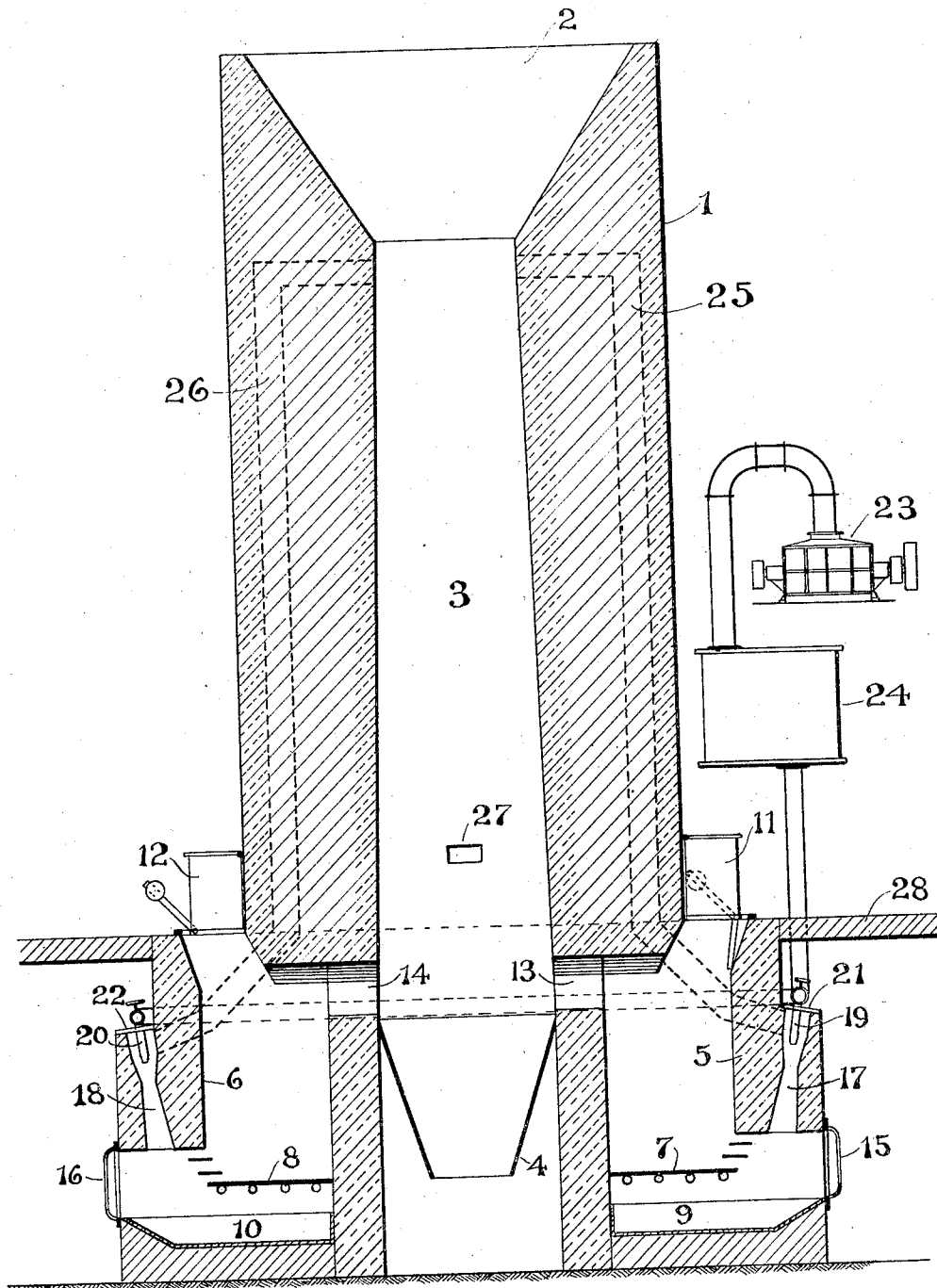


No. 821,996.

PATENTED MAY 29, 1906.

C. ELLIS.  
APPARATUS FOR BURNING LIME.  
APPLICATION FILED JAN. 11, 1906.



WITNESSES:  
*Max F. Mandelsohn*

INVENTOR  
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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR BURNING LIME.

No. 821,996.

Specification of Letters Patent.

Patented May 29, 1906.

Application filed January 11, 1906. Serial No. 295 553.

*To all whom it may concern:*

Be it known that I, CARLETON ELLIS, a citizen of the United States, and a resident of White Plains, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Apparatus for Burning Lime, of which the following is a specification.

This invention relates to apparatus for burning lime, and has for its object the gasification of the fuel employed in such proximity to the lime that the heat hitherto lost in the calcination of lime by gasified fuels is completely conserved and rendered available for useful work.

Lime-burning with producer-gas has not in general proven economical, owing to the large heat losses in the producer and conduits due to occurrence of wasteful reactions, to radiation, and other causes. These losses are variously estimated at from fifteen to twenty per cent. or more of the total fuel. By my invention this fuel is saved.

My invention comprises a shaft-kiln, preferably of the continuous-draw type, having immediate connection with one or more gasifying-chambers adapted to continuously gasify hard or soft coal, coke, or other solid fuel.

By reference to the accompanying sectional drawing a clear understanding of my invention may be had.

The drawing shows in vertical section a vertical shaft in whose foundation gas-generators are disposed in such a manner as to form an integral structure.

