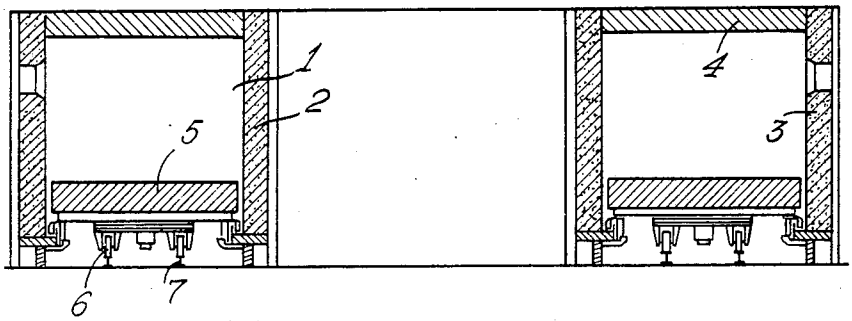
Nov. 23, 1965 J. R. GUINGAND 3,219,332

SEAS FOR ROTARY HEARTH FURNACES

Filed Nov. 27, 1961

Fig. 1.



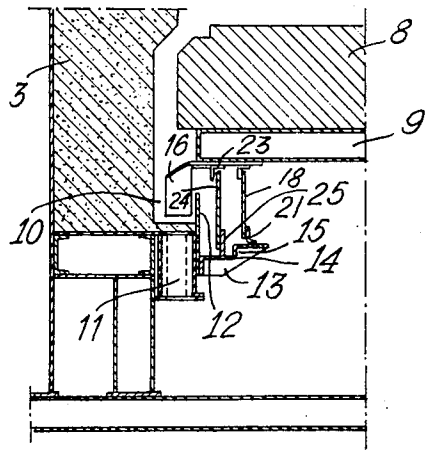


Fig. 2

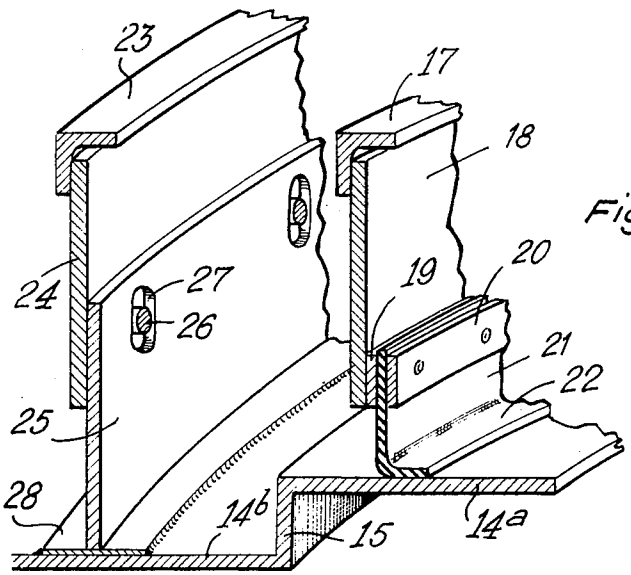


Fig. 3

United States Patent Office 3,219,332
Patented Nov. 23, 1965

3,219,332

SEAL FOR ROTARY HEARTH FURNACES

Jean Raymond Guingand, Paris, France, assignor, by mesne assignments, to Societe Anonyme Heurtey, Paris, France

Filed Nov. 27, 1961, Ser. No. 155,156
Claims priority, application France, Nov. 28, 1960, 845,220, Patent 1,281,330
11 Claims. (Cl. 266—18)

The present invention relates to seals for rotary hearth furnaces and more particularly to a dry seal for such a furnace.

In rotary hearth furnaces, when it is required to ensure tightness between the hearth and the side walls, this has generally been achieved by means of sand seals or hydraulic seals.

Sand seals, however, lack impermeability, while hydraulic seals, though absolutely tight, entail the use of relatively complex equipment, which may create chill zones which may in turn affect the furnace temperature or even cause the formation of steam, which is often undesirable and sometimes detrimental.

The chief aim of the present invention is to overcome the drawbacks of the above type of seals.

With this end in view, a dry seal according to the invention comprises at least one flexible-lipped skirt constituting a tightening skirt of which an elastically deformed part is applied against a bearing surface, and at least one second skirt protecting the first, in which contiguous mobile elements are in rubbing contact with a chafing ring on said bearing surface, said second skirt being designed mainly to screen the first skirt from heat and dust.

In a preferred embodiment, the bearing surface is provided with at least one step which assists in trapping dust which step is located between the chafing ring and the area contacted by the deformable lip in order to further improve the degree of protection against dust or such extraneous matter as oxide scale or splits, or pieces of refractory, for example.

The bearing surface of the seal is preferably associated with a channel that acts as a dust trap and is provided with hoppers that are designed to receive the dust and can easily be emptied periodically, said channel being preferably swept continuously by associated movably driven scrapers.

In a further embodiment of the invention, the bearing surface, the channel and the hoppers are rigid with stationary parts of the furnace, while the skirts and the scrapers are mounted beneath a furnace-hearth bearer, and hence on a moving part. Alternatively, a converse arrangement may be adopted.

In the case of an annular furnace, such seals are provided on each side of the hearth in order to provide the charge-chamber with the required tightness.

Seals of this type may comprise a plurality of skirts, between which it is further possible to maintain a slight overpressure for the purpose of ensuring, by the use of a smoke or an atmosphere gas for example, a degree of protection with improved sealing and enhanced reliability, that may be monitored if required.

The description which follows with reference to the accompanying drawing, filed by way of example and not of limitation, will give a clear understanding of how the invention may be carried into practice.

In the drawing:

FIGURE 1 is a diametrical sectional view of an annular rotary hearth furnace, showing the location of the seals.

FIGURE 2 is a sectional detail view of the disposition of the seal between an outer wall and the corresponding edge of the hearth.

FIGURE 3 is a fragmentary perspective view of the seal detail in FIGURE 2.

Referring now to FIGURE 1, the furnace shown therein is an annular furnace the charge-chamber **1** of which is disposed between an inner cylindrical wall **2** and an outer cylindrical wall **3** with an associated arch **4**, the bottom of the charge-chamber **1** being closed by a movable annular hearth **5** adapted to revolve on suitable moving bearings comprising rollers **6** adapted for rolling movement along a circular track **7**. The hearth **5** consists of a refractory facing **8** resting on a bearing **9** to which the said rolling gear **6** is secured.

The bottoms of the walls **2** and **3** are provided with annular channels **10** constituting dust traps, the bottom of which are perforated from place to place and communicate with corresponding hoppers **11**. On its side nearer to the center of the charge-chamber, each channel **10** is bounded by a wall **12** raised above the level of the channel bottom, and said wall carries through the medium of supports **13** an annular bearing surface **14** which is provided with a circular step **15** serving to elevate the inner portion **14***a* of said bearing surface, to wit the portion remote from the furnace wall **3** (or **2**), as opposed to a portion **14***b* that is closer thereto.

The bearer **9** is rigid with scrapers **16** formed as known by blades movably driven by bearer **9** in channel **10** to sweep said channel **10** and conduct dust or other impurities through the perforations (not shown) in the channel **10** to the hoppers **11**. Said bearer is equipped with a circular angle bracket **17** from which is suspended a tightening skirt **18** located above the surface **14***a*, and the lower edge of the skirt **18** supports a pair of rings **19** and **20** between which is clamped a cylindrical diaphragm **21** made of flexible and elastic material such as rubber. The joints between the bearer **9** and the bracket **17**, between the bracket **17** and the skirit **18**, and between the skirt **18** and the diaphragm **21** are sealed joints. This assembly is designed so that the diaphragm **21** contacts the bearing surface **14***a* through a flattened portion **22** which is directed inwardly or outwardly accordingly as the pressure of the outside atmosphere is less or greater than that of the atmosphere in the charge-chamber **1**. The disposition shown in FIGURE 3 corresponds to an outside pressure slightly higher than that prevailing in the charge-chamber **1**, and the position **22** is bent towards the higher pressure.

The bearer **9** is further provided, with a second circular bracket **23** to which is fixed a second, protecting skirt. The latter skirt includes a cylindrical element **24** which is associated, through the instrumentality of a sliding assembly, to cylindrical segments **25**, and in the example illustrated these contiguous segments are connected to the element **24** through the medium of tenons **26** which are rigid therewith and which co-operate with mortises **27** provided in each segment, said mortises being cut parallel to the generators of the corresponding cylinders. The bottom arcuate face of each segment **25** is supported on an annular chafing plate **28** welded to the bearing surface **14***b*.

The two seals flanking the hearth **5** are formed identically and concentrically, with their like parts disposed opposite one another.

On the charge-chamber side, the scrapers **16** passing in the channels **10** sweep the dust and other impurities therefrom into the hoppers and thereby prevent most of the dust or other extraneous matter from passing the partition **12**. The hoppers **11** are periodically emptied of accumulated material. Any impurities finding their way past the channels, however, are arrested by the corresponding element **24** and segments **25** since said con-

tiguous segments are applied against the element **24** and against the annular chafing plate **28** and said element constantly masks the mortises **27**.

Any ultimately subsisting extraneous matter can still be retained by the step **15**, so that the quality of the contact between the lip **22** and the surface **14***a* is effectively protected against possible deterioration and therefore remains thoroughly tight.

The diaphragm **21** and the lip **22** are furthermore protected thermally by the element **24** and the segments **25**.

