

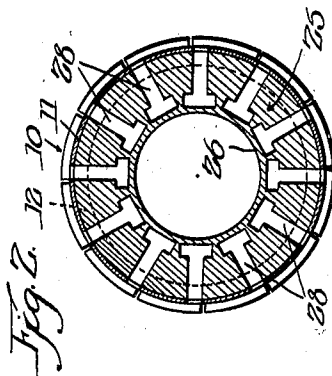
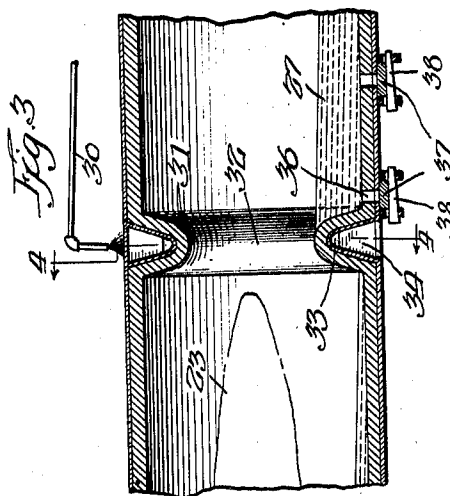
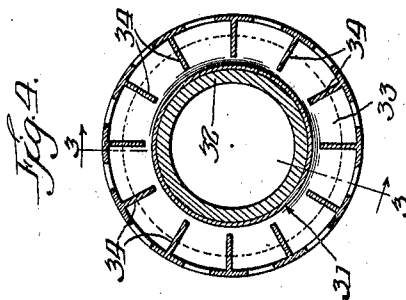
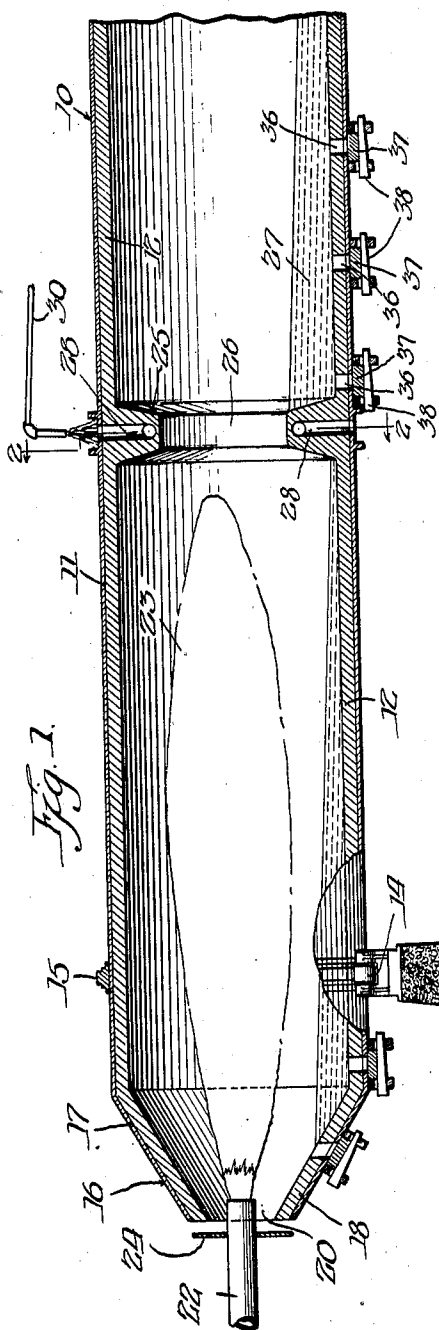
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RADIATION SCREEN FOR ROTARY KILNS

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RADIATION SCREEN FOR ROTARY KILNS

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1 Claim. (Cl. 263—33)

The invention relates to rotary cement kilns and has particular reference to improvements adapting the kilns for use in melting or entirely fusing the product, as for example, in the manufacture of aluminat cement which is fused instead of merely sintered as in the case of Portland cement.

In the progress of raw material through the kiln it changes from the granular or pulverulent condition, which it usually possesses when it enters the kiln, to the molten condition which it possesses when it leaves. In the kiln the material passes through an intermediate state in which it is semi-molten and possesses viscous, gummy or sticky characteristics. In this stage it readily adheres to the lining of the kiln and grows by accretion as the kiln rotates until it forms a dam or ring in the kiln which interferes with the operation of the kiln by cutting down the amount of combustion gases that can pass through the kiln. The change from the granular or pulverulent stage to the gummy stage requires a rather high temperature. I have discovered that this is not ordinarily accomplished by the heat of convection of the gases leaving the melting zone but requires the radiant heat of the flame-plume itself.

In order to prevent or reduce the formation of rings the invention provides a radiation screen of such construction and so located as to confine the highest temperatures to the melting zone of the kiln and to prevent the temperature beyond that point from reaching a heat where the granular or pulverulent material becomes gummy or sticky.

Another object is to provide a series of openings or tap holes in the kiln in back of the radiation screen of said kiln through which openings the pulverulent material dammed up by the screen may be removed from the kiln.

With these and various other objects in view the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawing and claim appended hereto.

In the drawing which illustrates an embodiment of the invention and wherein like reference characters are used to designate like parts—

Figure 1 is a view mainly in longitudinal section showing a rotary kiln embodying the features of the invention;

Figure 2 is a transverse sectional view through the radiation screen taken substantially along line 2—2;

Figure 3 is a fragmentary longitudinal sectional view of a kiln equipped with a modified form of radiation screen; and

Figure 4 is a transverse sectional view taken substantially along line 4—4 of Figure 3.

