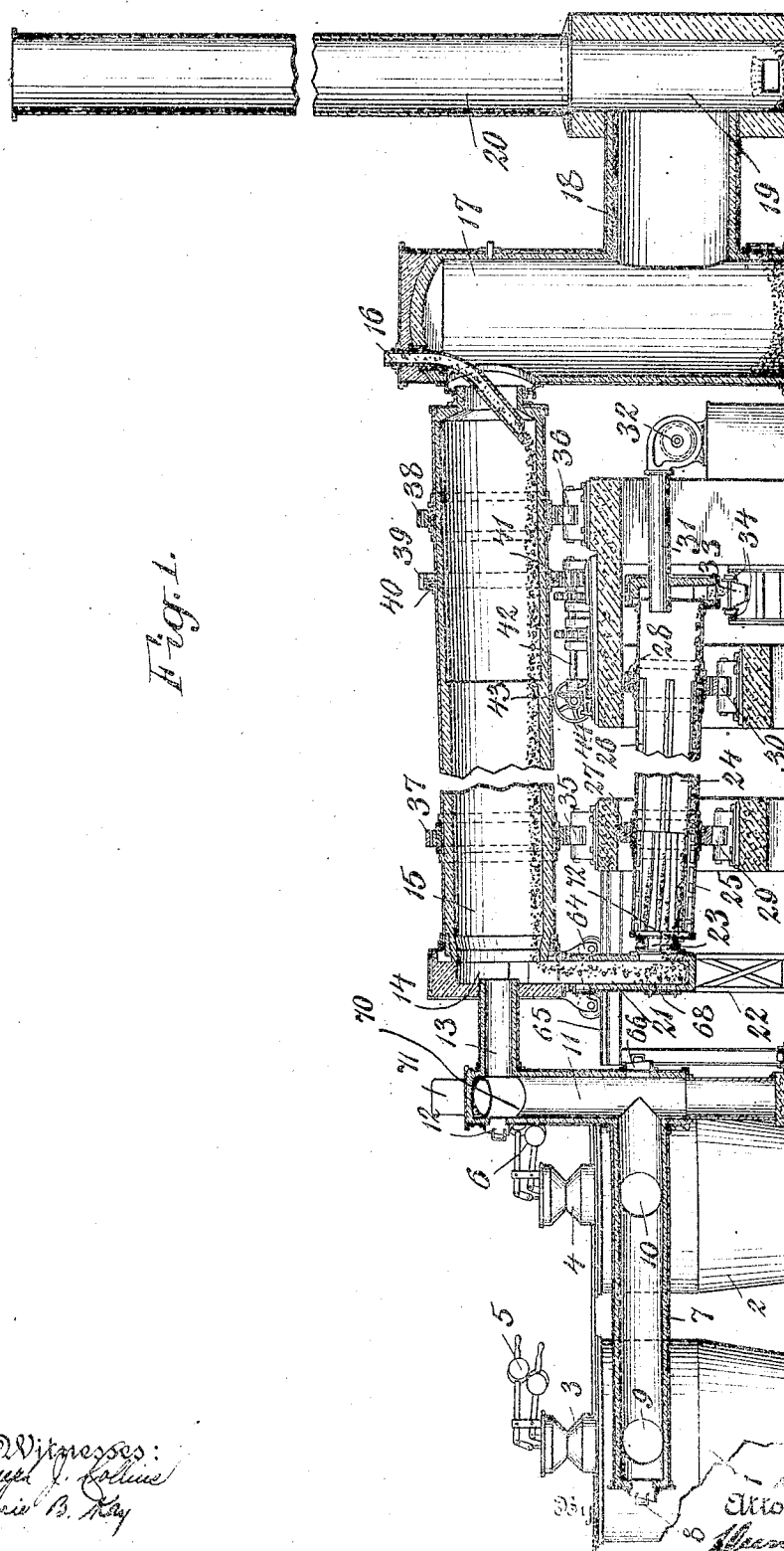


H. S. SPACKMAN.
CEMENT BURNING APPARATUS.
APPLICATION FILED MAR. 13, 1908.

Patented May 4, 1909.
3 SHEETS—SHEET 1.

920,784.

Fig. 1.



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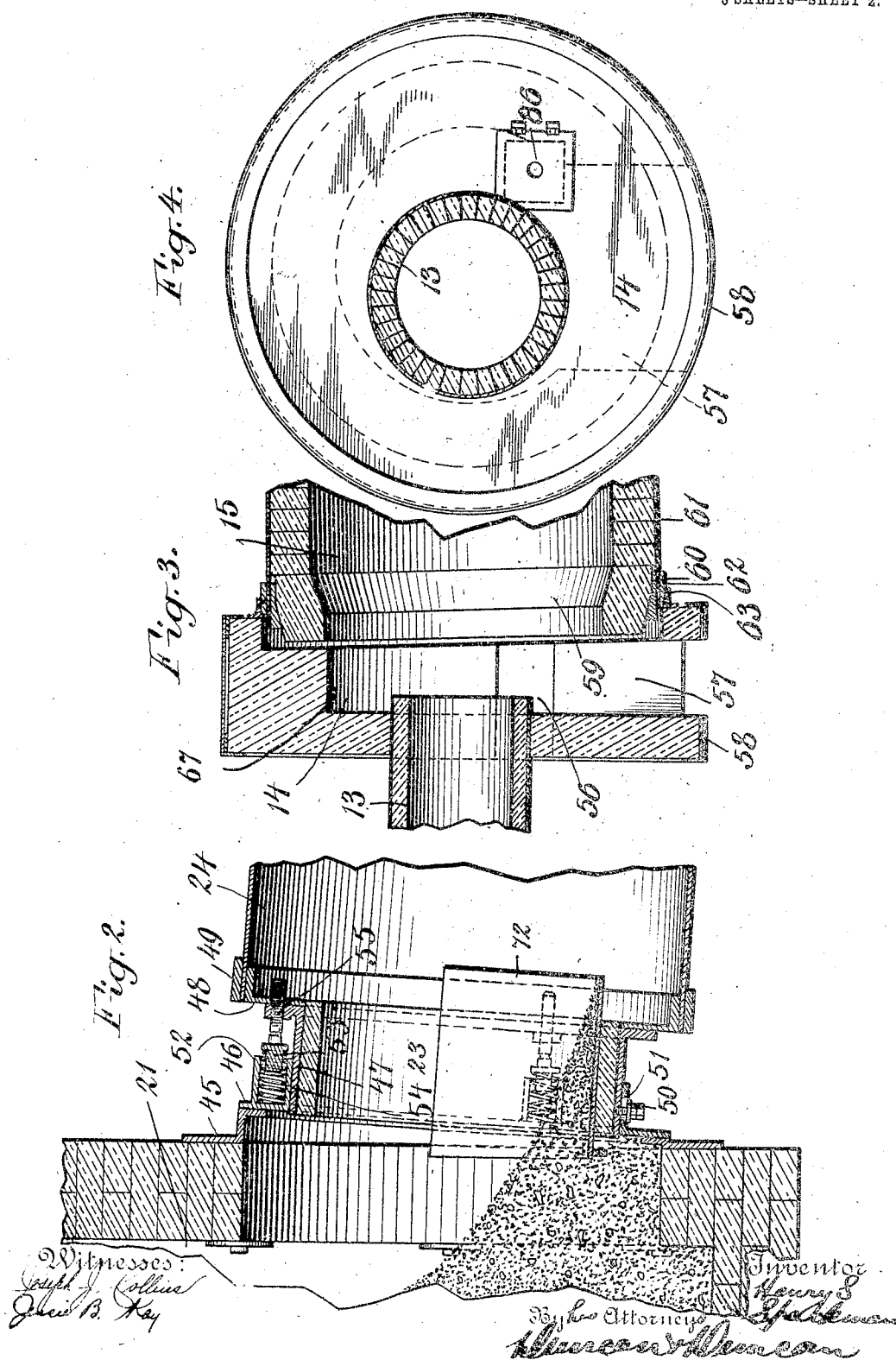
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3 SHEETS—SHEET 2.



