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Roberts

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[54] **KILN SEAL**

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[52] **U.S. Cl.** **287/189.36,** 34/242, 432/115

[51] **Int. Cl.**.....**F27b 7/24**

[58] **Field of Search** .....263/32 R, 33 R; 34/242

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

1,201,999 1/1960 France 263/32

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Attorney—Pennie, Edmonds, Morton, Taylor & Adams

[57] **ABSTRACT**

An end seal for a rotary kiln having axial-reference centering means.

6 Claims, 2 Drawing Figures

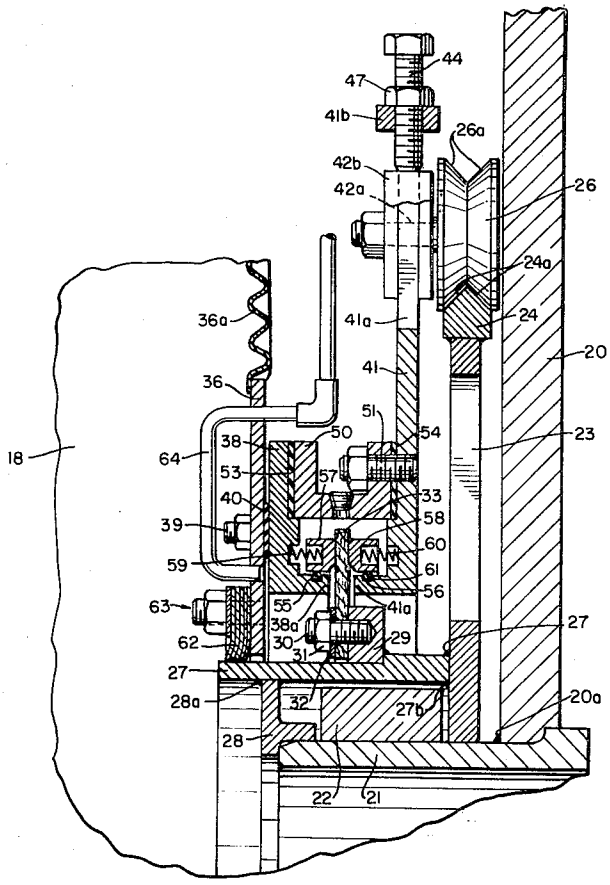


FIG. 1

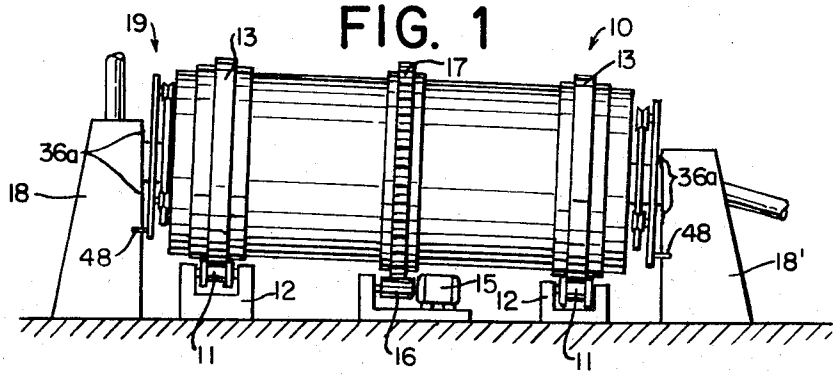
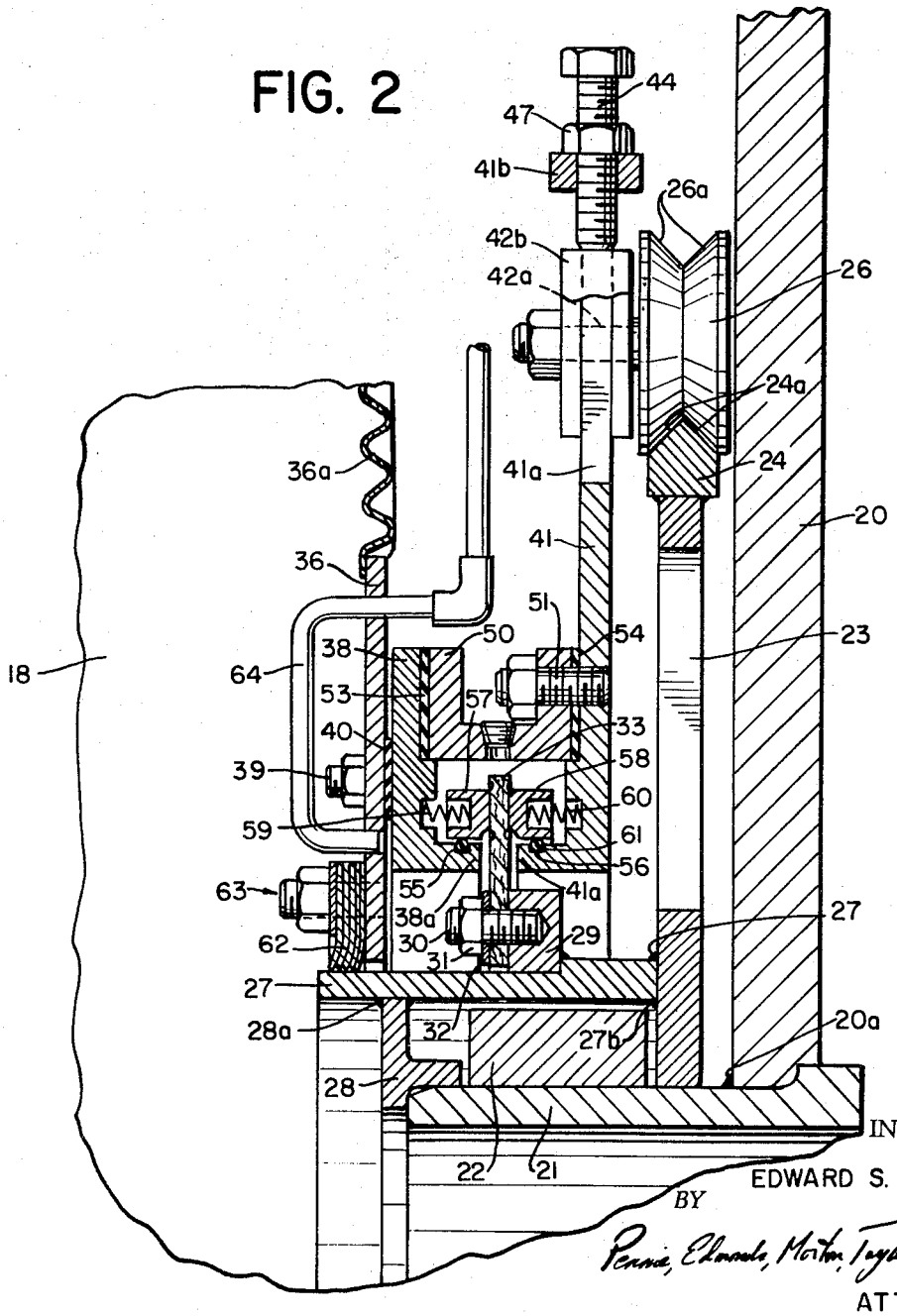


FIG. 2



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KILN SEAL

BACKGROUND OF THE INVENTION

Rotary kilns frequently require that an effective seal be maintained between stationary apparatus through which the kiln is fed or discharged and the rotating kiln itself. Such is necessary, for example, when an appropriate atmosphere must be maintained within the kiln while the material therein is heated and processed.

Rotary kilns of this type may be extremely large, and may reach diameters of 15 feet or more and lengths of over 20 feet. Since the kiln end plate may be subject to considerable thermal expansion and contraction with consequent movement of the axis of rotation, sealing between the relatively moving parts becomes a difficult problem. Various solutions have been proposed such as that of U.S. Pat. No. 1,460,764 involving the use of a stuffing box having resiliently biased packing rings or the use of a movable sealing ring proposed in U.S. Pat. No. 1,794,454. However, none of these seals solves in an entirely satisfactory manner, the complex problem of sealing large rotating kilns about an axis which is variable in position due to thermal expansion and contraction of the kiln.

It is the purpose of the present invention to provide a solution to this problem.

