

Sept. 30, 1924.

1,510,140

J. S. FASTING

ROTARY KILN AND COOLER

Filed Sept. 8, 1923

Fig. 1.

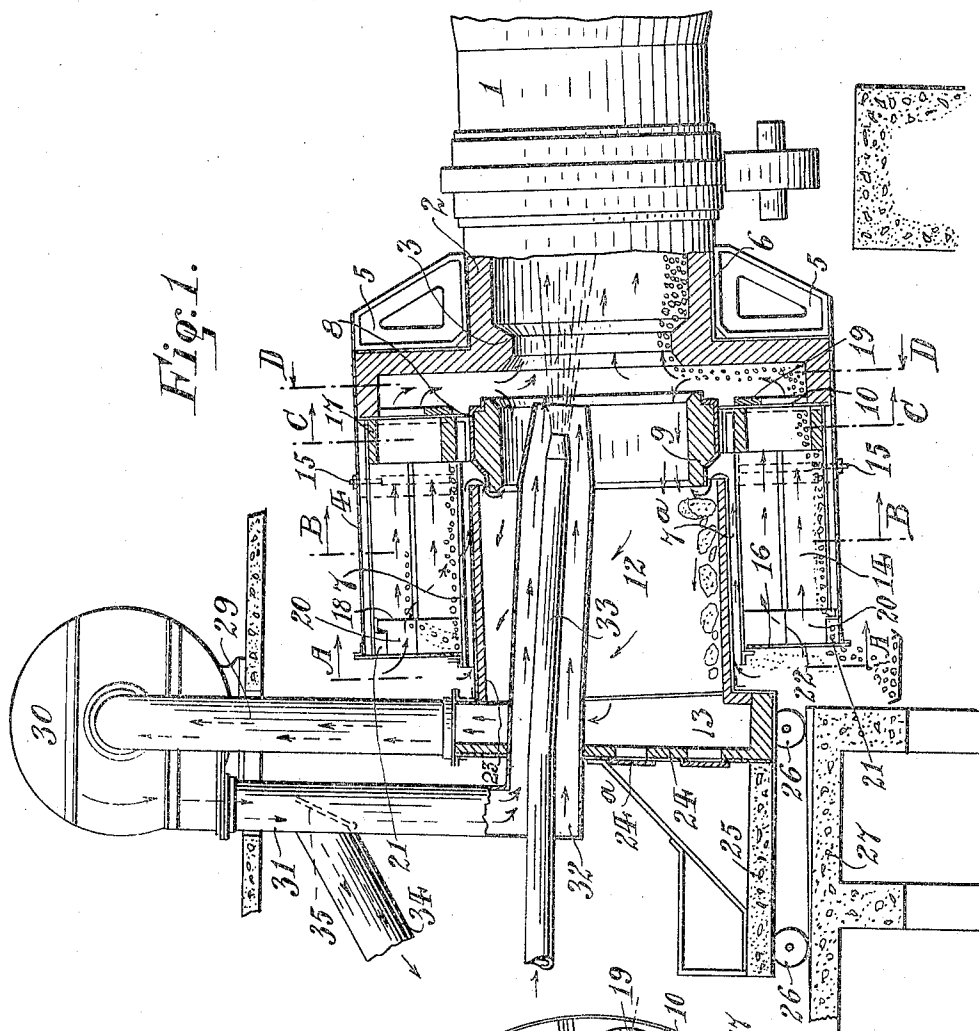
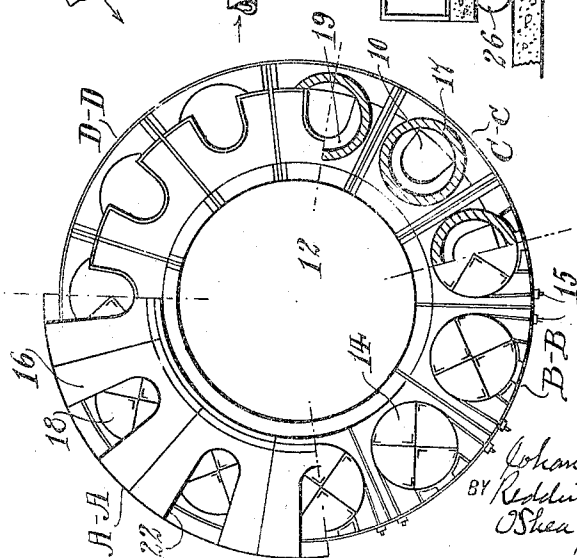


Fig. 2.



