages:

( 1 ) The guiding device for guiding the clinker to drop into the clinker-crushing area of the clinker crusher(3), disposed between the slag hopper outlet (4) and the slag crusher(3), with the upper end connected to the slag hopper outlet (4), may prevent the slag from dropping into the area where the clinker crushing body can not reach.

(2) Each heat-resistant metal rod is in dismountable fixed connection with the clinker case,

and the axial movement is restricted by stop means. Once one of heat-resistant metal rods is broken or with the need of replacement, it only needs to pull such rod out, and is unnecessary to change the whole impact bar, so that there is no need to stop the working of the coal-fire boiler, thereby increase the efficiency and lower the cost.

(3) The fact that the clinker crushing body is in the form of cone-shaped clinker crushing jaws, especially, a plurality of such jaws installed on the crushing working surface of the clinker crushing body in the erect direction may allow the clinker crushing body to provide larger pressure intensity on the clinker than the flat jaws, so as to engaged the irregularly-shaped large clinker more firmly and be easily crushed. The cone angle of the jaws is  $60^{\circ}$ - $90^{\circ}$ , which can not only avoid the low intensity and snapping of the jaws in the case that the t jaws are with too small cone angle, but also prevent smaller pressure intensity caused by bigger cone angle which not conducive to impaled the irregularly shaped large clinker.

#### **BRIEF DESCRIPTION OF THE DRAWING**

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig.1 is a front view of bottom ash discharging device for coal-fired boiler of the invention.

Fig.2 is a side view of bottom ash discharging device for coal-fired boiler of the invention;

Fig.3 is a structural schematic view of the stop means device for discharging bottom ash from bottom of coal-fired boiler of the invention.

Fig.4 is a top view of bottom ash discharging device for coal-fired boiler of the invention.

Fig.5 is a side view of the clinker crusher for discharging bottom ash from bottom of coal-fired boiler of the invention.

Fig.6 is a sectional view of the clinker crusher of the invention along the A-A direction.

Fig.7 is a top view of a single clinker crusher for discharging bottom ash from bottom of

coal-fired boiler.

Fig.8 is a combination view of two clinker crushers for discharging bottom ash from bottom of coal-fired boiler.

List of Reference Number:

1-bottom ash conveyer, 2-impact bar , 3-clinker crusher, 4- bottom ash hopper outlet, 5-supporting beam, 6-heat-resistant metal rod, 7-clinker crushing body , 8-clinker crushing jaw, 9-clinker case,10-cover, 11-screw hole, 12-bottom ash hopper, 13-ringbolt, 14-guiding plate, 15-ash silo, 16-observation hole, 17-observation window, 18-camera window, 19-camera, 20-clinker case supporting structure, 21- bottom ash hopper supporting structure, 22-hydraulic cylinder, 23-push rod, 24-expansion joint, 25- clinker crushing component, 26-shelter plate, 27-baffle plate, 28-chute .

## **DETAILED DESCRIPTION OF THE INVENTION**

Bottom ash discharging device for coal-fired boiler is installed underneath a bottom ash hopper 12, and the bottom ash hopper 12 is connected to the lower end of a furnace, for receiving the bottom ash out of the furnace. The bottom ash discharging device comprises a clinker case 9, a impact bar 2, and clinker crusher 3, wherein the clinker case 9 is installed between a bottom ash hopper outlet 4 and bottom ash conveyer 1, the impact bar 2 is composed of a plurality of heat-resistant metal rods 6 propped up against the clinker case 9 , and the clinker crusher 3 is installed above the impact bar, for crushing the clinker. The impact bar 2 is adapted for preventing the large clinker from dropping onto the bottom ash conveyer 1, and the clinker crusher is movable above the impact bar 2, for crushing the large clinker into small ones, so that the smaller ones may drop down through the intervals of the impact bar, and then the bottom ash conveyer 1 may discharge the ash from the bottom ash hopper outlet and the clinker crusher to another crushing and screen device.