The kiln illustrated in Figure 1 is indicated in its entirety by numeral 10 and consists of the usual cylindrical steel shell 11 lined with refractory lining 12. The kiln is supported at intervals throughout its length by supports 13 which are provided with rollers 14 engaging the annular metal tire 15. The kiln is accordingly mounted for rotation and is disposed at a slight inclination to the horizontal. The low end of the kiln or the melting zone thereof is provided with a conical ignition hood 16 which consists of an outer conical steel shell 17 lined with refractory lining 18. The ignition hood is provided with an axial opening 20 for admitting the nozzle 22 of the burner pipe which conveys the fuel to be burned and which produces within the melting zone of the kiln the flame-plume 23. The opening 20 is partially closed by a plate 24 spaced the proper distance from the end of the kiln in order to allow varying amounts of secondary air to enter.

At a point beyond the flame-plume the kiln is provided with a radiation screen 25 which may be constructed in a number of ways but it is preferred to make the screen of a fire resistant concrete composed of suitable refractory aggregate bound together with "Lumnite", an aluminat cement. The screen is in effect an annular ring within the kiln and forms a restricted passage 26 through which passes the gases from the melting zone and the material from the preheating or low temperature zone of the kiln. Also the screen by reason of the inclination of the kiln dams up a considerable quantity, indicated by numeral 27, of the granular or pulverulent material fed to the kiln. The radiation screen is water cooled by means of tubes 28 which extend from the periphery of the kiln well into the radiation screen. The tubes and their radial arrangement are more particularly disclosed in Figure 2. A water supply pipe 30 is located over the kiln directly above the opening of the tubes 28 for supplying cooling water thereto, which is discharged from the tubes when they reach their lowermost position.

Another form of radiation screen 31 is shown in Figure 3. In this form the screen has a rounded nose defining the restricted passage 32. This modified screen is cooled by the annular trough 33 formed in the screen and which ex-

tends from the periphery of the kiln well into the nose of the screen. Metal partitions 34 are inserted at intervals throughout the circular extent of the trough and are accordingly radially disposed as shown in Figure 4.

The preferred location of the radiation screen longitudinally of the kiln is dependent on several factors, the most important of which is the length of the flame-plume, which is of course dependent on various factors including the amount of fuel consumed per unit of time and in the case of coal the amount of primary air used and the amount of volatile matter in the coal. In general, the best location is at or slightly beyond the tip of the flame-plume. The depth of the radiation screen, or conversely, the diameter of the restricted passageway formed thereby, depends on various operating factors, but the best results have been secured by having the radiation screen occupy approximately three-fourths of the area of the kiln at that point, thus allowing about one-fourth for the passage of the material to be melted and the counter-current passage of the gases leaving the burning or melting zone.

The invention is not limited to the location, size nor method of construction of the radiation screen. These factors may vary considerably without seriously affecting the efficiency of the apparatus if the construction is such as to accomplish the main object which is to shield the granular material being preheated or calcined in the upper part of the kiln from the radiant heat of the flame plume of the melting zone. Incidentally, the construction of the invention increases the efficiency of the kiln by causing the high temperature heat to be reflected back into the burning zone instead of allowing it to be dissipated into the preheating or calcining zone where low temperature heat only is required.

Under certain conditions the material being treated may form a ring even when the kiln is provided with a radiation screen. In such cases the ring usually forms in front of the radiation screen, that is, toward the firing end of the kiln. At the same time the granular or pulverulent material 27 will be dammed up back of the radiation screen. The removal of this ring is ordinarily accomplished by burning or melting it out, which requires that the feeding of the material be discontinued and the flame-plume is then controlled so that the hottest part of the flame-plume is arranged to be in as close proximity as possible to the ring. The increased temperature causes

the ring material to melt and flow to the discharge end of the kiln. The material 27 dammed up in back of the radiation screen will not be melted but is only brought to the gummy or sticky condition, and if operation of the kiln were to be resumed another ring back of the radiation screen or back of said first ring would be formed.

To prevent the formation of repeating rings the kiln of the invention is provided with a tap hole or a series of tap holes 36 located directly back of the radiation screen at which point the repeating rings generally occur. Plates 37 are provided for closing said tap holes 36, the wedges 38 effectively holding the plates in position. By means of these openings it is possible to remove substantially all of the granular or pulverulent material from in back of the screen, thus preventing the formation of additional rings. The material is removed from the tap holes 36 and the ring is melted out as above described. The operation of the kiln can now be resumed with the normal length of flame-plume and the material removed from the tap holes is fed back into the kiln.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawing, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claim.

What is claimed is:

In a rotary kiln comprising a cylindrical body portion, means supporting said body portion for rotation and at a slight inclination to the horizontal whereby one end of the kiln is lower than the other end, an ignition hood fixed to the body portion of the lower end thereof which comprises the discharge end of the kiln, said hood having an axial opening for admitting the nozzle of a fuel burner, a radiation screen within the body portion dividing the kiln into a melting zone and a low temperature zone, said melting zone comprising the portion of the kiln from said radiation screen to the ignition hood, means extending from the periphery of the kiln into said radiation screen for cooling the same, said kiln having openings therein on the upper side of the radiation screen providing access to the low temperature zone, and means for closing said openings.

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