INVENTOR
John S. Fasting
 BY *Rolling Greely*
Shea Campbell
 ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHAN S. FASTING, OF VALBY, NEAR COPENHAGEN, DENMARK, ASSIGNOR TO F. L. SMIDT & CO., OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

ROTARY KILN AND COOLER.

Application filed September 8, 1923. Serial No. 661,621.

To all whom it may concern:

Be it known that I, JOHAN S. FASTING, a subject of the King of Denmark, residing at Monrads Alle 9, Valby, near Copenhagen, Denmark, have invented certain new and useful Improvements in Rotary Kilns and Coolers, of which the following is a specification, reference being had to the accompanying drawing, forming a part hereof.

This invention relates to rotary kilns and coolers of the type commonly employed in the burning of cement raw materials in which the cooler is incorporated with the kiln proper and is in effect an extension thereof. In kilns of this character, by reason of the interposition of the cooling devices, the point of observation is so far removed from the burning zone of the kiln that it becomes difficult to observe the operation of the kiln, partly on account of the distance and partly on account of the dust which is carried forward from the cooling devices into the kiln. The object of the present invention is primarily to overcome this difficulty in observation and incidentally to provide a construction in which the cooling chambers are protected from direct radiation of heat from the kiln and in which the air which supports combustion in the kiln is highly heated before it enters the kiln or is mixed with the fuel. In accordance with the invention there is formed beyond, in the direction of travel of the raw materials through the kiln, a chamber, substantially co-axial with the kiln, which is surrounded circumferentially by a cooling chamber, which preferably comprises a series of longitudinally arranged cooling cells into which the hot clinker is discharged from the outlet of the kiln and from which the clinker, cooled by the counterpassage of atmospheric air, is in turn discharged. The central chamber referred to is preferably enclosed by a cylindrical hood, closed at the outer end and through which the fuel nozzle is extended into suitable proximity to the outlet of the kiln, the hood being movably supported so that it can be withdrawn from time to time as may be desirable. The atmospheric air is admitted to the cooling chamber at the end remote from the outlet of the kiln and passes thence through the opening provided for the passage of the clinker from the kiln into the cooling chamber, a portion of the air, heated by contact

with the hot clinker, being drawn by natural draft directly into the kiln, while another portion of it may be drawn back through the central chamber by a fan suitably placed and discharged under pressure to be mingled with the fuel, such as powdered coal, delivered through the fuel nozzle. In this manner an abundant supply of atmospheric air is made to pass through the cooler for the purpose of cooling the clinker and at the same time the air is preheated to a high degree for the support of combustion within the kiln.

The invention will be more fully explained hereinafter with reference to the accompanying drawing in which it is illustrated and in which—

Figure 1 is a view partly in longitudinal section and partly in side elevation showing a portion of a kiln of ordinary construction with the cooling devices in operative relation therewith.

Figure 2 is a view in cross sectional elevation, the planes of section of the several quadrants being indicated by the broken lines A—A, B—B, C—C and D—D of Figure 1.

The kiln proper, a portion of which is shown at 1 in Figure 1, may be of any usual or suitable construction. As shown, it is slightly contracted beyond the burning zone, toward its discharge end or outlet, and is provided with a firebrick lining 2 and with nose bricks, as at 3, which form the contracted discharge opening or outlet. The cooling devices, as shown in the illustrated embodiment of the invention, comprise a cylindrical shell 4 which is supported by brackets 5 from the main shell 6 of the kiln so as to rotate therewith; an inner shell 7 which extends partway from the outer or discharge end of the cooler toward the outlet of the kiln and is connected to the outer shell by means hereinafter referred to; and a ring 8 which has a firebrick lining 9. Within the cooling chamber which is formed between the outer and inner shells 4, 7, there are preferably provided cylindrical cooler cells 14 which are arranged in a circumferential series, these cooler cells being secured in position by straps 15 and sectional end plates 16, each cooler cell being provided for a portion of its length, near its inner end, with a firebrick lining 17, to protect the cells from direct contact with the hot clinker which en-

ters them, at or near the lowest point in the rotation of the cooler with the kiln, through the opening 10 which is provided between the outlet of the kiln and the inner end of the cooler. Each of the cooler cells 14 is preferably subdivided into longitudinal compartments by partitions 18 for the purpose of distributing the clinker and providing for a more thorough and rapid cooling of the same by the air which is admitted through the openings in the end plates 16 and passes from the cooler cells through the opening or passage 10. The discharge openings of the cooler cells 14 are partially closed by plates 19 which prevent the spilling of the hot clinker from each cooler cell when in or near its uppermost position into the opening or passage 10.

