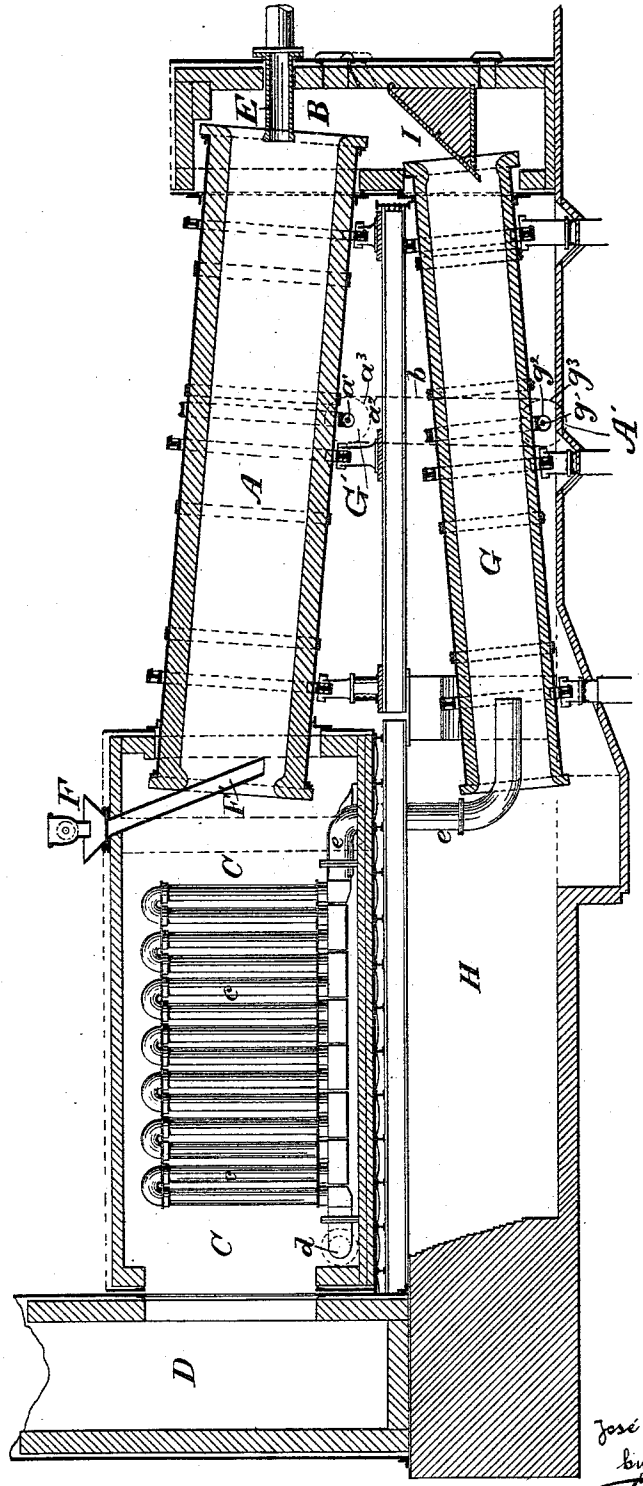
(No Model.)

J. F. DE NAVARRO.

ROTARY FURNACE FOR BURNING CEMENT, LIME, &c.

No. 457,589. Patented Aug. 11, 1891.



Witnesses:
L. N. Legendre
George Barry.

Inventor
José F. de Navarro
by Attorneys
Brown & Seward

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSÉ F. DE NAVARRO, OF NEW YORK, N. Y.

ROTARY FURNACE FOR BURNING CEMENT, LIME, &c.

SPECIFICATION forming part of Letters Patent No. 457,589, dated August 11, 1891.

Application filed December 11, 1890. Serial No. 374,271. (No model.)

To all whom it may concern:

Be it known that I, JOSÉ F. DE NAVARRO, a resident of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Rotary Furnaces for Burning or Calcining Cement, Lime, and other Substances, of which the following is a specification, reference being had to the accompanying drawing.

The objects of this invention are, first, to obtain the highest practical economy of fuel in rotary furnaces, and, second, to obtain a very slow cooling of the burned or calcined products during some time after they have left the furnace, such slow cooling in the manufacture of cement giving the clinkers or burned material such a texture as will greatly facilitate the subsequent operation of grinding and giving a better color to the cement than when the cooling is quicker.

The drawing represents a vertical section of a furnace illustrating my invention.

A is the main cylinder of the furnace, which may be constructed in the manner common to the cylinders of rotary furnaces, of a cylindrical shell of wrought-iron and a fire-brick lining. This cylinder is arranged as is common with a longitudinal inclination and is open at both ends. It may be supported and rotated upon rollers in the same way and by the same means as rotary cylinders of furnaces in common use. The lower end of the said cylinder opens into a stationary chamber B, through which is supplied the fuel-gases for heating the said cylinder and its contents. The upper end of the said cylinder opens into one end of a hot-air stove C, which contains a series of air-heating pipes *c*, the said stove and pipes resembling the apparatus commonly used for heating air supplied to blast-furnaces used in metallurgy. The other end of the said stove C communicates with a chimney D. In the example represented the cylinder is supposed to be heated by fuel-gas introduced through the chamber B by a pipe E. At the upper end of the cylinder A, between it and the hot-air pipes, there is a hopper F and feed-pipe F′ for introducing into the said cylinder the material to be burned or calcined.

Directly under the cylinder A, as near as convenient thereto, is arranged another rotary cylinder G, which is open at both ends and may be constructed like the cylinder A, but is preferably smaller. This cylinder G has a longitudinal inclination the reverse of that of the said cylinder A, the higher end of the said cylinder G being under the lower end of the said cylinder A and the lower end of the said cylinder G being under the higher end of the said cylinder A. The upper end of the said cylinder G opens into the chamber B. The lower end opens into the chamber H. In the lower part of the chamber B is arranged an inclined chute or conductor I, the lower part of which enters the cylinder G. The inlet to the air-heating tube *c* is at *d*, through one side of the oven C, and the outlet is by a delivery-pipe *e*, which has a communication through the bottom of the oven and which is carried downward through the chamber H, and the lower end of which enters a short distance into the cylinder G through the lower end thereof.

The cylinders A and G may be geared together in any suitable manner to rotate at the same speed or at such relative speeds as may be desired. They are represented as furnished, respectively, with worm-gears A′ and G′, which gear, respectively, with endless screws a' and g' on horizontal shafts a^2 and g^2, the said shafts being furnished, respectively, with pulleys a^3 and g^3, (shown in dotted outline in the drawings,) and the said pulleys receiving an endless driving-belt *b*. (Shown also in dotted outline.) Rotary motion given to either one of the shafts a' or g' will be communicated to the other, and the shafts will drive their respective cylinders.

The operation of the apparatus is as follows: Rotary motion being given to the two cylinders A and G, gas being supplied through the pipe E at the lower end of the cylinder A, and air being admitted through the tubes *c c* of the heating apparatus and delivered through the pipe *e* into the cylinder G, the air passes through the said cylinder G to the chamber B, and there meeting the ignited gas from the pipe E, combustion is produced, by which the cylinder A is heated to an intense heat. The material to be burned or calcined, being then introduced into the upper part of the cylinder A through the hopper F and pipe F′, is caused by the rotary motion of the

cylinder and by gravitation to slowly descend the cylinder, wherein as it moves along it is burned or calcined by the intense heat. Reaching the lower end of the cylinder it falls onto the chute or conductor I, which conducts it into the rotary cylinder G. By the rotary motion of the cylinder G and by gravitation the burned or calcined material is caused to descend slowly to the outlet at the lower end of the cylinder, whence it falls into the chamber H, from which it may be removed in any suitable manner. In the meantime the air, heated to a high degree in the tubes *c c* by the waste products of combustion escaping from the upper end of the furnace-cylinder A and delivered through pipe *e* into the cylinder G, produces a very slow and gradual cooling of the burned or calcined material delivered to the said cylinder from the furnace-cylinder A, the cooling being retarded by the heat imparted to the air in the heating apparatus as compared with cooling produced by cold air admitted to the cooling-cylinder. The heated air delivered by the pipe E to the said cylinder G is further heated by the heat of the burned or calcined products therein and reaches the chamber B at such intense heat that it will promote an intense combustion of the gases introduced by the pipe E, and the combustion of these gases being further continued through the furnace-cylinder A, the material to be burned or calcined will be subjected to a very intense heat. By the heating of the air first by the heated waste products of combustion and further by the heat it derives from the burned or calcined material in the cylinder G, a great saving of fuel is obtained, and by heating the air preparatory to its introduction into the cylinder G the cooling in the said cylinder G is rendered so slow that in the case of cement the clinker is rendered so friable that the subsequent grinding is facilitated and the cement has a better color than when not cooled so slowly.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with an inclined rotary furnace-cylinder and a second rotary cylinder arranged under the said furnace-cylinder with a reverse inclination for the reception of the burned or calcined products therefrom, of an air-heating apparatus arranged at the upper end of the said furnace-cylinder to be heated by the waste products of combustion from said cylinder, the outlet from said air-heating apparatus communicating with the said second cylinder to retard the cooling of the burned or calcined products received in said cylinder from the furnace-cylinder, substantially as herein set forth.

2. The combination of an inclined rotary furnace-cylinder, a fixed chamber at the lower end of said cylinder provided with an opening for fuel-gas, a second rotary cylinder arranged under the said furnace-cylinder with a reversed inclination and having its upper end open to said fixed chamber, a conductor to conduct material from the one cylinder to the other, an air-heating apparatus arranged at the upper end of said furnace-cylinder to be heated by the waste heat therefrom, and a delivery-pipe leading from said apparatus to the lower end of said second cylinder to supply heated air to retard the cooling of the material in said second cylinder and to be further heated therein by said material for the purpose of producing combustion of gases for heating the furnace-cylinder, substantially as herein set forth.

JOSÉ F. DE NAVARRO.

Witnesses.
FREDK. HAYNES,
GEORGE BARRY.