

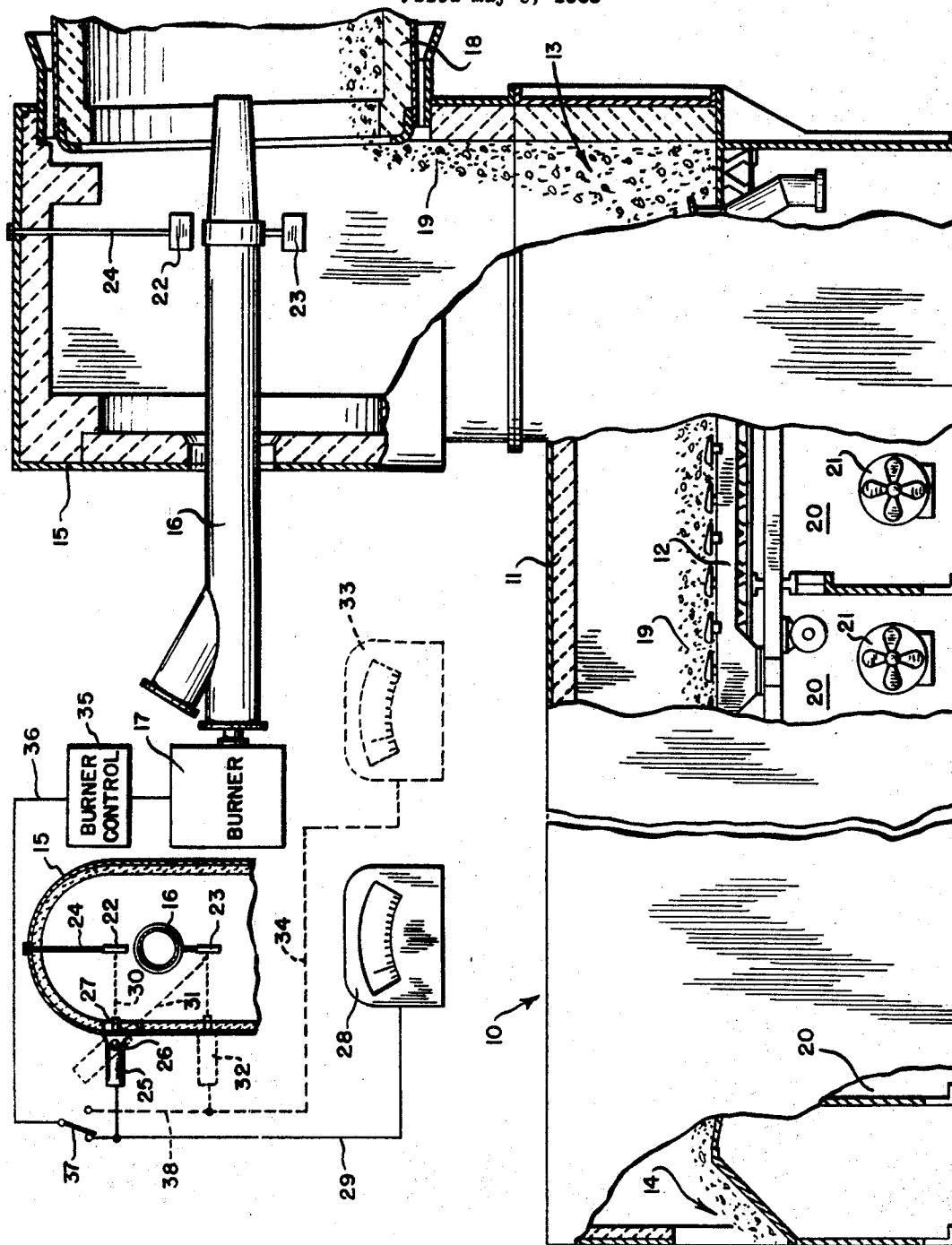
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ROTARY KILN AND COOLER OPERATION

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ROTARY KILN AND COOLER OPERATION
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10 Claims

ABSTRACT OF THE DISCLOSURE

Operation of a rotary kiln for treating particulate solid material where the secondary air for the kiln burner is received from a clinker cooler and including a special method and special apparatus for measuring the temperature of such highly heated secondary air flowing from the clinker cooler to the rotary kiln. A comparatively thin stationary plate of heat-resisting material such as ceramic material, fused carborundum for example, is mounted edgewise in the air current and the temperature of the radiation from this plate is measured from outside the cooler and kiln. A radiation pyrometer is used for this purpose. The pyrometer advantageously is connected to a control mechanism for the kiln burner so as to automatically maintain the required temperature within the kiln.