SUMMARY OF THE INVENTION

In accordance with the present invention, an end seal for a rotary kiln comprises a first seal assembly or portion which is fixedly secured to and rotatable with the kiln inlet and a second seal assembly which is stationary with respect to the kiln and the rotary seal assembly. The stationary seal assembly has connected to it a plurality of rollers which support and center this seal assembly relative to the axis of the rotation of the kiln. Between the stationary and rotary portions of the seal is an annular seal element secured to the rotary portion of the seal and maintained in close sealing contact with the stationary portion of the seal by spring mounted shoe means.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a side elevation of a rotary kiln incorporating the seal of the present invention; and

FIG. **2** is a cross-section of essential parts of the seal of the present invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

With reference to the drawing and initially to FIG. **1** thereof, a rotary kiln **10** incorporating the kiln seal of the invention has been illustrated. The kiln **10** is of the conventional cylindrical drum type having a refractory lining and internal gas-fired heating means (not shown). The kiln is supported at each end upon rollers **11** journalled in trunnions **12**, the rollers engaging circumferential ring supports **13**. Rotation of the kiln **10** is accomplished by a motor **15** which drives the pinion **16** engaging a bull gear **17** secured to the kiln. Inlet and outlet housings **18** and **18'** enclose respective feed and outlet transport mechanisms (not shown) for supplying the kiln with raw material and for withdrawing processed material therefrom. Seals **19** constructed according to the present invention are located about both the inlet and outlet of the kiln, the construction and function of which will now be described.

With reference to FIG. **2**, a portion of an end plate **20** of the kiln **10** has been illustrated. The plate **20** is connected by suitable welding **20***a* to a generally cylindrical member **21** which defines the feed inlet opening to the kiln. The member **21** has its axis coincident with the axis of rotation of the kiln **10**. Reinforcement **22** is secured to member **21** for strength and stiffening. Extending generally perpendicularly from the member **21** and welded thereto, is a large circular pate **23** (apertured for weight reduction) having an outer section **24** which has beveled machined edges **24***a*. This permits a plurality of centering rollers **26** having similarly inclined machined surfaces **26***a* to ride thereupon for reasons which will be described.

A cylindrical member **27** extends outside and parallel to inlet member **21** and is welded at **27**a to plate **23**. Cylindrical member **27** is further secured to the end of inlet member **21** through intermediate support **28** by the welds shown at **28***a*. A seal mount **29** is welded to the cylinder **27**. Secured to said seal mount by means of threaded studs **30**, nuts **31** and washer **32** is a flat annular seal element **33**. The seal element **33** is advantageously of a suitable longwearing, tough sheet material comprising fabric impregnated with teflon.

Thus far the elements described with exception of the roller **26** are rigidly secured to the inlet member **21** and rotate with the kiln.

The stationary portions of the seal will now be described. These include plate **36** which is connected by means of a flexible corrugated connection **36***a* or other flexible means in sealed relation to housing **18** for a feed mechanism (not shown). The plate **36** is fastened to an annular ring **38** by studs or bolts **39**. Washer seal **40** prevents leakage between the plate **36** and ring **38**. Another and opposing ring **41** extends radially outwardly and is slotted at **41***a* to receive the shaft **42***a* of roller **26**, which is attached to slidable block mount **42***b*. Three such centering rollers **26** advantageously are provided equally spaced about the periphery of plate **23**. The roller **26** can be adjusted radially by means of a screw **44** which is threaded through a nut **41***b* secured to the periphery of the ring **41** and which bears upon block **42***b*. Lock nut **47** prevents rotation of screw **44** once the positioning of the roller **26** has been made. The ring **41** is held against rotation (see FIG. **1**) by an arm **48** engaging a stationary stop to prevent rotation of the ring **41** and of the elements connected thereto.

Intermediate the ring members **41** and **38** is an annular member **50** (U-shaped in cross-section) secured by studs or bolts **51** to ring **41** and by like studs or bolts (not shown) to ring **38**, and maintained in sealing relation to members **38** and **41** by seals **53** and **54**. Near their inner peripheries, the ring members **38** and **41** are provided with facing axially extruding flanges **38***a* and **41***a* which are grooved for receiving O-rings **55** and **56**. These provide a seal between the members **38** and **41** and between two opposing shoes **57** and **58** which are urged toward each other and against the opposite faces of the seal **33** by springs **59** and **60**. Oil under pressure may if desired be introduced into the annular space about the shoes **57**, **58** through an inlet **61** to lubricate the seal and by its pressure on the shoes to aid in holding them against the seal element **33**.

