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APPARATUS FOR BURNING CEMENT.

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1,071,303. Patented Aug. 26, 1913.

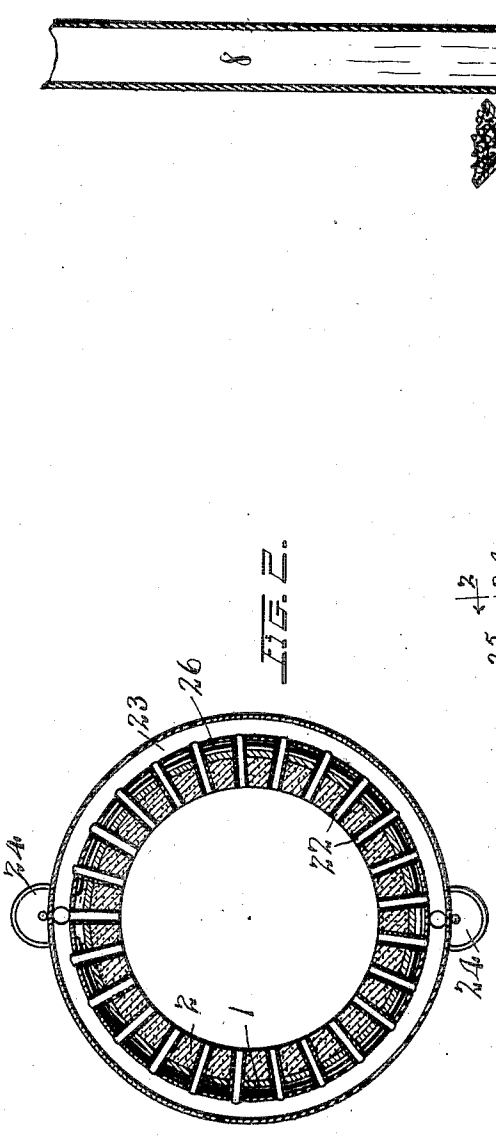

FIG. 2.

FIG. 1.

Witnesses.
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR BURNING CEMENT.

1,071,303. Specification of Letters Patent. Patented Aug. 26, 1913.

Application filed December 17, 1910. Serial No. 597,816.

To all whom it may concern:

Be it known that we, JOHN W. DREISBACH, SAMUEL E. FLEXER, and EDGAR A. SLAGLE, residing at Union Bridge, in the county of Carroll and State of Maryland, have invented a certain new and useful Improvement in Apparatus for Burning Cement, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention concerns an apparatus for burning cement, and its object is to effect a more complete and uniform treatment of the materials used in the production of "Portland" and other cements, with a great saving in the consumption of fuel and a consequent economy in operation.

In the manufacture of cements it is customary to employ a slightly inclined, cylindrical, rotating kiln, feeding the raw material into said kiln at its upper end and allowing it to gravitate slowly to the lower end of the kiln where it is discharged, being meanwhile acted upon by the heat produced by burning coal, gas or oil which first dries out the raw materials, then calcines the calcium carbonate, then causes a partial combination of the calcium with the silica and alumina. In all former kilns, however, of which we are aware, the occurrence of flame in the stack, and the presence of carbon monoxid in the kiln gases, as shown by analysis, indicates an incomplete combustion of the fuel and a consequent loss in efficiency. It is customary in such kilns to employ pulverized gas coal for fuel, however gas and oil have been successfully employed. This coal is blown into the kiln by compressed air which, of course, furnishes a part of the oxygen required for combustion, but, as a practical matter, it is found that only about 20% of the oxygen required for combustion can be introduced in this manner, since an attempt to introduce more air at this point so dilutes and cools the entering gas coal that ignition is difficult or impossible. It has heretofore been customary under the best contemporary practice to provide a stack at the upper end of the kiln having a good draft and to trust the natural intake of air through the partially open lower end of the kiln and hood to supply the remainder of the oxygen required, with the result that the combustion has been incomplete and much fuel wasted. According to our invention, we supplement this natural air supply by introducing air under pressure through suitable apertures made in the walls of the kiln, and we so position this air supply inlet with respect to the fuel inlet, and so regulate the amount of air supplied through the different openings as to obtain a more thorough, uniform, and economical treatment of the raw material than has ever before been attained to the best of our knowledge.

The apparatus by means of which our process is applied is illustrated in the accompanying drawings, which, it will be understood, are not working drawings, and are not intended to restrict us to any precise dimensions, arrangement, or operation of parts except as particularly limited in the claims appended hereto or rendered necessary by the prior state of the art.

In those drawings, Figure 1 illustrates a partial, vertical, longitudinal section through our improved kiln; and Fig. 2 a cross section therethrough taken on the conical surface of which the lines 2—2—2 are elements and looking in the direction of the arrows.

Describing the parts by reference characters, the kiln consists of a cylinder 1 of iron or steel, having a lining 2 of fire-brick, magnesia, or other refractory material, and having exterior, circular tires 3 concentrically carried thereby and mounted upon suitable supports 4 attached to the cylinder. These tires are spaced along the kiln at intervals, their number depending upon the length of the kiln, and are arranged to be rotated upon rollers 5 carried by piers 6, in a well known manner. The upper end of the kiln is received in a chamber 7 communicating with a stack 8 which acts to provide a suitable draft and to carry away the products of combustion. A conduit 9 serves to introduce into the kiln the mixed pulverized limestone and clay, suitable means being provided for delivering through said conduit a constant, regulated stream of this raw material.

At the other or lower end the kiln is surrounded by a hood 10 which consists of a ring 11 of iron or steel having a lining 12 of refractory material and mounted upon wheels 13 to permit its withdrawal to allow inspection or repair of the interior of

the kiln. This hood is closed by a plate or wall 14 of refractory material, having therein suitable fuel and air inlet openings, indicated at 15 and 16, respectively, and also suitable observation windows, not shown. The air opening may be provided with a suitable regulating device as indicated at 16′. It will be understood that the particular arrangement here shown is illustrative merely and that any desirable expedient may be employed, as will be well understood by those skilled in the art. The fuel inlet comprises a conduit 17 adapted to deliver pulverized coal and a nozzle 18 through which air is forced to inject the coal into the kiln. The bottom wall of the hood has an opening 19 through which the burned cement is delivered into a conduit 20 formed in a brick or stone hopper 21 which is straddled by the hood.

At a suitable point between the ends of the kiln we introduce air inlet nozzles or twyers 22, preferably arranged in conical relation, as shown, with their openings all pointing toward a common center, and their rear ends connected to an annular reservoir or conduit 23, supported by the kiln wall and adjacent thereto. This reservoir is supplied with compressed air by rotary fans or blowers 24 also carried by the kiln and direct-connected to electric motors 25 whose terminals are connected to insulated slip-rings 26. Power is delivered to these rings by brushes 27 supported by any convenient pier or standard 28 and connected with a suitable current source 29. We prefer to use two of these blower sets, since in this way they can be balanced.

The operation of the device is as follows: The finely ground material is delivered to the kiln through the conduit—and is first thoroughly dried. As it passes into a region of more intense heat, it is next calcined with evolution of carbon dioxid. This is a process which requires much heat and has never heretofore been completely and economically accomplished, since with existing kilns the heat is not sufficiently intense, and since the evolved carbon dioxid acts as a blanket and retards the action of the heat. With our apparatus, this layer or blanket cannot form, owing to the action of the injected air in mixing the gases and in accelerating the draft. The advantage of this is as follows: The evolution of carbon dioxid from lime-stone takes place at about 800° C. and is dependent to a great extent on the partial pressure of the evolved gas in the atmosphere above the material. It is very important that calcination be complete before the material enters the clinkering zone in the kiln. In addition, the temperature of the kiln is greatly increased at this point and the process of calcination is accelerated. The next stage in the process is a combination of the calcium oxid, resulting from the calcination, with the silica and alumina. This is an exothermic reaction, yet in the somewhat impure state, in which the ingredients are usually found, the application of heat is necessary. This reaction begins soon after the passage of the materials into the hottest point of the kiln, viz. the point just forward of the twyers, and continues for some distance, its occurrence being indicated by an incipient vitrefaction of the material which now rolls together into lumps and passes from the kiln ready for grinding. While there is a flame in the interior of the kiln in the portion where this reaction is taking place, the temperature at this point is not particularly high, owing to the insufficient supply of air necessary for complete combustion. The result is that by regulating the amount of air entering through the inlet 16 the temperature of this portion of the kiln can be kept just at the point where this reaction will most readily take place, while the provision of the twyers and blowers permits the next portion of the kiln to be raised to the temperature best suited to calcination. The force of the air blast is sufficient to prevent any of the material from falling into the twyer openings, while at the same time the air blast is prevented from undesirably interfering with the passage of material along the kiln, since the convergence of all the air blasts to one point causes them to neutralize each other and lose their force.

Although we have described this kiln in connection with the introduction of air through the twyers, it should be noted that we consider the introduction of additional fuel through some or all of them, as also within our invention.

Having thus described our invention, what we claim is:

1. The combination, with a rotatable kiln supported with its axis slightly inclined to the horizontal, of a plurality of twyer openings formed in the wall thereof intermediate its ends and discharging toward a common point, and means for forcing fluid through said twyers.

2. The combination, with a rotatable kiln supported with its axis slightly inclined to the horizontal, and means for inducing a draft therethrough, of means for introducing fuel into the lower end of the kiln, means for restricting the amount of air entering the lower end of the kiln, a plurality of twyer openings formed in the wall of the kiln at a point removed from the lower end thereof and discharging toward a common point, and means for forcing fluid through said twyers.

3. The combination, with a rotatable kiln of elongated shape supported with its axis slightly inclined to the horizontal, of a

non-rotatable hood supported adjacent to the lower end of said kiln and making a substantially tight joint therewith, a chamber surrounding the upper end of said kiln, means for supplying granular material to the upper end of said kiln, means for supplying hydro-carbonaceous fuel to the lower end of said kiln, means for supplying a limited quantity of air to the lower end of said kiln, the wall of said kiln intermediate the ends thereof being formed with a plurality of radial twyer openings discharging toward a common point, and means for forcing fluid through said twyers.

4. The combination, with a rotatable cylindrical kiln supported with its axis slightly inclined to the horizontal, of means at the lower end of the kiln for limiting the amount of air admitted, the upper end of the kiln being substantially unimpeded, means for creating an aspiration upon the upper end of the kiln, means for supplying granular material to the upper end of said kiln, means for supplying hydro-carbonaceous fuel to the lower end of said kiln, the wall of said kiln intermediate the ends thereof being formed with a plurality of radial openings discharging toward a common point, and means for forcing additional air through said openings.

5. The combination, with a rotary cylindrical kiln, the axis whereof is maintained in a position slightly inclined to the horizontal, of a non-rotatable closure member supported adjacent to the lower end of said kiln, means for supplying hydro-carbonaceous fuel to the lower end of said kiln, means for supplying granular material containing lime stone to the upper end of said kiln, a plurality of radial twyers projecting through the wall of said kiln intermediate its ends and discharging toward a common point, said twyers being inclined to the axis of the kiln and discharging toward the end thereof opposite to said closure, and means for forcing fluid through said twyers.

In testimony whereof, we hereunto affix our signatures in the presence of two witnesses.

JOHN W. DREISBACH.
SAMUEL E. FLEXER.
EDGAR A. SLAGLE.

Witnesses:
CLEVELAND ANDERS,
FRANK S. THOMAS.