

Oct. 13, 1931.

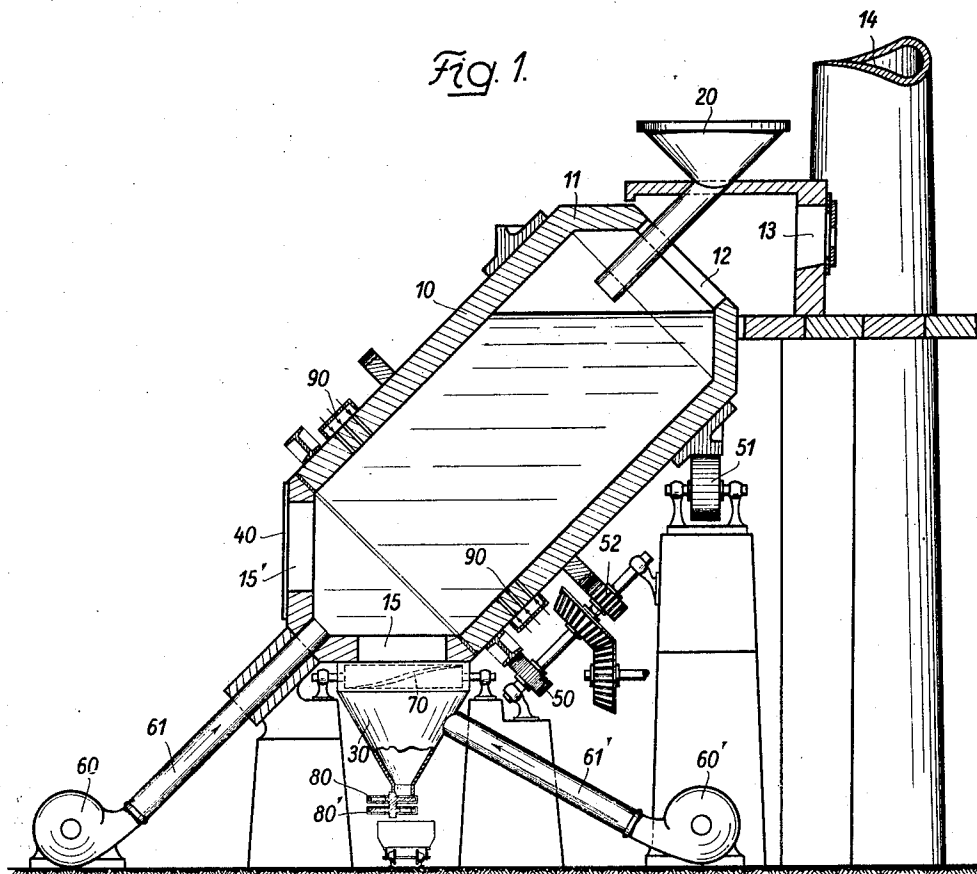
H. ENGEL

1,827,144

KILN FOR THE PRODUCTION OF CEMENT

Filed May 29, 1930

2 Sheets-Sheet 1



Inventor:
Hans Engel

Conway *H. E.*
H. E.

Oct. 13, 1931.

H. ENGEL

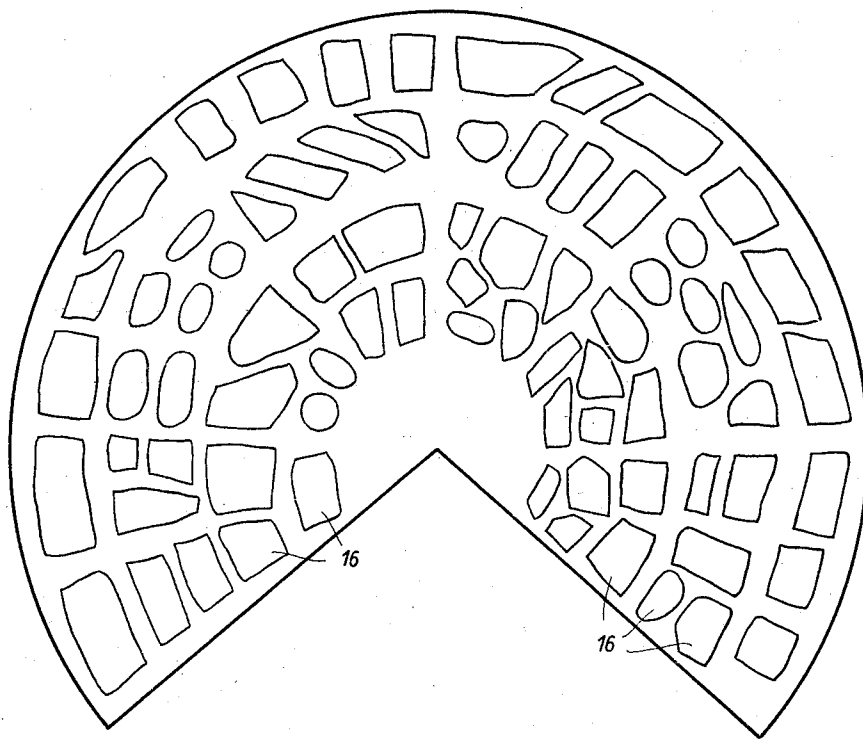
1,827,144

KILN FOR THE PRODUCTION OF CEMENT

Filed May 29, 1930

2 Sheets-Sheet 2

Fig. 2.



Inventor:
Hans Engel

Attorney

UNITED STATES PATENT OFFICE

HANS ENGEL, OF STETTIN, GERMANY

KILN FOR THE PRODUCTION OF CEMENT

Application filed May 29, 1930, Serial No. 457,298, and in Germany June 25, 1928.

My invention relates to improvements in kilns for the production of cement and like artificial hydraulic mortars in which the raw material—blocks of dried slurry—is burnt at a glowing heat and thereby converted into clinker.

The object of the invention is to provide an improved kiln for the purpose set forth in which the advantages offered by kilns of the old type consisting of a stationary vertical shaft having thick walls of bricks, and on the other hand by kilns of the revolving type of more recent origin, consisting of a long rotary drum arranged in slightly inclined position, are combined, while the drawbacks inherent individually to the said known types of kilns are eliminated.

As a matter of fact known to practitioners in this field with stationary kilns of the vertical shaft type there is a tendency of the material under treatment to choke the kiln because of being too highly heated in the burning zone and thereby baking and sintering together into large obstructing blocks.

Another drawback consists in the fact that the material under treatment, usually consisting of blocks of different shape and size, is not uniformly distributed within the kiln and will not be uniformly burnt because the compressed air and the gaseous products of combustion in passing through the kiln will naturally prefer the passages of larger cross section and will thus not reach to the same extent other parts of the charge in which the material is more closely assembled and aggregated.

On the other hand stationary cement kilns of the vertical shaft type have the advantage of consuming relatively little fuel in as much as the loss of heat conducted through and radiating from the thick brick walls of the kiln is obviously much smaller than the loss of heat inherent to kilns of the revolving type consisting of a rotary drum of sheet iron and having only a thin lining of refractory material on the inner side of the drum.

Moreover in revolving kilns the drum of which is in slightly inclined position the material under treatment in passing through the kiln usually covers only a limited section of

the inner area—usually $\frac{1}{3}$ —resting on the lower side of the drum and, presenting a relatively small surface to the current of highly heated gaseous products of combustion, will utilize an accordingly small amount of the heat, the larger proportion of which radiates through the walls of the rotary drum or is lost with the gases escaping through the chimney.

However by reason of the fact that the material passing through revolving kilns is constantly stirred up, thus always presenting fresh surfaces to the heating gases the quality of the burnt product is more uniform than in the case of stationary kilns.

Another advantage consists in the fact that the output of revolving kilns is obviously much larger than of stationary kilns of the same size and that also raw material consisting of relatively small pieces containing fine lumps and granules can be satisfactorily treated in revolving kilns even if charged into the kiln in somewhat moist condition, without clogging the kiln or impairing the quality of the finished product.

As indicated above the invention aims at providing an improved kiln which offers the advantages individually attached to known types of cement kilns—i. e. the stationary and the revolving types—which are briefly explained above, yet eliminating their drawbacks.

The nature and scope of the invention are briefly outlined in the appended claims and will be more fully understood from the following specification taken together with the accompanying drawings in which

Fig. 1 is a vertical cross section through a kiln embodying the features of the invention;

Fig. 2 shows a flattened evolution of a modified form of the bottom of the heating chamber having discharge holes of different size and irregular shape for the purpose explained hereinafter.

In contradistinction to the stationary types of cement kilns consisting of a vertically arranged heating chamber and to the rotary types of cement kilns in which the heating chamber is arranged at a small angle to the horizontal and in which the material pass-

ing therethrough occupies only a limited section of the whole cross sectional area I propose to arrange the rotary heating chamber 10 of the improved kiln at such an angle that the material slowly passing through the chamber will fill up the latter from top to bottom.

I prefer to make the heating chamber 10 in the form of a cylindrical drum i. e. the cross sectional area of which is substantially uniform and to provide a lid member 11 attached to and closing the upper end of the chamber which has an exhaust hole 12. The latter communicates through flue 13 with the chimney 14 and with a hopper 20 through which the material to be treated is charged into the heating chamber 10.

At its lower end the heating chamber 10 is closed by a bottom member having a plurality of holes 15, 15' provided therein, through which the burnt cement clinker is discharged into a bin 30, stationarily fixed underneath the said holes and adapted to close the heating chamber against the atmosphere. Another stationary member, i. e., lid 40, which is preferably structurally connected with the bin 30, serves to close the rest of the discharge holes 15' against the atmosphere.

Any suitable means known per se e. g. rollers 50, 51 and driving gear 52 may be provided for rotatably supporting the heating chamber 10 in its specific inclined position and for slowly revolving the latter about its longitudinal axis.