A guiding device is installed between the bottom ash hopper outlet 4 and the clinker crusher

3, for limiting the clinker to drop into the clinker crushing area of the clinker crusher<sup>3</sup> which inside the baffle plates. In the first embodiment, the guiding device may be guiding plate 14, which are welded around the bottom ash hopper outlet 4, in order to make sure that the clinker may drop into the crushing area of the clinker crusher so as to avoid the clinker drops to the back area of the clinker crusher, in which the clinker cannot be crushed; the crushing area herein represents the area in which the clinker is able to be crushed by the slag crusher.

The clinker case 9 is installed on the bottom ash conveyer and supported by clinker case supporting structure 20, which is for supporting the clinker crusher and the impact bar 2. An expansion joint 24 is installed on the top of the clinker case 9, which is able to absorb the downward thermal expansion of the bottom ash hopper. Side walls of the clinker case 9 are connected with each other via bolts and nuts; the bolts are dismountable and the side walls of the clinker case 9 can be opened for repairing in the case that the clinker crusher 3 or the impact bar 2 broken, which is quite convenient for repairing. A camera window 18 and an observation window 17 are formed in the appropriate position of the clinker case, for observing the state of the large clinker accumulating on the impact bar, and the camera installed outside the camera window 18 can be used to record the accumulation of clinker, and send the video signal to the displayer, so that the operator may get the information about the position of the large clinker through the displayer and manipulate the working of the clinker crushing body to crush the clinker accordingly. The operator also may directly observe the state of the impact bar through the observation window 17 and may open the observation window 17 to cleanup sundries on the impact bar 2.

The impact bar 2 is composed of a plurality of heat-resistant metal rods 6, the two ends of the heat-resistant metal rod 6 supported on the clinker case 9 through fixing on the supporting beam 5, at least one end of the heat-resistant metal rod 6 is dismountable and fixed on the clinker case 9 through a stop means for restricting the axial movement of the heat-resistant metal rod 6. The stop means comprises a screw hole 11 that is welded inside the heat-resistant steel bars and installed at the end of such bars, openings installed on the side wall of the clinker case 9 that

adapted for pulling out the heat-resistant metal rod 6, a cover installed outside of the clinker case 9, for sealing the openings and fixing the heat-resistant metal rod 6, holes on the cover 10 for allowing ringbolt 13 metal rod to pass through, and one end of the ringbolt 13 passes through the hole of the cover 10 and then match the screw hole 11. Of course, the shape of the supporting beam 5 may be variable according to the real conditions, for example, the supporting beam fixed on the clinker case 9 can be circular, as long as the supporting beam is able to support the heat-resistant steel bars. When large clinker drops onto the impact bar 2 and smashes one or some of the heat-resistant steel bars, in order to repair or replace the bars, the maintainer can hold and turn round the ringbolt 13 to screw it out of the screw hole 11, and then pull out the broken heat-resistant steel bars. Therefore, it is not necessary to shutdown the device, because only replacing one or some of the heat-resistant steel bars will not affect the boiler's discharging work. And it may increase the efficiency, lower the cost and save the labor, in comparison with the design that the impact bar 2 is fixed on the clinker case 9 or integrally formed thereon. The intervals of the heat-resistant metal rods of the impact bar 2 allow granulated ash and small bottom ash to directly drop onto the bottom ash conveyer 1, meanwhile, large clinker is headed off and stays on the impact bar. On one hand, it may protect the bottom ash conveyer from being damaged by large clinker; on the other hand, it prolongs the cooling time of the large clinker, so as to reduce the temperature of the clinker to a level at which the clinker will not damage the conveyer.

The clinker crusher 3 is installed above the impact bar 2, which comprises clinker crushing components 25 and a driving device that is for driving the clinker crushing components to move in axial direction; a pushing rod 23 is installed between the clinker crushing components 25 and the driving device for transmitting the driving force between the driving device and the clinker cased components, and a plurality of clinker crushing bodies 7 are formed on the clinker crushing component. A baffle plate 26 is installed above the clinker crushing components 25 for protecting the clinker crushing body; a plurality of baffle plates 27 extending upwardly are disposed around the clinker crushing components 25. The guiding plate 14 are closer than that of