In the drawing, 1 is the thick shaft-wall; 2, a hopper or conical-shaped chamber in which the raw limestone is placed.

3 is the shaft proper.

4 is a cooling-receptacle of the usual type.

5 and 6 are gas-generators or gasifiers of considerable depth of fire-chamber, thereby differing from the fire-boxes ordinarily employed. They are adapted to contain a bed of fuel of efficient gasifying depth. Grate-bars 7 and 8 support the fuel-bed in the gasifiers 5 and 6, respectively.

9 and 10 are ash-pits, which under certain conditions may take the form of a water seal.

The gasifiers are provided with the fuel-feeding hoppers 11 and 12. Under certain circumstances automatic feeds may be used. The top of the producer is provided with poking-holes, which conveniently may be situated in the flanged bottom of the feeding-

hopper. The gasifiers are placed at the base of the vertical shaft, are appurtenant thereto, and open directly thereinto through the openings or ports 13 and 14. Ordinarily the gasifiers are situated in the foundations of the shaft-chamber. The disposition is such that an integral structure is produced which has many advantages over the separately-constructed producer and kiln—that is to say, those forms of apparatus in which the producer is structurally remote from the combustion-chamber.

15 and 16 are ash-pit doors, which are opened only for cleaning, &c.

17 and 18 are inductors or "blowers," adapted to propel a mixture of air and products of combustion into the ash-pits. The inductive force is developed by a jet of compressed air discharged through the nozzles 19 and 20. This air is supplied by the positive pressure blower or compressor 23. Interposed in the pipe connecting the blower with the nozzles is a pressure-equalizer 24, which, however, may be dispensed with in many instances. The nozzles are equipped with valves for regulating the air-flow. The heads of the inductors are fitted with removable lids 21 and 22 in order that air, cold or heated, may be supplied independently of that introduced by the nozzles. From the upper part of the kiln flues 25 and 26 extend to the inductors 17 and 18, respectively, for the purpose of entering products of combustion into the gasifiers. Dampers (not here shown) are ordinarily placed in these flues. When air under four or five pounds pressure is discharged through the nozzles 19 and 20, a suction or inductive action is exerted, causing the waste products of combustion to be introduced into the ash-pit. If the lids 21 and 22 are opened, air is likewise drawn in. By adjusting these aforementioned valves and dampers a mixture of carbon dioxide, oxygen, and nitrogen is obtained, which maintains the generator-fire at an effective gasifying temperature.

At suitable points in the kiln sight-holes are provided, one of which is shown at 27.

The air required for the combustion of the gas enters either by the way of the cooler 4 or by air-ports (not shown) located near the gas-ports 13 and 14. The air may be preheated, if desired.

My apparatus is constructed, as is evident, in a manner which prevents loss of heat in transmission. The gasifiers open directly

into the shaft and the gas is used almost the instant it is generated. Hence the radiation losses are practically *nil*. Radiated heat from the fuel-bed in the gasifiers also aids in burning the lime. With this apparatus almost double the amount of lime may be burned by a gas-producer apart from the kiln under existing practice. With lime-rock in small fragments, such as "quarry-spalls," it is desirable to use a short-shaft kiln and apply induced draft. Fan-blowers may be used to force air into the shaft for combustion or to supply air or air mixed with products of combustion to the gasifiers. Such apparatus is generally needed only when the draft is poor, due to presence of spalls or to the employment of a lime-rock, which pulverizes or "fines" under the influence of heat. As shown, the bottom of the ash-pits 9 and 10 are pan-like receptacles, in which may be placed water, if desired. Moisture is often desirable in the calcination of lime, owing to its catalytic action.

The limestone is introduced into the upper part of the vertical-shaft calcination-chamber and moves downwardly through the shaft, coming in contact with the flame and hot gases which are moving upwardly. The carbon dioxide is thereby driven off from the lime-rock and the lime is removed intermittently through the cooler 4, which is constructed to open at the bottom and periodically discharge the desired amount of lime.

My invention combines all the advantages of direct firing with those of gas-firing, without the disadvantages of either. With direct firing a flame of sufficient length is difficult to secure. The present invention easily affords a flame of the desired length. With gas-firing in the ordinary way there are great

losses of heat which do not obtain with my apparatus.

What I claim is—

1. A gas-fired furnace for calcining lime which comprises a vertical-shaft calcination-chamber having thick walls; a gas-generator adapted to contain a deep bed of fuel, opening thereinto; an inductor for entering air and products of combustion into said generator; and a flue in the walls of said chamber connecting the upper portion thereof with said inductor.

2. A gas-fired furnace for calcining lime which comprises a vertical-shaft calcination-chamber; at the base thereof a deep-chambered gasifier adapted to contain a deep bed of coal; an opening from the upper part of said gasifier into the lower part of said chamber; means for the admission of air to said chamber; and means for entering into said gasifier in its lower part a draft-current containing regulated amounts of air and products of combustion.

3. A gas-fired furnace for calcining lime which comprises a calcining-chamber; at the base thereof a deep-chambered gasifier; a passage from the upper part of said gasifier into the lower part of said chamber; means for the admission of air to said chamber; and means for entering into said gasifier a draft-current containing regulated amounts of air and products of combustion.

Signed at New York, in the county of New York and State of New York, this 10th day of January, A. D. 1906.

CARLETON ELLIS.

Witnesses:

FLETCHER P. SCOFIELD,  
FRED. I. SMITH.