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METHOD AND APPARATUS FOR COOLING BURNED MATERIALS DISCHARGED BY A FURNACE FOR BURNING CEMENT, MAGNESITE, LIME OR THE LIKE

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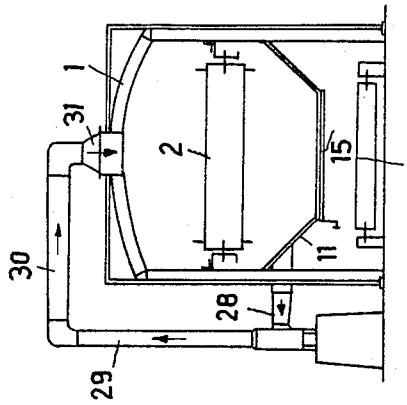

Fig. 2

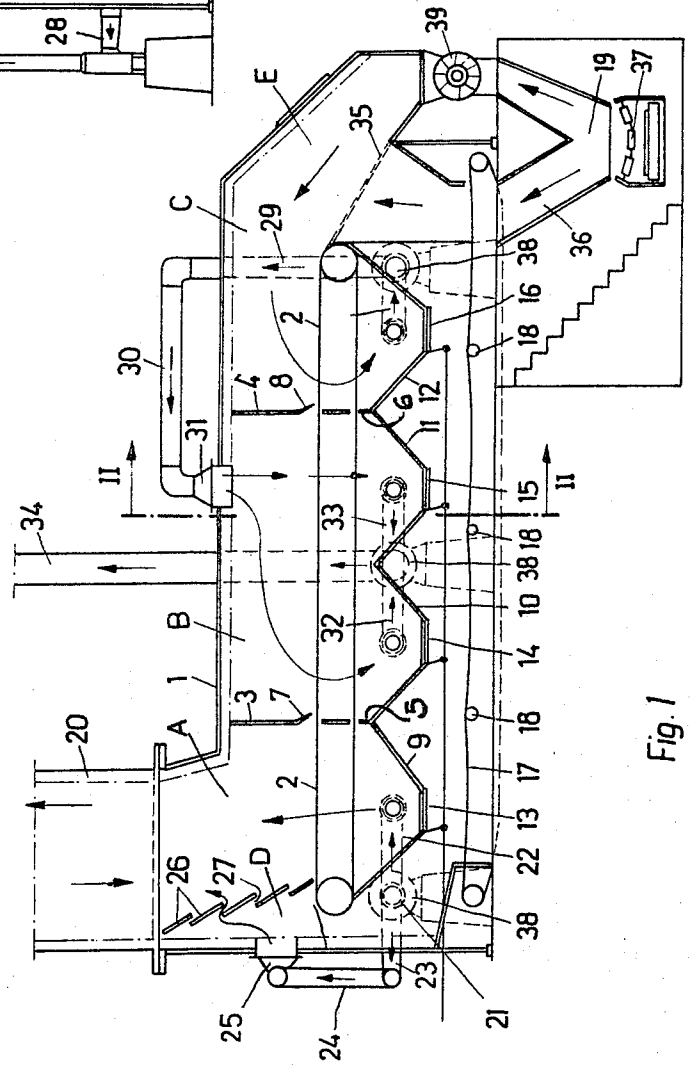

Fig. 1

Inventor:
WALTER KRAMER
BY Robert H. Jacobs
ATT

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METHOD AND APPARATUS FOR COOLING BURNED MATERIALS DISCHARGED BY A FURNACE FOR BURNING CEMENT, MAGNESITE, LIME OR THE LIKE

Walter Kramer, Hamburger Allee 62,
Frankfurt am Main, Germany

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The present invention relates to furnaces and kilns and in particular to a method and means for cooling the burned materials discharged by furnaces which burn cement, magnesite, lime and the like.