the baffle plate 27 to the clinker crushing body 7, and the bottoms of the guiding plate 14 are lower than the top edge of the baffle plates. At least one chute 28 is installed underneath at least two clinker crushing component 25 and on/above the heat-resistant steel bars of the impact bar 2, for allowing the clinker crushing components to slide on, wherein, the clinker crushing components 25 on the same chute moves relatively. Three rectangular pyramid shaped clinker crushing jaw are formed on the clinker crushing body 7 with vertical arrangement, and a pair of clinker crushing jaws of the clinker crushing body on the same chute 28 engages with each other, and crushes the clinker under driving force. In this embodiment, three cone-shaped jaws 8 are formed on each clinker crushing body with vertical arrangement, the cone angle of which is 60°-90°. And these jaws may provide larger pressure intensity than the jaws with flat top under the same driving force, so as to tightly grip on the large clinker with irregular structure and then crush it. In this embodiment, the driving device may be a hydraulic cylinder 22, which is supported by bottom ash hopper supporting structure 21 of the bottom ash hopper. Each clinker crushing component is driven by two hydraulic cylinders 22 in parallel connection with each other, and a pushing rod 23 is installed between each hydraulic cylinder 22 and each clinker crushing component 25, for transmitting the driving force. The hydraulic cylinder 22 is provided with a travel switch for controlling the length of travel of the clinker crushing body. It is also advantageous of the clinker crushing body 7 that the clinker crushing body 7 can be stopped working when the bottom ash conveyer shutdown, and then lump and clinker can be temporarily stored in the bottom ash hopper, so as to prevent too much lump and clinker from damaging the clinker conveyer. In addition, the guiding device which guides the clinker to drop into the area encompassed by the baffle plates 27 also may be with different structures which may facilitate the dropping of the clinker, for example, the guiding device can be composed of a plurality of guiding grooves, of which the cross section is U-shaped, and which are installed circularly along the baffle plates 27.

According to an additional preferred, an ash discharging device is installed in the area that is not covered by the baffle plates 26, which is under the impact bar 2. In the embodiment, the

ash discharging device may be an ash silo 15 with an ash discharging door, the ash silo 15 is able to store partial fly ash, in addition, the ash discharging door of the ash silo can be opened to discharge the fly ash, after a certain amount of fly ash accumulates in the ash silo 15. The ash silo 15 is for preventing the fly ash from accumulating in the space between the clinker case 9 and the clinker crushing body 7, which may affect the normal running of the device. The clinker case 9 also is provided with an observation hole 16, which is installed underneath the clinker crushing body 7. The operator can observe the state of the ash accumulating in the ash silo 15 from the observation hole 16, and also can open the door to clear the ash after a certain amount of ash accumulates therein.

The second embodiment of the invention is the same as the first embodiment, except that the end of the heat-resistant steel bars is provided with an internal screw thread, which matches the ringbolt, and the clinker crushing body may be cone-shaped, and the ash discharging device may be a discharging door installed on the clinker case, and the operator can open the door to discharge partial fly ash, after a certain amount of fly ash accumulates in the space between the clinker case and the impact bar.

The third embodiment of the invention is the same as the first embodiment, except that the heat-resistant metal rod may be a solid shaft, and two ends of the heat-resistant metal rod supported by the clinker case via two supporting beams and are fixed on the clinker case via stop means, i.e. each end of the heat-resistant metal rods passes through the hole of the cover 10, and a small hole whose orientation is perpendicular with that of the heat-resistant metal rods, formed on the segment of the heat-resistant metal rods, which exposes to outside of the clinker case; and a pin passes through the small hole and is installed therein, which combined with the cover, for restricting the axial movement of the heat-resistant metal rods.

The fourth embodiment of the invention is the same as the first embodiment, except that a stop means is installed at one end of the heat-resistant metal rods, one end of the heat-resistant metal rods passes through the hole of the cover, and a small hole whose orientation is

perpendicular with that of the heat-resistant metal rods is formed on the segment of the heat-resistant metal rods, which exposes to outside of the clinker case; and two metal rings are installed on the clinker case, and the axis of each ring is perpendicular with the heat-resistant metal rods, and a pin successively passes through one of the metal rings, the small hole of the heat-resistant metal rods and another metal ring, combining with the cover for restricting the axial movement of the heat-resistant metal rods, and the other end of the heat-resistant metal rods is sealed in the clinker case by the cover without the small hole.

While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims