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ROTARY KILN THERMOCOUPLE COLLECTOR RING AND BRUSH ASSEMBLY

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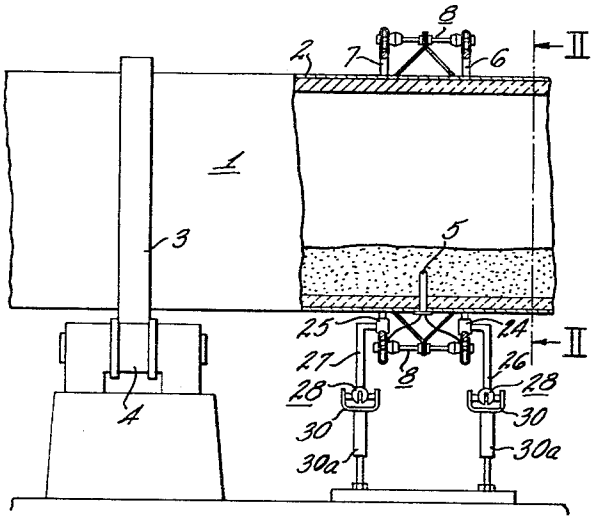


Fig. 1

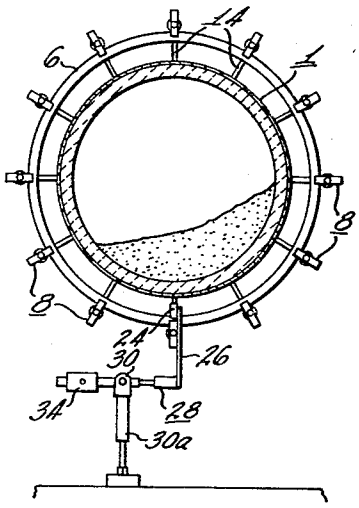


Fig. 2

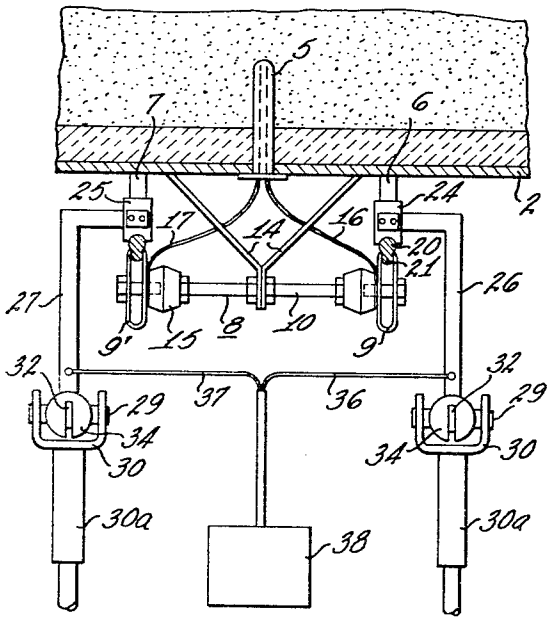


Fig. 3

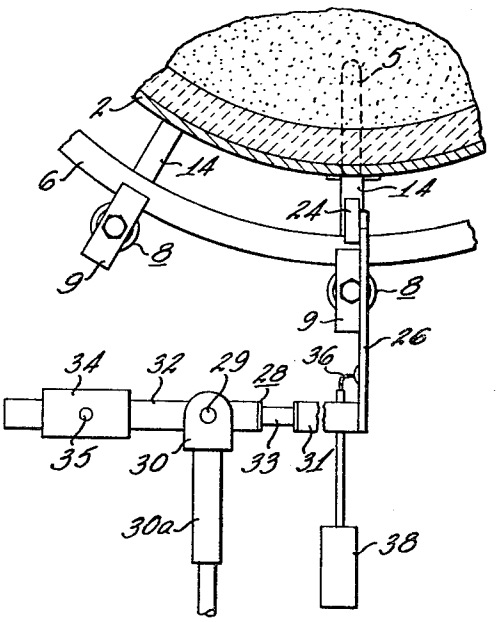


Fig. 4

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ROTARY KILN THERMOCOUPLE COLLECTOR RING AND BRUSH ASSEMBLY

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ABSTRACT OF THE DISCLOSURE

A collector ring attached around a rotary kiln for temperature indicating signals generated by a thermocouple projecting into the kiln, and a stationary signal pickup brush beneath the kiln and inside the rotating ring with the brush having a downward facing concave surface riding on an upward facing convex surface of the rotating ring.

A rotary kiln internal temperature signaling thermocouple and signal collector ring assembly is shown in U.S. Patent No. 2,303,843, granted Dec. 1, 1942. In the arrangement disclosed in that patent, a pair of signal pickup brushes are arranged in a stationary position above the kiln to ride upon flat external contact surfaces of collector rings mounted around the kiln to rotate with the kiln. Such flat contact surfaces are, however, never truly perfactly flat and always have some slightly concave areas that collect dirt, brush material and moisture from rain to which the assembly is exposed. Thermal expansion and contraction of a kiln shell can move the rings slightly relative to the brushes resulting in the brushes riding off a path worn clean and on to a relative dirty surface. This results in changing resistance to the passage of the electrical temperature indicating signal which then becomes erratic and an unreliable indication of temperature changes taking place within the kiln. Collector ring systems have been further developed in which the contact surface of the ring, as viewed in cross section, presents a semicircular convex configuration to contact a concave grooved surface in a brush. Such systems have been provided with surface cleaning means in advance of the signal pickup brushes and have provided substantially improved reliability affected only by a substantial rainstorm whereas a few drops of rain adversely affected the system previously described. However, in many areas kilns are exposed to occasional heavy rainstorms and, therefore, further increases in reliability are desired by kiln operations and to provide further improvements of such nature is the primary object of the present invention.

Other and more specific objects of the present invention include providing a new and improved assembly of parts that can be formed, assembled and operated to indicate with improved reliability the temperature and temperature changes occurring within a rotary kiln.

According to the present invention, the brushes are arranged beneath the kiln and inside the collector rings. The brush has a downwardly facing concave surface riding on an upward facing convex surface of the ring. Thus, rain that falls upon the portion of the ring above the kiln will tend to flow downwardly, as the kiln rotates and this portion of the ring approaches the brushes beneath the kiln, and in flowing downward the rainwater will then be moving away from the brush contacting surface of the ring. At such time, this portion of the ring has been carried to a position beneath the kiln where it is protected from additional rain falling thereupon until after this portion of the surface has made contact with and passed beyond the brush. In order to provide for easily bending a ring material into a circle without kinks or other surface imperfections that might tend to collect and hold rain,

the rings are made of a material called figure-8-wire formed into a ring and supported on the kiln in a special way that will be described. This type of wire is so named because in cross section it appears as two adjacent circular portions joined together and thus resembles a figure 8. One portion is, therefore, available for engaging a brush while another portion is available to be held by clamps to support the ring on the kiln circumference. Clamps can get a good grip on such a portion of the ring without interfering with the engagement of the brushes with the other portion of the ring. The two circular portions of the wire are not, however, of equal diameter, that is, one is larger in circular cross section than the other. A collector ring is formed from such a wire with the larger portion of the figure 8 being on the radially inward side of the ring to engage the brush and the smaller portion is then on the radially outward side of the ring to engage with clamps of the ring supporting structure. The manner which this arrangement is supported and contributes to the attainment of the objects of this invention will be explained with reference to the drawing in which:

FIG. 1 is a fragmentary side view, partly in section, of a rotary kiln assembly according to the present invention;

FIG. 2 is a view in section taken along line II—II in FIG. 1 as seen in the direction indicated by arrows;

FIG. 3 is a portion of FIG. 1 to enlarged scale; and

FIG. 4 is a portion of FIG. 2 to enlarged scale.

Referring to FIG. 1, there is shown a portion of a rotary kiln **1** which has a shell **2** provided with a riding ring **3** mounted on the usual rollers **4** so that the kiln may be rotated about its central axis by means (not shown).

In order to measure temperature and temperature changes within the kiln a temperature sensing means is provided which may be a thermocouple **5** mounted to project through the shell **2**.

Annular collector rings **6** and **7** are arranged and supported concentrically in radially spaced position around shell **2** to rotate therewith. A plurality of holding means **8** for engaging the rings **6** and **7**, are arranged around the entire periphery of shell **2** as best shown in FIG. 2. Referring to FIG. 3, each holding means **8** has a clamp **9** holding a radially outer portion of each of the rings **6** and **7**. The holding means **8** has a clamp support **10** connected to the clamp **9** and extending therefrom parallel to the central axis of shell **2**. A plurality of arms **14** are connected on an end thereof to the kiln shell **2** and project radially outward as shown in FIG. 2 and FIG. 4. As shown in FIG. 1 and FIG. 3, the arms **14** are between the radial planes defined by rings **6** and **7** and each is connected on its outer ends to a clamp support **10** of the holding means **8**. Each support **10** is an assembly of parts including an insulator **15** so that no electrical circuit is established from clamp **9** that holds a ring **6**, through support **10** and arms **14** to the kiln shell **2**. As shown in FIG. 3, one of the clamps **9** holding ring **6** is connected by a conductor **16** to the thermocouple **5** and one of the clamps **9'** holding ring **7** is connected by a conductor **17** to the thermocouple.

Each of the rings **6** and **7** comprise a circle of figure-8-wire. As shown in FIG. 3, this wire is so named because the cross-sectional configuration is that of two circular portions **20** and **21** joined together. The circular portions **20**, **21** are of unequal diameter and the rings **6**, **7** are so formed that the circular portion **20**, which is of larger diameter, is radially inward of the portion **21** which is somewhat smaller. It is desired that each ring **6**, **7** define a circle about shell **2** that has an inner periphery that presents as smooth and as true a circular surface as possible. It has been discovered to be easier to form the desired shape with the larger portion **20** on the inside of the ring than if the larger portion forms the outside of

the ring. This is because the outer portion **21**, which requires greater deformation, not only has less mass to be deformed but its deformation is in tension whereas the inner portion **20** is deformed in compression. Deformation by tension requires less force than by compression, and deformation of a small diameter portion requires less force than a large diameter portion. Thus, the smaller portion being deformed in tension on the outside of a ring provides less resistance to forming a smooth, true circle on the inside of the ring than would be the case if the positions of the two portions **20**, **21** were reversed. In the described assembly, it is not important that the outside of the ring be smooth and a true circle because that portion of the ring merely provides mass and surface to be engaged by the clamps **9**. It is, however, desired to provide as smooth and true an inner surface as possible for each ring because it is that surface that provides a track for brushes to ride upon according to the description to follow.

Signal pickup brushes **24**, **25**, most clearly shown in FIG. 3 and FIG. 4, are provided beneath the kiln shell **2** in the unobstructed space between the kiln shell and each of the rings **6**, **7**. Each brush **24**, **25** is provided with a concave underside to ride upon and engage the convex top side of each ring at this location beneath the kiln shell. As shown in FIG. 3, each brush **24**, **25** is mounted on an inverted L-shaped holder **26**, **27**. Referring to FIG. 4, the holder **26** is attached to one end of lever **28** supported by a pivot **29** passing through lever **28** and a Y-shaped yoke **30** on top of a post **30***a*. The lever **28** comprises segments **31**, **32** separated by an insulator **33**. A counterweight **34** is slotted to fit over segment **32** of lever **28** and a set screw **35** is provided to secure the counterweight **34** in a position on segment **32** selected to counterbalance a desired portion of the downward force on ring **6** caused by the weight of brush **24**, holder **26**, segment **31**, insulator **33** and the portion of segment **32** on the brush side of pivot **29**. Thus, the brush **24** can be caused to ride lightly on ring **6** with minimum wear to the brush. Conductors **36**, **37** can be connected to holders **26**, **27** respectively, as shown in FIG. 3, to complete signal transmitting connections from thermocouple **5** through conductors **16**, **17**, clamps **9**, **9'**, rings **6**, **7**, brushes **24**, **25**, brush holders **26**, **27** and conductors **36**, **37** to an indicating or recording instrument **38**.

From the foregoing detailed description of the present invention it has been shown how the objects of the present invention have been attained in a preferred manner. However, modifications and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included in the scope of this invention. Thus, the scope of this invention is intended to be limited only by the scope of the claims such as are, or may hereafter be, appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a rotary kiln assembly having a cylindrical shell supported for rotation about its central axis, internal temperature sensing means mounted to project through the shell, and an annular collector ring arranged concentrically in radially spaced position around said shell, wherein the improvement comprises a plurality of holding means radially outward of the inner periphery of said ring and each having a clamp grasping a radially outer portion of said ring and a clamp support extending from said clamp parallel to said central axis, a plurality of arms connected to the periphery of said shell and projecting radially outward therefrom, said arms being axially spaced away from the radial plane defined by said ring and connected on their outer ends to said clamp support to thereby support said ring for rotation with said kiln and define an unobstructed annular space between said inner periphery of said ring and said shell, electrical signal conducting means connecting said ring to said temperature sensing means, and a stationary signal pickup brush beneath said kiln in said unobstructed space radially inward of said rotating ring, said brush having a downward facing surface riding on an upward facing surface of said ring.

2. In an assembly according to claim **1** said ring comprising a figure-8-wire having a cross-sectional configuration of two adjacent circular portions joined together, said wire defining said ring with both said circular portions in the same radial plane placing one circular portion radial inward of the other, said clamp of each holding means grasping the radially outer of the circular portions, and said brush having a concave surface riding on the inwardly facing convex surface of radial inner circular portion of said collector ring.

3. In an assembly according to claim **2** said figure-8-wire forming said ring having a cross-sectional configuration in which said two circular portions are of unequal diameters with the smaller circular portion being the radially outer portion held by the clamp of each holding means, and the larger circular portion being the radially inner portion engaged by said brush.

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