Background of the invention

The flow pattern of the air from a clinker cooler to the kiln is not well defined and takes place in layers or laminas which vary in temperature. Proper blending of the various laminas will not occur until the air enters the kiln itself. Previous attempts to measure and control the temperature of this air, for example, involving the use of a thermocouple, have not proved adequate.

Summary of the invention

The present invention proposes to employ a heat-resistant plate, or plates, in the area of the kiln discharge where the clinker leaves the kiln and enters through the hood into the cooler and where the secondary air enters the kiln. Such plate is suspended either from the roof of the hood or from the burner pipe adjacent the end of the kiln, or in other convenient way. With plate, or plates, arranged parallel to the kiln axis in edgewise relation to the travel of the air stream, a radiation pyrometer is mounted outside the hood in position to measure continuously the variation in temperature of such plate or plates. A pyrometer is directed at each plate where a plurality of plates are used simultaneously. Instruments are connected to the pyrometers for indicating the temperature variations, and connection is also made to a suitable control system for the burner with the object of maintaining constant secondary air temperature.

Brief description of the drawing

A preferred embodiment of the invention is described below with reference to a single drawing figure showing diagrammatically partly in side elevation and partly in section a clinker cooler connected to a rotary cement kiln.

Description of the preferred embodiment

It will be understood that the particulate solid material burned or treated in the kiln may include various ores, material for making Portland cement, etc., and that this material is supplied to the upper or inlet end of kiln 18, and after treatment within the rotary kiln is discharged at the lower end of the kiln into a clinker cooler 10.

Clinker cooler 10 is shown as having an elongated insulated housing 11 defining a hot air compartment lined with refractory and in which is mounted a reciprocating

movable grate 12 which extends longitudinally in the housing for transferring granular material from an inlet end 13 to an outlet end 14. The horizontal grate is supported on a heavy frame and part of the grate usually consists of a series of wedge-shaped conveyor pads called movable grates, which have the butt of the wedge facing in the direction in which clinker is conveyed so that on the forward movement the conveyor pads will push the clinker bed ahead and on the reverse movement the wedge end of the pads will slide under the clinker.

Extending above the inlet end 13 of the cooler is a kiln hood 15 into which extends a kiln burner pipe 16 through which fuel is injected from a burner 17 into the outlet end of a rotary kiln 18. The outlet end of the rotary kiln 18 is shown opening into the kiln hood 15 and granular material such as cement clinker 19 is shown being discharged onto moving grate 12. Mounted beneath the reciprocal grate 12, as is common in grate coolers, are a series of plenum chambers 20 from which air under pressure is blown by blowers 21 through the grate and the bed of granular material to effect cooling of the granular material. The air is drawn in by the blowers from outside the apparatus. The air after passing through the granular material is conveyed to the kiln hood and into the kiln as secondary heated air for combustion. As the temperature of the clinker on grate 12 is in the neighborhood of 2300° F., the air flowing through hood 15 and into the discharge end of kiln 18 is at a high temperature.

The purpose of burner 17 and burner tube 16 is to supply additional heat to this air so as to raise its temperature somewhat and particularly to regulate the temperature of this air by increasing or decreasing the amount of heat supplied by burner tube 16.

In order to control or adjust burner 17 for this purpose it is necessary to know the temperature of the secondary air passing through the upper portion of hood 15 and into kiln 18. This is accomplished in accordance with the present invention by arranging one or more heat-resistant plates 22 and 23 approximately at the entrance to the kiln. As shown plate 22 is suspended by means of a rod 24 from the top of hood 15. Plate 23 is suspended from a collar which surrounds burner tube 16 below plate 22. Plates 22 and 23 are arranged parallel with one another and with the axis of the kiln and are disposed edgewise to the current of heated air passing them. The exact location of these two heat resistant plates may vary according to the circumstances, placing them either closer to or farther from the entrance to kiln 18 and at different elevations.

In order to measure the temperature of these plates 22 and 23 one or more radiation pyrometers which respond to the temperature of the surfaces of these plates are provided. One of these pyrometers is indicated at 25 and can be swung about a horizontal pin 26 supported by a bracket or a pair of brackets on the exterior of hood 15. An opening in the hood permits the nose 27 of the pyrometer to be directed horizontally towards the left-hand surface of plate 22, or swung downwardly so that it is directed towards the surface of the lower plate, that is plate 23. In this way the temperature of the two plates 22 and 23 can be measured separately and will be indicated on the meter 28 electrically connected through suitable wiring indicated at 29 with pyrometer 25.