At 20 each cooler cell 14 is cut away so as to provide an opening through which the cooling air which is admitted through the cut away plates 16, may pass outside of each cooler cell as well as into the same and through which, when each cooler cell is at or near its lowermost position, the cooled clinker may be discharged, its movement being facilitated by short conveyor flights 21 which are mounted on the outer shell 4 and, in the rotation of the cooler, carry the cooled clinker forward through the openings 22 in the sectional plates 16, which plates also prevent the spilling of the clinker from each cell when it is in or near its uppermost position.

Within the circumferential cooler is a central chamber 12 which is substantially co-axial with the kiln and with the cooler, the cooler being protected from the radiant heat from the outlet of the kiln by a movable hood 23, provided with a firebrick lining as shown and closed at its outer end by a wall 24, also provided with a firebrick lining, and preferably, when in operating position, overlapping slightly, but with proper clearance, the end of the ring 8 above mentioned. The hood may be supported on a platform 25 which itself is supported by wheels 26 on the floor 27 in front of the kiln, so that, as occasion requires, the movable hood can be withdrawn from the central chamber 12 so as to permit access to the interior of the kiln. The wall 24 may be provided with observation openings, as indicated at 24^a, and also with an opening, as at 13, through which may be removed from time to time such lumps of clinker as are too large to pass into the opening or passage 10 and therefore pass on through the ring 8 with its lining 9 into the hood 23.

Part of the air which, heated through contact with the hot clinker in the cooler, passes from the cooler into the opening or passage 10, is drawn by natural draft directly into the kiln to support combustion therein. Another part of such air, so

heated, is withdrawn from the central chamber within the hood 23, so that it may be mixed directly with the fuel, such as powdered coal, through a pipe 29 which is connected to the inlet side of a fan 30, the discharge pipe 31 of the fan being connected with a pipe 32 which surrounds the fuel discharge nozzle 33. The pipe 31 may be provided with a branch 34 and damper 35 by means of which a portion of the air may be diverted if conditions of operation render it desirable.

It will be understood that in the operation of the kiln and cooler the hot material discharged from the outlet of the kiln will enter the annular passage 10 and will pass thence at the bottom into the cooler cells 14 of the circumferential cooler from which it will be discharged through the openings 22 in the sectional plates 16 as they successively pass through the lowermost position. The natural draft of the kiln will cause the atmospheric air to be drawn into the cooler cells, withdrawing the heat of the clinker and becoming itself highly heated before it enters the kiln. At the same time, by reason of the partial vacuum maintained in the central chamber 12 and within the hood 23 by the fan 30, some of the heated air which passes into the passage 10 and some of the air which passes around the cooler cells 14 and through openings 7^a in the shell 7 as well as air which enters between the shell 7 and the hood 23, will be drawn within the hood through the opening between the hood and the ring 8, 9, and will be discharged by the fan under moderate pressure to be mixed with the fuel, such as powdered coal, or fuel oil, or other suitable fuel, from the fuel nozzle 33.

It will be observed that the cooling devices are protected against the radiant heat from the outlet of the kiln and from the hot clinker by the hood 23 and the air space between the same and the cooler, whereby the cooling of the clinker is facilitated, and that, as the main body of air which is drawn within the hood 23 is supplied through the air space between the hood and the cooler through the spaces around the cooler cells, it will be comparatively free from dust so that observation through the central chamber, by means of the observation openings in the wall 24 of the hood, will be facilitated. It will also be observed that, except for an occasional lump which is too large to pass into the passage 10, none of the hot clinker or other material from the kiln, passes into the central chamber 12.

It will be understood that various changes in details of construction and arrangement can be made to suit different conditions of operation and that the invention, except as pointed out in the claims, is not restricted

to the precise construction and arrangement shown and described herein.

I claim as my invention:

1. The combination with a rotary kiln, of
5 a circumferential cooler connected to the kiln to rotate therewith, extended beyond the outlet of the kiln, spaced longitudinally from the kiln at its inner end, open at its outer end to admit air and to discharge
10 cooled clinker and at its inner end to communicate with the space between itself and the end of the kiln and to receive hot clinker therefrom, and surrounding a central chamber substantially coaxial with the kiln.

15 2. The combination with a rotary kiln, of a circumferential cooler comprising an outer shell connected to the kiln to rotate therewith and an inner shell extended partway toward the outer end of the kiln to leave
20 a space therebetween, such cooler being open at its outer end to admit air and to discharge cooled clinker and at its inner end to communicate with the space between itself and the end of the kiln and to receive hot clinker
25 therefrom and surrounding a central chamber substantially coaxial with the kiln.

3. The combination with a rotary kiln, of a circumferential cooler comprising an outer shell connected to the kiln to rotate there-
30 with, an inner shell extended partway toward the end of the kiln to leave a space between itself and the end of the kiln and cooler cells secured between said shells and open at their forward ends to admit air
35 and to discharge cooled clinker and at their inner ends to communicate with the space between the cooler and the end of the kiln and receive hot clinker therefrom, the inner shell surrounding a central chamber sub-
40 stantially coaxial with the kiln.

4. The combination with a rotary kiln, of a circumferential cooler connected with the kiln to rotate therewith, extended be-
45 yond the outlet of the kiln, spaced from the kiln at its inner end, open at its outer end to admit air and to discharge cooled clinker, and at its inner end to communicate with the space between itself and the end of the kiln and to receive hot clinker there-
50 from, and surrounding a central chamber substantially coaxial with the kiln, and a substantially cylindrical hood interposed between the central chamber and the circumferential cooler.

55 5. The combination with a rotary kiln, of a circumferential cooler connected with the kiln to rotate therewith, extended beyond the outlet of the kiln, spaced from the kiln at its inner end, open at its outer end to admit
60 air and to discharge cooled clinker, and at its inner end to communicate with the space between itself and the end of the kiln and to receive hot clinker therefrom, and surrounding a central chamber substantially coaxial
65 with the kiln, and a cylindrical hood having

its inner end open and its outer end closed, interposed between the central chamber and the circumferential cooler.

6. The combination with a rotary kiln, of a circumferential cooler connected with the
70 kiln to rotate therewith, extended beyond the outlet of the kiln, spaced from the kiln at its inner end, open at its outer end to admit air and to discharge cooled clinker, and at its inner end to communicate with
75 the space between itself and the end of the kiln and to receive hot clinker therefrom, and surrounding a central chamber substantially coaxial with the kiln, a cylindrical hood interposed between the central cham-
80 ber and the circumferential cooler, and means to support the hood movably.

7. The combination with a rotary kiln, of a circumferential cooler connected with the
85 kiln to rotate therewith, extended beyond the outlet of the kiln, spaced from the kiln at its inner end, open at its outer end to admit air and to discharge cooled clinker, and at its inner end to communicate with the space between itself and the end of
90 the kiln and to receive hot clinker therefrom, and surrounding a central chamber substantially coaxial with the kiln, a cylindrical hood interposed between the central chamber and the circumferential cooler,
95 open at its inner end and closed at its outer end, a fuel nozzle extended within the central chamber in proximity to the outlet of the kiln, an air tube surrounding the fuel nozzle, and means to withdraw air from the
100 central chamber and deliver it to said tube.

8. The combination with a rotary kiln, of a circumferential cooler connected with the
105 kiln to rotate therewith, extended beyond the outlet of the kiln, spaced from the kiln at its inner end, open at its outer end to admit air and to discharge cooled clinker, and at its inner end to communicate with the space between itself and the end of the
110 kiln and to receive hot clinker therefrom, and surrounding a central chamber substantially coaxial with the kiln, a cylindrical hood interposed between the central chamber and the circumferential cooler, open at its inner end and closed at its outer
115 end, a fuel nozzle extended within the central chamber in proximity to the outlet of the kiln, an air tube surrounding the fuel nozzle, means to withdraw air from the central chamber and deliver it to said tube,
120 and means to divert a portion of the air from said tube.

9. The combination with a rotary kiln, of an outer circumferential shell secured to the
125 kiln to rotate therewith, an inner circumferential shell forming a central chamber and, with the outer shell, a circumferential cooling chamber, and a circumferential series of cooler cells located in said cooling cham-
130 ber, said cells being open at their outer

ends to admit air and to discharge cooled clinker and open at their inner ends to deliver heated air to the kiln and to receive hot clinker therefrom.

- 5 10. The combination with a rotary kiln, of a circumferential cooling chamber comprising an outer circumferential shell secured to the kiln to rotate therewith, and
10 an inner circumferential shell surrounding a central chamber, said circumferential cooling chamber being open at its outer end to admit air and to discharge cooled

clinker and open at its inner end to deliver air to the interior of the kiln and to receive hot clinker therefrom, a ring secured 15 to the cooling chamber to rotate therewith, and a cylindrical hood interposed between the central chamber and the cooling chamber and overlapping the outer end of said ring. 20

This specification signed this 11th day of August, A. D. 1923.

JOHAN S. FASTING.