In the embodiment of my invention shown in the drawings by way of an example the heating chamber 10 is arranged at an angle of about 45° at which the kiln operates satisfactorily, yielding a product of uniform quality, and consuming less fuel than ordinary rotary kilns of known type having the same output would require.

Blowers 60, 60' are provided for supplying compressed air to the heating chamber 10, which are connected by pipes 61, 61' with the extreme bottom end of the kiln and with the bin 30 respectively.

The operation of the kiln if heated by solid fuel is as follows:

The raw material—dried slurry—and the fuel mixed in appropriate proportions are fed into the kiln through the hopper 20 until the heating chamber 10 is filled up almost to its full capacity. After the charge has been set on fire and while the kiln slowly revolves and compressed air is blowing therethrough the material under treatment because of the constant stirring action imparted to it by the revolving chamber 10 is very effectively and uniformly dried, calcined, burnt into clinker and eventually cooled in the different zones through which the charge passes.

Attention is drawn to the fact that the material in slowly moving downwardly in a

helical path even on becoming rather highly heated so as to sinter and bake will nowhere permanently stick to the walls of the heating chamber and will not choke the latter because the hottest zone by reason of the inclined position of the kiln extends at an angle to the walls of the heating chamber. Thus the respective sections of the walls will be exposed to the greatest heat only once in each revolution and temporarily while they are allowed to cool during the rest of the revolution by contact with portions of the charge which are less hot.

Various changes and modifications may be made in the structural design of rotary kilns for the production of cement and like artificial hydraulic mortars as described above and in the shape and cooperation of their component parts without substantially deviating from the spirit and the leading ideas of this invention and sacrificing any advantages offered by the same.—

E. g., grinding and crushing means such as bars or rollers 70 facing the discharge holes 15 may be fixed in the bin 30 and are adapted to cause the larger clinkers by coming repeatedly into contact with the said grinding and crushing means to be gradually comminuted.

Convenient means may be provided at the bottom end of the bin 30 for automatically discharging the clinker at intervals and in limited quantities.

In the embodiment of the invention shown in Fig. 1 by way of an example said discharging means comprise a pair of rotary discs 80, 80' arranged in superposed position to and spaced from each other, said discs having holes provided therein which alternately communicate with the discharge port of the bin.

Fig. 2 represents an evolution of the bottom of a heating chamber having discharge holes 16 of different size and irregular shape.

My experiments have shown that the provision of holes of irregular shape and size as shown by way of an example tends to facilitate and enhance the discharge of the clinker proceeding through the grate bars or crushing rollers 70 underneath.

The larger holes in passing over the grate or rollers 70 will cause a more rapid downward movement of the clinker above which contributes to stir up and thus bring forward other portions of the clinker in adjoining sections which heretofore have moved somewhat slowly and required some time to escape from the heating chamber.

I wish not to be limited to the use of solid fuel such as coke in kilns designed according to this invention.

These may be fired with equal success with fuel such as combustible gases or liquid fuel. Nozzles 90 may be provided at the circumference of the heating chamber 10 for intro-

ducing combustible gases and (or) compressed air.

What I claim is:

1. In a rotary kiln for the production of cement or the like, in combination, a heating chamber of substantially uniform cross-section having its axis inclined at an angle of substantially 45° to the horizontal whereby said chamber is normally substantially filled with material, a lid fixed to the upper end of said chamber and having an exhaust opening therein, means for charging raw material into said chamber, a bottom member secured to the lower end of said chamber and having discharge openings therein, a hopper mounted below said bottom and adapted to receive material escaping through the openings in the lower part thereof, a plate adjacent said bottom and closing the remaining openings therein, and means for rotating said chamber and for introducing air into the lower part thereof.

2. In a kiln as claimed in claim 1, grinding and crushing means fixed in the upper part of said hopper below said bottom.

3. In a kiln as claimed in claim 1, grinding and crushing means fixed in the upper part of said hopper below said bottom, said last named means comprising a plurality of members spaced apart to form a grate.

4. In a kiln as claimed in claim 1, grinding and crushing means fixed in the upper part of said hopper below said bottom, said last named means comprising a plurality of rollers spaced apart to form a grate.

5. In a kiln as claimed in claim 1, said discharge openings varying in size and shape.

6. In a rotary kiln for the production of cement or the like, in combination, a heating chamber of substantially uniform cross-section having its axis inclined at an angle of substantially 45° to the horizontal whereby said chamber is normally substantially filled with material, a lid fixed to the upper end of said chamber and having an exhaust opening therein, means for charging raw material into said chamber, a conical bottom member secured to the lower end of said chamber and having discharge openings therein, a hopper mounted below said bottom, the upper edges of said hopper conforming to and abutting a portion of the surface of said conical bottom and to receive material escaping through the openings in the lower part thereof, a plate conforming to the remaining portions of the surface of the conical bottom and closing the remaining openings therein, and means for rotating said chamber and for introducing air into the lower part thereof.

In testimony whereof I have signed my name to this specification.

HANS ENGEL.