In connection with furnaces for burning cement, magnesite, lime and the like grate coolers are known in addition to tubular and shaft coolers. These grate coolers that are surrounded by a housing chamber contain stationary feed grates for the burned material to be cooled, swinging grates or continuously rotating plate belts which permit the passage of air therethrough. In order to withdraw the necessary heat from the burned material in these coolers fresh air is introduced into the coolers, which is passed through from the bottom to the top, first through the grate plate arrangement and subsequently through the layer of burned material resting thereon. Considerable quantities of air are required if effective cooling of the burned material is to be accomplished with these coolers, so that the cooled burned material can be taken over without any problems by the succeeding conveyor arrangements. If these total air quantities were introduced as secondary air to the furnace preceding the cooler, for example, to the rotatable tubular furnace, then it would have to be expected on the one hand that this secondary air due to the large quantities in which it enters the furnace would not be preheated to a sufficient extent, while on the other hand, large air quantities would necessarily be fed to the furnace for the burning process which would result in an additional requirement of fuel in order to maintain the temperature in the sintering zone.

On the basis of these considerations provisions have already been made in the coolers which are in question here and which operate as horizontal or inclined coolers, that a part of the air quantities conducted through the grate or plate conveyor arrangement and through the layer of burned material thereon are not supplied to the furnace or kiln in the form of secondary air but carried off separately for some kind of extraneous use. The separated quantities of air which likewise have absorbed heat in the cooler are utilized, for example, for drying the coal or raw material. In these known coolers it was also unavoidable that the part of the air leaving the cooler intended for the extraneous use was permeated with dust particles to a considerable extent. Therefore, it was still necessary to feed these air quantities determined for extraneous use through a dust removing device.

It is an object of the present invention to provide a horizontal or inclined cooler of the type mentioned above whereby it is made possible to accurately proportion that part of air which is determined for use as secondary air in the burning or calcinating process, to heat this secondary air portion as much as possible by withdrawing air from the burned material, while in addition arranging the air conduction of the air supplied to the cooler for the extraneous use in a manner that an additional, subsequent dust removing device becomes unnecessary, while on the other hand the air conduction in the cooler is arranged in such a manner that the grate plate arrangement is not adversely affected by an excess heat application.

Accordingly the invention resides primarily in the feature of subdividing the housing of the cooler by separating walls above and below the grate, respectively the plate or flat top conveyor, into separating chambers for directing the air flow. In the chambers adjacent the discharge end of the cooler fresh air is first fed in from the top to the bottom through the layer of burned material resting on the grate or conveyor and subsequently through the grate or the plate conveyor. This portion of the air is not supplied to the furnace or kiln but it is rather withdrawn from the cooler for utilization in a different area.

Separately from the fresh air supply to the chambers adjacent the discharge end of the cooler a further fresh air supply is furnished solely to the chamber or chambers facing the entrance end of the cooler. This portion of the air which is fed in a manner known per se first from the bottom through the grate or the plate conveyor and subsequently also through the layer of burned or calcined material resting thereon before this part of air, reaches the furnace or kiln as secondary air.

Such a manner of operating a cooler with the aforementioned separating walls that effect subdivision into chambers results in that in the zones of the grate or plate conveyor where burned material that is still correspondingly hot rests upon the grate or the conveyor, a cooling by fresh air takes place in a manner that the fresh air first cools the grate or conveyor, so that here no unnecessary wear results such as may be caused by the effects of high temperature.

This portion of air can be exactly adjusted as to quantity, and that in a manner that not too much air is supplied to the furnace so that, in other words, also this part of the air reaches the rotary furnace or kiln in highly heated condition, and that in spite of this, sufficient protection of the grate or the plate conveyor proper will be obtained in the "hot zones" of the grate or conveyor. In this manner the high temperature difference between the fresh air and the hot burned material leaving the furnace meets the requisite for an effective heat transfer from the burned material to the air.

In this connection the invention is furthermore based on the additional discovery that in the zones of the grate or plate conveyor where the layer of burned material resting upon the grate or plate conveyor is already previously sufficiently cooled, it is not necessary as heretofore to conduct the cooling air from the bottom to the top, first through the air permeable cooler plates and subsequently through the layor of burned material resting thereon. Here it is sufficient even if for these zones of the grate or of the plate conveyor the fresh air used for cooling purposes is conducted from the top to the bottom, i.e., that this portion of the air first sweeps through the layer of burned material and only subsequently through the grate or the plate conveyor.