The radiation from plate 22 travels horizontally as indicated by the dotted line 30 into the pyrometer 25 which is constructed to be responsive to such radiation. Similarly the radiation from plate 23 in the direction of the angular dotted line 31 will energize the pyrometer when tilted as indicated by the dotted lines. If it is desired to employ a separate pyrometer for each of the two heat-resistant plates, a second pyrometer 32 shown in dotted lines may be mounted in horizontal position

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and directed horizontally at the surface of the lower plate 23. The second indicating meter 33 is connected to pyrometer 32 through wiring 34, all of these being shown in dotted lines.

By employing the indicating meters 28 and 33, one or both as desired the burner 17 can be regulated manually by means not shown, but it is advantageous to provide an automatic control mechanism indicated diagrammatically at 35, this mechanism being connected with pyrometer 25 through wiring 36 and switch 37. The circuits of such wiring are conventional and control of burner 17 by the lower pyrometer 32 can be obtained by means of wiring 38 and the shifting of switch 37.

It will be understood that pyrometers 25 and 32 produce continuous measurement of the temperatures of the two plates 2 and 3. These plates will assume the temperature of the surrounding air current and will respond more or less instantaneously to any variation of this temperature. The plates will also absorb heat by radiation from the walls of the kiln hood and from the clinker bed and cooler throat. The weighted average of these temperatures will serve as indication of the variation in heat input from the air coming from the cooler bed. The heat of radiation coming from the burner zone within the kiln will affect the temperature of the plates somewhat but not to any great extent since the plates hang parallel with the kiln axis. The automatic control herein described will aim at maintaining constant the total heat input to the burning zone within the kiln and also to maintain the secondary air at constant temperature.

I claim:

1. The method of measuring the temperature of a current of heated air flowing within a confined space which comprises arranging a heat sensitive member in the heated air current, and measuring from without the confined space the temperature of the radiation from the heat sensitive member.

2. The method as set forth in claim 1 wherein the heat-resistant member is a plate-like body and is arranged within the air current in edgewise relation thereto.

3. The method as set forth in claim 2 wherein the plate-like body is of ceramic material.

4. The method as set forth in claim 2 wherein the plate-like body is of fused carborundum.

5. In apparatus for treating particulate solid material including a rotary kiln, a burner for heating the kiln, a clinker cooler for the solid material discharged from the kiln, a hood having a chamber interconnecting the kiln and cooler, a grate within the cooler for supporting the clinker during cooling, means underlying the grate for supplying air under pressure upwardly through the grate and through said hood thus supplying secondary combustion air for the kiln burner, the improvement in com-

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bination therewith comprising a plate-like body of heat-resistant material disposed edgewise in the stream of secondary air entering the kiln, and a radiation pyrometer mounted exteriorly of said hood responsive to the temperature of the surface of said plate.

6. Apparatus for treating particulate solid material in a rotary kiln as set forth in claim 5 wherein the plate-like body is of ceramic material.

7. Apparatus for treating particulate solid material in a rotary kiln as set forth in claim 5 wherein the plate-like body is of fused carborundum.

8. Apparatus for treating particulate solid material in a rotary kiln as set forth in claim 5 wherein two plate-like bodies are mounted approximately in the same vertical plane parallel to the axis of the kiln, and the radiation pyrometer is pivotally mounted in an opening in the side wall of the hood so that it can be directed selectively toward either plate-like body.

9. Apparatus for treating particulate solid material in a rotary kiln as set forth in claim 8 wherein separate radiation pyrometers are mounted exteriorly of said hood, each of said pyrometers being directed at right angles to the surface of one of said plate-like bodies.

10. In apparatus for treating particulate solid material including a rotary kiln, a burner for heating the kiln, electrical control means for the burner, a clinker cooler for the solid material discharged from the kiln, a hood having a chamber interconnecting the kiln and cooler, a grate within the cooler for supporting the clinker during cooling, means underlying the grate for supplying air under pressure upwardly through the grate and through said hood thus supplying secondary combustion air for the kiln burner, the improvement in combination therewith comprising a plate-like body of heat resistant material disposed edgewise in the stream of secondary air entering the kiln, a radiation pyrometer mounted exteriorly of said hood for measuring the temperature of the surface of said plate, and circuit means between the pyrometer and the electrical control means for the burner.

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JOHN J. CAMBY, Primary Examiner

U.S. Cl. X.R.

73-351, 355; 236-15, 78

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,475,013

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Inventor(s) Mogen H. Fog

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

<u>COLUMN</u>	<u>LINE</u>	<u>READS</u>	<u>SHOULD READ</u>
2	61	electriacilly	electrically
3	16	plate 2 and 3	plates 22 and 2

SIGNED AND
SEALED
FEB 17 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents