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[54] **ROTARY KILN PROVIDED WITH SEAL MECHANISM**

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[51] **Int. Cl.²** **F27B 7/024**

[58] **Field of Search** 432/115, 111; 34/242

[56] **References Cited**

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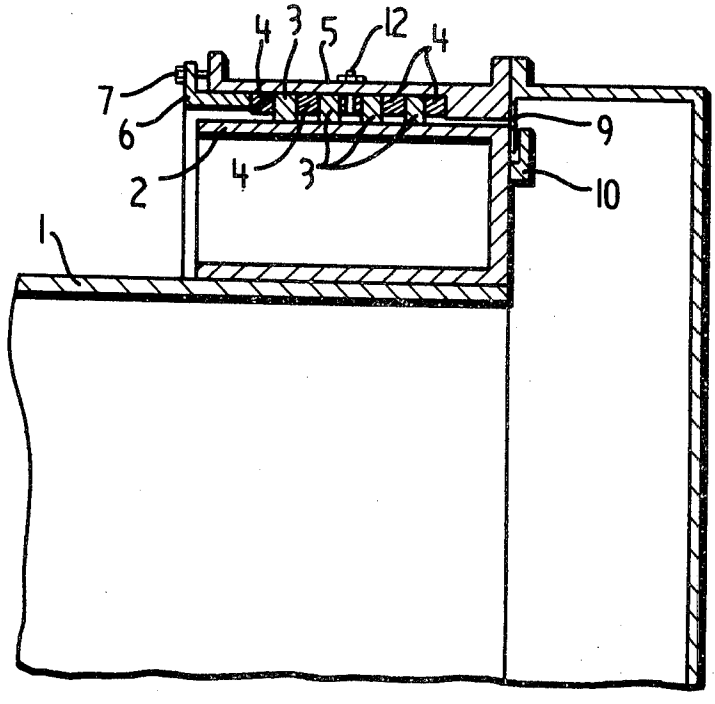
[57] **ABSTRACT**

A so-called rotary kiln in which a material is continuously heated by means of a rotatably supported cylinder is provided with a seal mechanism for blocking the outer air from the interior of the cylinder, hereinafter referred to as the "rotary kiln proper". The seal mechanism for the rotary kiln undergoes various adverse conditions involved inherently in the operation of the rotary kiln, such as vibration in the peripheral portion of the rotary kiln proper during rotation, thermal deformation, thermal elongation and contraction of the rotary kiln proper, continuous operation at high temperatures and the like. In the rotary kiln of this invention, improved air-tightness can be maintained stably even under such conditions, principally being achieved by the provision of an elastic member supporting the weight of a hood independently of the rotary kiln proper for preventing a deflected load from being imposed on the seal mechanism, and preferably, a specific seal mechanism especially fit for such an elastic member is employed.