Provisions may be made that in these zones the air is only heated to approximately 300 to 400° C. or the burned material resting upon the grate or plate conveyor no longer reflects any temperatures worth mentioning at the discharge end of the cooler. Thus as far as temperature is concerned, there exist in these zones of the coolers no dangerous conditions adverse to the use of the mechanical installation. Any dangerous condition can be eliminated here from the beginning in that in these zones the grate or plate conveyor arrangement, i.e., in the respective chambers air in such sufficient quantities is employed above and below these zones that an uninterrupted and safe course of operations is definitely insured. Moreover, it is not necessary to confine oneself to minimum air quantities, because these air quantities first sweep through the clinker bed above the plate conveyor belt. These quantities are thus automatically freed of dust in the burned material, so that these dust freed air quantities can be dis-

charged from the cooler for any desired extraneous use without it being necessary to connect any additional dust removing devices to the cooler.

In the practical furnace or kiln operation the transit from the furnace or kiln to the cooler frequently is a critical area which due to adhesion of the clinker can readily result in interruption of the operations. In accordance with the invention this transit from the furnace or kiln to the cooler is to be formed in a manner to eliminate any dangers that might affect the continuous operation, and simultaneously this transit or transfer is in addition to be utilized as a cooling space for heating the secondary air that is to be supplied to the furnace or kiln. Accordingly the invention furthermore provides that the slide connecting the furnace and the entrance to the cooler is made of individual plates arranged in the manner of roof tiles with slots provided within and between these plates and that fresh air is supplied to the space that is separated by this slide. This fresh air can be derived from the fresh air duct that is arranged at the entrance of the cooler. This portion of fresh air is then supplied to the space which is separated with respect to the cooler by the slotted wall in the form of a grate. Thus the grate-like slotted wall is here also cooled by fresh air. Simultaneously the individual grains of the burned material are cooled at their surface by the air which sweeps over them, and thus the danger of the grains baking onto the slide is eliminated. The heat thus carried off, however, is immediately fed as secondary air portion to the burning zone.

The separating walls provided above the grate or the plate conveyor are in a known manner provided with swinging plates which may contact the surface of the layer of burned material. These swinging plates serve for the purposes of establishing a separation between the individual chambers of the cooler which is as effective as possible, and in particular above the grate or plate conveyor band.

Further advantages of the invention will become apparent from the following specification with reference to the drawings, which show one embodiment of the subject of the invention and in which—

FIG. 1 is a longitudinal section through a cooler having a supporting surface for the burned material in the form of a continuously operating plate conveyor belt, and

FIG. 2 is a section taken along the line II—II of FIG. 1.

The cooler is constructed as a horizontal cooler and comprises a housing **1** provided with a horizontally journalled, air permeable, discharging plate or flat top conveyor **2**. In the present case the interior of the housing is subdivided above and below the plate conveyor into three chambers A, B and C. For this purpose separating walls **3** and **4** are provided above and separating walls **5** and **6** are provided below the plate conveyor **2**. At the lower end of each of the separating walls **3** and **4** a swinging plate **7** respectively **8** is hingedly secured. These plates can rest on the layer of burned material (not shown) atop the plate conveyor **2**.

The spaces below the plate conveyor **2** for each of the chambers A to C are separately closed off by conically tapered connecting chambers **9**, **10**, **11** and **12**. The discharge apertures of these chambers **9** to **12** are closed with slides **13**, **14**, **15** and **16** in order to provide a suitable seal for the conducting path of the forced air. Below these slides **13** to **16** a further conveyor belt **17** is provided which is guided over rollers **18**. Components of burned material which might reach the spaces **9** to **12** below through the plate conveyor **2** can be discharged at certain time intervals onto the conveyor belt **17**, and by way of this conveyor belt also the burned material is carried to the discharge outlet **19**.