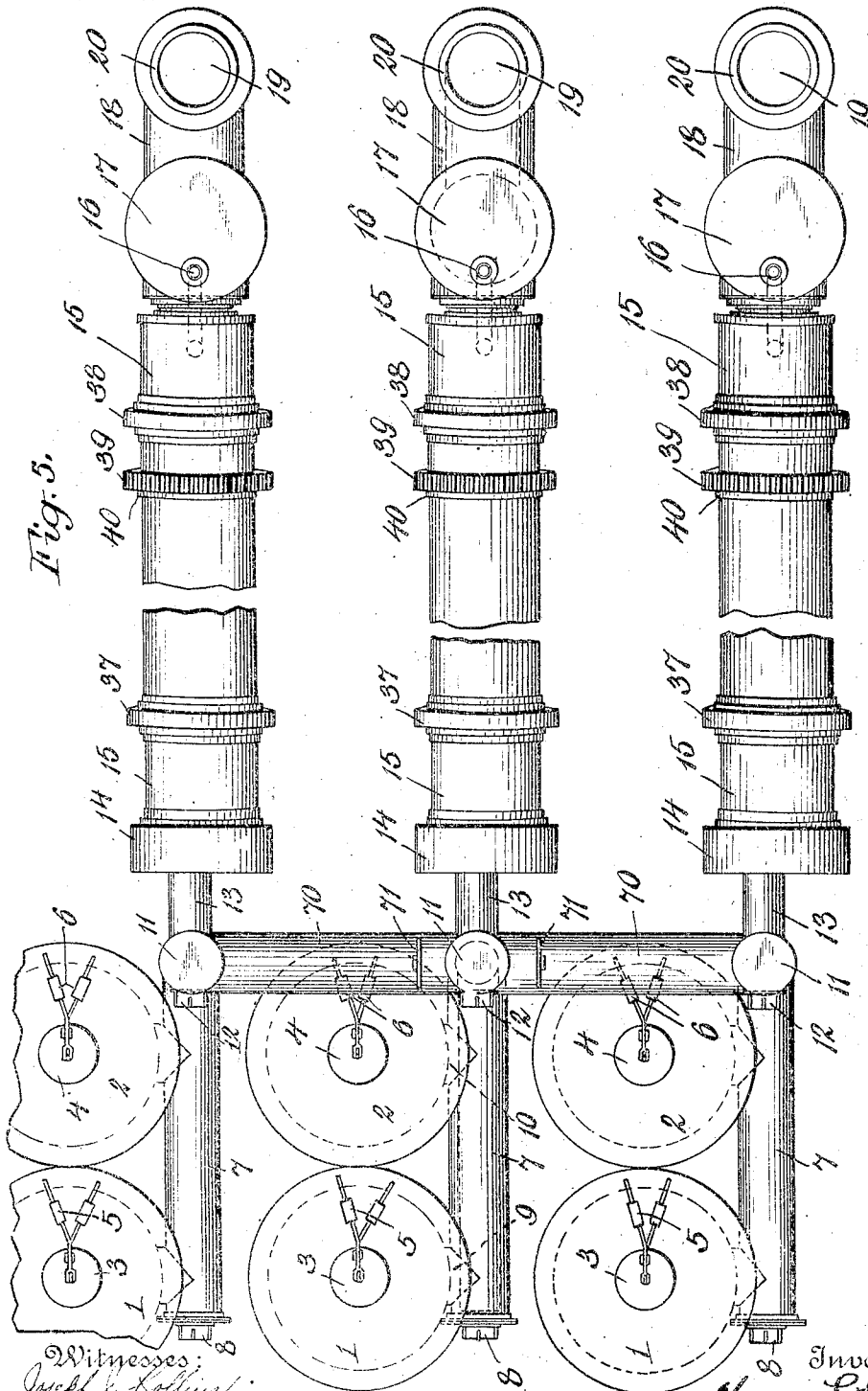
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3 SHEETS—SHEET 3.

920,784.

Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY S. SPACKMAN, OF ARDMORE, PENNSYLVANIA.

CEMENT-BURNING APPARATUS.

No. 920,784.

Specification of Letters Patent.

Patented May 4, 1909.

Application filed March 13, 1908. Serial No. 420,973.

To all whom it may concern:

Be it known that I, HENRY S. SPACKMAN, a citizen of the United States, and a resident of Ardmore, in the county of Montgomery and State of Pennsylvania, have made a certain new and useful Invention Relating to Cement-Burning Apparatus, of which the following is a specification, taken in connection with the accompanying drawings, forming part of the same.

This invention relates to cement burning apparatus and relates especially to apparatus units each comprising a rotary kiln and an air preheating rotary clinker cooler preferably arranged below the kiln, and having substantially air tight connections therewith to supply highly preheated air for combustion in said kiln and producers preferably located adjacent to and substantially in line with said kiln to give a luminous flame therein of sufficient intensity to properly burn Portland cement clinker.

In the accompanying drawings showing in a somewhat diagrammatic manner an illustrative embodiment of this invention and in which the same reference numeral refers to similar parts in the several figures, Figure 1 is a vertical sectional view of one unit of the apparatus. Fig. 2 is an enlarged vertical section through the air chute and cooler connection. Fig. 3 is a similar enlarged sectional view through the hood and kiln connection. Fig. 4 is a transverse sectional view showing the hood end; and Fig. 5 is a plan view showing a battery comprising three units of apparatus.