4 Claims, 3 Drawing Figures



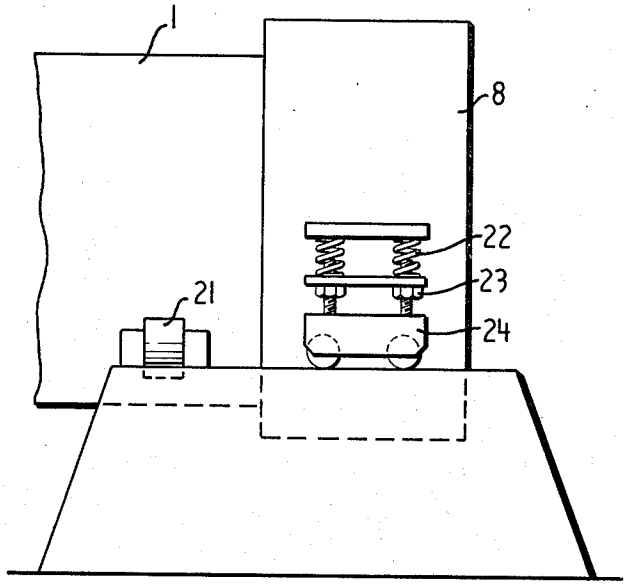


FIG. 1

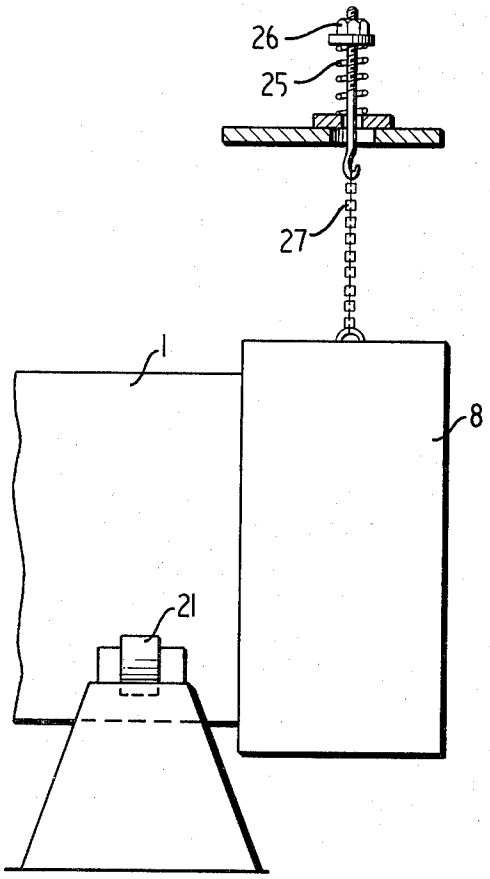


FIG. 2

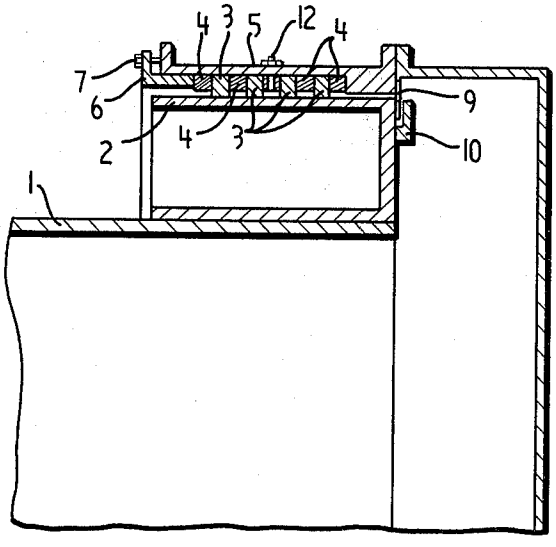


FIG. 3

ROTARY KILN PROVIDED WITH SEAL MECHANISM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to rotary kilns in which a material is continuously heated by means of a rotatably supported cylinder, and more particularly to an improved rotary kiln having a seal mechanism for providing a greater degree of air tightness of the cylinder than former kilns possessed.

Rotary kilns of the type characterized herein are broadly employed as effective heating kilns for the burning of cement and the calcination of lime and the like. In such rotary kilns, it is generally unnecessary to attain complete interception of the air currents from the interior of the kiln unless special articles or materials are being heat-treated therein. However, when such rotary kilns are used for the preparation of reduced pellets and in the thermal decomposition treatment of wastes, such as plastic and rubber wastes, it is necessary to completely block the outer air from the interior of the kiln proper by means of a seal mechanism in order to prevent the oxidation of such reduced pellets, the leakage of resulting gases or oils and the occurrence of an explosion which might be caused by the incorporation of air.