The hot burned material coming from the furnace or kiln is conducted by way of the connecting or entrance shaft **20** directly into the chamber A where it drops onto the plate conveyor **2**. Fresh air arrives through air duct **21** by way of duct **22** into the bottom chamber **9**. This

fresh air penetrates first the plate conveyor **2** in the chamber A, then the layer of burned material resting on the conveyor whence it is conducted by way of connecting shaft **20** to the burning zone of the furnace or kiln (not shown).

Fresh air is supplied by the same air conduit **21** through branches **23**, **24** to the head piece **25** so that the fresh air enters the space D which is separated from the chamber A by the grate plates **26**. These grate plates are arranged in the manner of roof tiles, and slots **27** are defined between the plates through which fresh air leaving the space D can enter the furnace or kiln by way of the chamber A and the connecting shaft **20**. Thus the mechanical and structural components, namely the plate conveyor **2** and the grate plate assembly **26**, **27** are cooled with fresh air in the chambers A and D.

The air is conducted in the chambers B and C in a manner that fresh air enters upwardly through the discharge chute for the burned material into the space in hood E. This fresh air then sweeps in the chamber C from the top downwardly, first through the layer of burned material and then through the plate conveyor **2**. Thence the air is conducted by way of conduits **28**, **29**, **30** and the hood member **31** into the chamber B. In chamber B the air is guided by way of ducts **32**, **33** into the drawoff tube **34**. The air preheated in the chambers B and C is carried along by tube **34** for use in other parts of the installation.

At the end of the plate conveyor **2** the burned material drops onto the grate **35**. The fine burned material passes through the tubular chute **36** onto the conveyor belt **37**. Coarse burned material is comminuted in the crusher **39** and is subsequently also discharged onto the transporting arrangement **37**. The fresh air for the chamber C is introduced through the lower aperture of the discharge housing **19**. As a result the dust removal from chute **36** and crusher **39** which is usually required is eliminated.

Ventilating or blower means **38** are provided for drawing the fresh air into chamber A and for withdrawing the preheated air from chambers B and C.

Having now described my invention with reference to the embodiment illustrated in the drawings, I do not wish to be limited thereto, but what I desire to protect by Letters Patent of the United States is set forth in the appended claims.

I claim:

1. Cooling apparatus for cooling burned or calcined material such as cement, magnesite, lime or the like discharged from a furnace or kiln, said cooler comprising a housing having a top, a bottom and side walls, an entrance shaft and a discharge outlet, a grate in the form of a continuously rotating air permeable conveyor belt arranged in said housing between said entrance shaft and said discharge outlet, separating walls subdividing said housing into first, second and third chambers, said separating walls extending transversely of said housing between said side walls, downwardly from said top into proximity of said conveyor belt and upwardly from the bottom area into proximity of said conveyor belt, a grate plate assembly comprising a plurality of staggered plates defining a slide and having slots therebetween arranged in downwardly inclined fashion in the manner of roof tiles arranged in said first chamber proximate said entrance shaft and above one end of said conveyor and dividing said first chamber into a material entrance space and a fresh air space, and means including conduits for supplying fresh air to said air space and through said grate to said entrance and thence as secondary air to the furnace or kiln, and means for drawing in air through said discharge outlet into said third and second chambers.

2. Cooling apparatus in accordance with claim **1**, wherein said downwardly extending separating walls are provided with swinging plates hingedly secured thereto and extending to the upper surface of the burned material on said conveyor.

3. Method for cooling the burned material discharged by a furnace, kiln or the like for burning such materials as cement, magnesite and lime, comprising the steps of feeding the burned material over a slotted slide into the first chamber of a cooler and onto a permeable conveyor, blowing fresh air upwardly through said slide and through said conveyor and through the material on said slide and on the conveyor, continuously moving said conveyor and the burned material thereon, conducting air from the discharge opening of the cooler into the third chamber of said cooler downwardly through the layer of material on the conveyor portion therein and through said conveyor portion, conducting said air from said third chamber to the second chamber of said cooler, downwardly onto the burned material on and through

the conveyor portion therein and thence into and through an air discharge duct for use other than as secondary air in the burning or calcinating process.

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WILLIAM J. WYE, *Primary Examiner.*