The various arrangements described hereinbefore may be considerably modified without departing from the scope of the invention. In the case of a furnace with a circular hearth, a single seal of this type could be provided over the periphery. Similarly, should it be necessary to ensure an even higher order of tightness, such a seal could have a larger number of skirts, and particularly of skirts provided with a flexible lip. It would also be possible to introduce an intermediate fluid between said skirts, and, after setting the fluid under controlled overpressure or underpressure in the thus formed space, to use the fluid to provide a sealing barrier which rould additionally be monitored. Such an intermediate fluid may consist either of cooled smoke or atmosphere gas.

What I claim is:

1. A dry seal for a rotary hearth furnace comprising at least one tightening skirt having an elastically flexible lip, a corresponding bearing surface upon which a deformed part of said flexible lip is slidably applied, said bearing surface including a step in the vicinity of the portion of said bearing surface upon which is applied said deformed part of said lip, at least a second skirt spaced from the first skirt and including coaxial cylindrical segments contiguously supported in axially slidable overlapping relation, and a chafing ring on said bearing surface upon which are applied in rubbing contact said cylindrical segments, said chafing ring being located opposite said step on a side thereof away from said portion on which is applied said lip.

2. A dry seal for a rotary hearth furnace comprising at least one tightening skirt having an elastically flexible lip, a corresponding bearing surface upon which a deformed part of said flexible lip is slidably applied, said bearing surface including a step in the vicinity of the portion of said bearing surface upon which is applied said deformed part of said lip, at least a second skirt spaced from the first skirt and including coaxial cylindrical segments contiguously supported in axially slidable overlapping relation, a chafing ring on said bearing surface, upon which are applied in rubbing contact said cylindrical segments, said chafing ring being located opposite said step on a side thereof away from said portion on which is applied said lip, and a trap adapted for retaining dust and other extraneous matter, said trap having the form of a channel situated in the vicinity of said chafing ring on a side thereof opposite the tightening skirt whereby the second skirt constitutes a protecting skirt for the first said skirt as regards passage of dust and other extraneous matter from the trap to said first skirt.

3. A dry seal for a rotary hearth furnace comprising at least one tightening skirt having an elastically flexible lip, a corresponding bearing surface upon which a deformed part of said flexible lip is slidably applied, a step in said bearing surface in the vicinity of the portion of said bearing surface upon which is applied said deformed part of said lip, at least a second skirt including coaxial cylindrical segments contiguously supported in axially slidable overlapping relation, a chafing ring on said bearing surface, upon which are applied in rubbing contact said cylindrical segments, said chafing ring being located opposite said step on a side thereof away from said portion on which is applied said lip, a trap adapted for retaining dust and other extraneous matter, said trap having the form of a channel situated in the vicinity of said chafing ring on a side thereof opposite the tightening skirt whereby the second skirt constitutes a protecting skirt for the first said skirt as regards passage of dust and other extraneous matter from the trap to said first skirt, movable scrapers in said channel for sweeping the same, said channel being provided with apertures and collecting hoppers under said apertures.

4. A dry seal according to claim **3** in which said channel, hoppers and bearing surface are rigid with stationary parts of the furnace, whereas said scrapers and skirts are rigid with a movable part thereof.

5. In a rotary hearth furnace having a charge chamber defined by inner and outer cylindrical walls and a movable hearth in said chamber: dry seals for said chamber adjacent each of said walls, said furnace including a movable bearer supporting said hearth, each dry seal comprising a bearing surface opposite said movable bearer, a tightening skirt supported from said bearer and including a flexible lip in deformed sliding contact with said bearing surface, and a protecting skirt supported from said bearer between the first said skirt and the wall corresponding thereto, said skirts both respectively forming seals between the bearer and the bearing surface opposite thereto.

6. In a furnace as claimed in claim **5** wherein said bearing surface includes a step between said skirts.

7. In a furnace as claimed in claim **5** wherein each wall is provided with a channel adjacent the dry seal therefor, and scrapers supported on said bearer for moving in said channels for sweeping dust and impurities therefrom.

8. In a furnace as claimed in claim **7** wherein each channel is provided with apertures through which said dirt and impurities is swept, the furnace further comprising hoppers beneath the apertures for receiving the dust and impurities.

9. In a furnace as claimed in claim **7** wherein said skirts extend parallel to one another, said channels being at a higher level than said bearing surface of the seal, each of said walls including a wall element bounding said channel thereof and extending above said bearing surface of the associated seal.

10. In a furnace as claimed in claim **5** wherein the protecting skirt of each of said seals includes a pair of slidably adjustable elements and means adjustably securing said elements together.

11. In a furnace as claimed in claim **10** comprising a chafing plate supported on said bearing surface of each of the seals, one of the slidably adjusting elements resting in sealing sliding fashion on the chafing plate.

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JOHN F. CAMPBELL, *Primary Examiner.*

RAY K. WINDHAM, JAMES H. TAYMAN, JR., MORRIS O. WOLK, *Examiners.*