Various improvements have been made on the seal mechanism in connection with rotary kilns in which airtightness should be attained. In the case where such sealing is effected between the rotary kiln proper and a fixing member, because of poor rotation precision of the peripheral portion of the rotary kiln or thermal deformation and thermal elongation or contraction of the rotary kiln per se, a deflected load is discontinuously imposed on the sliding face of the seal mechanism. Further, since a non-metallic material constituting this sliding face is subjected to high temperatures during the operation, even if improved seal mechanisms are employed, they are readily destroyed in a short span of time. Accordingly, no rotary kiln that can be operated stably and continuously for a long period of time is now available. Especially, there are no rotary kilns now available having a great diameter rotary kiln proper in which a good seal can be attained stably when the operation is continued for a long period of time.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to provide a rotary kiln which can overcome the former problems characterized herein which are encountered in the conventional rotary kilns and in which an improved seal can be attained stably for a long duration.

Another object of the present invention is to provide a rotary kiln in which there is no deflected load discontinuously imposed on the seal mechanism of the kiln.

Still another object of the present invention is to provide a rotary kiln in which a mechanical seal per se is so disposed that no deflected load is imposed thereon, especially on a packing thereof composed of a non-metallic material.

A further object of the present invention is to provide a rotary kiln in which thermal deformation and thermal elongation and contraction of the rotary kiln proper do not adversely affect the seal mechanism of the device.

The foregoing and other objects are achieved according to the present invention through the provision of a rotary kiln which is characterized by a rotary kiln proper, a hood covering the end portion of the rotary kiln proper, a seal mechanism providing a seal between the rotary kiln and the hood, and an elastic member supporting the weight of the hood separately from the weight of the rotary kiln proper.

In the rotary kiln of the invention being constructed according to the specific teachings thereof, even if the precision of the rotation of the rotary kiln proper is poor at its peripheral portion, the hood follows the rotary kiln proper during such rotation and it is kept in the state of floating on the rotary kiln proper regardless of the vertical load, so that a deflected load is prevented from being imposed on the seal mechanism.

In a preferred embodiment of the invention, a metal ring is provided in the seal mechanism and the elastic member is disposed so that it can move in the direction parallel with the axial direction of the rotary kiln proper. In this embodiment the intended seal can be attained more effectively. More specifically, the metal ring improves the ability of the hood to follow after the rotary kiln and protects the non-metallic material of the seal mechanism. Further, the movement of the elastic member results in an absorption of the thermal elongation or contraction of the rotary kiln proper in the axial direction, and therefore, the stability of the seal mechanism is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the accompanying drawings, in which like reference numerals designate like or corresponding parts in the several views, and wherein:

FIG. **1** is a partial side view illustrating one embodiment of a rotary kiln constructed according to the present invention;

FIG. **2** is a partial side view illustrating another embodiment of a rotary kiln also constructed according to the teachings of the present invention; and

FIG. **3** is a partial sectional view illustrating an example of a seal mechanism to be used in the rotary kiln of the present invention and contructed according to the teachings thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The rotary kiln of the present invention may be either the internal heating type or the external heating type. In the accompanying drawing, the invention is illustrated by reference to embodiments concerning an external heating type rotary kiln to be used as an apparatus for thermally decomposing plastic or rubber wastes and for recovering oil or gaseous fuel, or useful materials such as carbides and the like.

Referring now to the drawings, and more particularly to FIGS. **1** and **2**, a rotary kiln proper **1** is shown being rotatably supported by a roller **21** and a hood **8** is disposed to cover an end portion of the rotary kiln proper. As is illustrated in FIG. **3**, a seal mechanism for providing a seal between the rotary kiln proper **1** and the hood **8** is formed from a double-cylinder sleeve **2** fitted integrally by soldering or the like to the end portion of

the rotary kiln proper **1**, a plurality of ring-like packings **3**, shown as being four in number, mounted on the periphery of the outer cylinder wall, and a plurality of corresponding metal rings **4**, shown as being five in number, being alternately arranged with the packing **3** on the double-cylinder sleeve **2**. These ring-like packings **3** and the metal rings **4** are secured within a ring member **5** fitted to the hood **8** by means of a clamping member **6** and a securing bolt **7** for adjusting the force of the binding packings **3**. A projection **9** and a control metal fitting **10** are mounted between the hood **8** and the sleeve **2**, respectively, so that the hood **8**, the ring member **5**, the metal rings **4** and the packings **3** can move along with any axial movement of the rotary kiln proper **1** which may be caused by the thermal expansion thereof. A grease nipple **12** is mounted on the ring member **5** and a lubricant, such as a heat-resistant grease, is fed therethrough on the sliding surface between the packings **3** and the metal rings **4** and the sleeve **2**.

In the embodiment shown in FIG. **1**, the hood **8** is shown being supported independently from the rotary kiln proper **1** through an elastic or resilient member composed of a plurality of springs **22**, a plurality of position-adjusting members **23** disposed in series with the elastic member and a moving truck **24** carrying the springs **22** and the position-adjusting members **23**.

In the embodiment shown in FIG. **2**, the hood **8** is supported through a spring **25**, apposition-adjusting member **26** and a chain **27**, and the hood **8** is likewise supported independently from the rotary kiln proper **1**.

In both embodiments, it can be seen readily from the drawings that the position-adjusting members may take the form of threaded bolts projecting through a plate and having nuts threadably secured on one side of the plate for varying the projection of the bolts through the plate, whereby the vertical disposition of the hood may be adjusted readily.

In the rotary kiln of this invention having such structure as described herein, even when the rotary kiln proper **1** is shaken through its rotation and the sliding face of the seal mechanism is displaced by such shaking of the rotary kiln proper **1**, the hood **8** follows the rotary kiln proper **1** without causing any deflected load on the sliding surface, and a good seal can thereby be attained stably for a long period of time. In order to further improve the followability of the hood **8** after the rotary kiln proper **1**, the metal rings **4** can be provided in the seal mechanism. By provision of these metal rings **4**, it is possible to prevent the deflected wearing of the packings **3**. More specifically, if either the position-adjusting member **23** or **26** is so regulated that the weight of the seal mechanism and the hood **8**, including the ring member **5**, is well balanced with the supporting force of the respective elastic member **22** or **25** when the hood **8** is at a proper position, then during the rotation of the rotary kiln proper **1**, the hood **8** can easily follow the rotary kiln proper **1** with a very small force and the force for supporting the structural members, such as the rotary kiln proper **1**, the hood **8** and the like, is not transmitted through the sliding surface to the seal mechanism. Further, if the above-mentioned metal rings **4** are employed, even the small force indicated herein is not imposed on the packings **3** in a deflected manner, and the sliding face or surface of the seal mechanism can be maintained in good condition.

Moreover, since the hood **8** is so disposed that it can move in the direction parallel to the axis of the rotary kiln proper **1**, it is not at all influenced by thermal elongation or contraction of the rotary kiln proper **1**. Namely, a good seal can therefore be attained stably without changing the relative positions of the sleeve **2** and the seal mechanism.

Obviously many modifications and variations of the present invention are possible in light of these teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and intended to be covered by Letters Patent is:

1. A rotary kiln provided with a seal mechanism, comprising:

a rotary kiln proper;

a hood covering one end portion of said rotary kiln proper;

a seal mechanism providing a seal between said rotary kiln proper and said hood which has metal rings, packings, and means for lubricating the sliding faces of said metal rings and packings;

an elastic means for supporting the weight of the hood independently of said rotary kiln proper; and

a position-adjusting means connected to said elastic means for vertically adjusting the hood supported thereby.

2. The rotary kiln set forth in claim **1** which further comprises:

a moving truck supporting said elastic means for moving said elastic means in a direction parallel to the axial direction of said rotary kiln proper.

3. The rotary kiln set forth in claim **1**, wherein said hood is suspended through said elastic means and said position-adjusting means.

4. The rotary kiln set forth in claim **1**, wherein said metal rings and packing are arranged alternately.

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