The invention further provides a wiper sealing element **62** secured to the ring **38** by studs and washer

combination **62**. The purpose of wiper element **62** is to prevent the dust from the housing **18** or kiln from penetrating into the interior of the seal. To further preclude such possibility, a positive gas pressure may be maintained within the seal by conducting a gas at above atmospheric pressure through the conduit **64** which opens to the interior of the seal at **64***a*.

The operation of the kiln seal is as follows: Each of the rollers **26** is first adjusted radially by setting screws **44** to bring rollers **26** into close contact with section **24** of plate **23**. Thus, the stationary parts of the seal connected to ring **41** are centered with respect to the kiln axis of rotation as determined by the circumference of section **24** which is a coincident reference extension of such axis.

The end wall **20** of the kiln may expand or contract due to thermal forces, thereby raising or lowering the axis of rotation of the kiln. However throughout such expansion and contraction the stationary portions of the seal **19**, due to the interconnection through rollers **26** to the rotating portions, will continue to be centered with respect to the rotational axis of kiln **19**. Effects of thermal expansion or contraction of the seal elements themselves are minimized, since both the stationary and rotating portions of the seal are connected directly or indirectly to the inlet member **21** which in turn is quite close to the rotational axis of the kiln. The seal elements are therefore divorced substantially from the large thermal expansion and contraction to which the kiln proper is subject.

It will be understood that the foregoing description has related to a particular embodiment of the invention and is therefore only representative. In order to appreciate fully the scope of the invention reference should be made to the appended claims.

What is claimed is:

1. A seal for a rotary kiln having nozzle means defining an opening therein comprising a movable seal portion fixedly attached to said nozzle for rotation therewith, seal mounting means in said movable seal portion, a stationary seal portion, seal mounting means in said stationary portion, a seal element in sealing engagement with each mounting means, one of said seal mounting means permitting relative movement of said seal element between said rotating and stationary seal portions, and centering means comprising a circular plate connected to said rotation portion of the seal and extending perpendicular to the kiln axis, said stationary seal portion including a plurality of rollers contacting the periphery of said plate to transmit to said stationary seal portion radial movements of said rotating seal portion.

2. The seal according to claim **1** wherein said inlet nozzle is rigidly and perpendicularly secured to said rotating plate, said stationary seal portion includes a member extending parallel to said rotating plate mounting said rollers and means for adjusting said rollers radially with respect to said rotating plate.

3. The seal according to claim **1** wherein one seal element is an annular member of flexible wear-resistant sheet material secured to one of the seal mounting means and the other seal element comprises a pair of opposed annular shoes secured to the other seal mounting means and pressing against opposite faces of said flexible sheet material.

4. The seal according to claim **3** wherein said stationary seal portion supports the opposing shoe elements in fluid-tight engagement therewith, spring means maintain said shoes in contact with said flexible seal element, and means secure said flexible seal element in fluid-tight engagement with said rotating seal portion.

5. A seal for a rotary kiln having nozzle means defining an opening therein comprising a movable seal portion fixedly attached to said nozzle for rotation therewith, seal mounting means in said movable seal portion, a stationary seal portion, seal mounting means in said stationary portion, a seal element in sealing engagement with each mounting means, one of said seal mounting means permitting relative movement of said seal element between said rotating and stationary seal portions, means for maintaining said stationary seal portion in central relation to the axis of rotation of said kiln despite displacement of said axis with contraction and expansion of said kiln, a stationary housing for a kiln feed mechanism, and the like, and an inlet nozzle to said kiln, a part of the stationary portion of said seal being flexibly mounted to said housing for sealing the area between said housing and said inlet nozzle, the remainder of said stationary seal portion being connected to rollers which roll on the peripheral edge of a circular member which is fixed to, and substantially concentric with, said kiln, each of said stationary seal parts mounting one of said opposing shoe elements.

6. The seal according to claim **5** wherein a wiper seal is provided between the rotating seal portion and said stationary portion, and means are provided for introducing between said stationary and rotating seal portions and said seal element and said wiper seal a gaseous atmosphere at a positive pressure within said seal.

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