In the illustrative embodiment of this invention shown in the drawings the rotary kiln 15 may be constructed with a metal shell 61 and suitable refractory lining of the usual character, the lower end of the kiln being preferably provided with an inwardly projecting lining ring 59 so as to maintain a more even distribution of clinker at this point. The upper end of the kiln may as indicated be provided with a reduced neck having a substantially air tight connection with the metal cased dust chamber 17 joined by the flue 18 with the base 19 on which the stack 20 of the desired height may be mounted. By forming the dust chamber and flue of such large size as indicated, a large proportion of the dust is deposited at this point and by reinforcing the brick work lining of these parts with a substantial metal casing their injury by gas explosions is obviated.

It is, of course, understood that the dust may be removed from these parts from time to time through doors which may be located at the points indicated and elsewhere. This rotary clinking kiln 15 may be mounted as usual on suitable tires 37, 38 supported by the bearing rollers 35, 36, and may be rotated by the crown gear 39 supported on the flange 40 secured to the shell of the kiln and engaged by the pinion 41 driven through suitable gearing 42, 43 by the pulley 44, so that the rotation of the kiln combined with the very slight inclination at which it is mounted feeds the raw material supplied through the feed pipe 16 and the resulting clinker down through the kiln in a regular manner.

At the lower end of the kiln is the hood 14 which may be movably mounted on the carriage 64 whose wheels engage suitable tracks 65 so that the position of the hood with respect to the kiln end may be readily adjusted. A substantially air tight joint may be made between these parts by rigidly supporting the joint ring 63 on the kiln end by the reinforcing members 60, 62 secured to the kiln shell 61 so as to maintain the joint ring in proper alinement (see Fig. 3), the internal reinforcing member 60 also serving as indicated to support the lining ring 59. By this means the hood may be moved forward until the revolving joint ring 63 makes a suitable seat for itself in the hood lining so as to form a substantially air tight connection at this point. The hood may be provided with a metallic rim 58 and with a suitable metallic facing on which the hood door 56 provided with a suitable peep hole may be hinged. An aperture may be formed in the hood face toward the ascending side of the kiln to accommodate the burner tube 13. Since the lined burner tube must be made of large size to carry the large volume of producer gas fuel without undue back pressure, it is desirable to arrange the burner tube eccentrically in the hood so as to allow suitable inspection and poke holes in the hood inside the kiln lining. The hood is of course formed with a suitable refractory lining through which the air passage 57 may be formed connecting with the air chute below, a suitable arch 67 or deflecting surface being preferably provided adjacent the upper portion of the hood to properly direct air into the kiln. By forming such a deflector above the burner tube the air may be directed under the lining ring 59 so that air enters the kiln adjacent

the top of the same in a direction substantially parallel to the kiln axis and at low velocity with respect to the fuel jet which is desirable for best combustion conditions and also the air enters above the jet and in sufficient quantities to form an air envelop around the flame and prevent undue upward deflection thereof. The extent to which the end 56 of the burner tube 13 projects into the hood aids in determining the influence of the deflector and the direction and force of the gaseous currents entering the kiln. Under these conditions heating by radiation takes place from the highly luminous hydrocarbon flame in the hot zone of the kiln so as to properly clinker the material which is of course gradually heated in the upper part of the kiln by the flame and hot products of combustion.

A plurality of producers 1, 2, of the water-seal type, or other desired construction, may be arranged closely adjacent to and substantially in line with the kiln so as to have their gas discharge pipes 9, 10, lead into a suitable refractory lined gas pipe 7, preferably having a strong metal casing within which firebrick or other refractory material is used to form a non-conducting lining of the desired thickness to economize heat. This gas pipe as indicated may communicate with a similarly constructed riser 11 connecting with the burner tube 13 of similar construction. Suitable clean-out and inspection doors, such as 8, 12, 66, may be used in these gas connections which, of course, should be kept as clean and free from deposited material as possible although by arranging the producers close to the kiln, as indicated, the gas generated is discharged through the burner tube into the kiln without either material loss of temperature or loss of heating value due to deposition of combustible material therefrom. This arrangement of gas producers also allows any desired number of units to be placed close beside one another, as is indicated in Fig. 5, the burner tubes being connected if desired by a large gas main 70 provided with valves, such as 71, on either side of every burner tube, so that the producers of one unit may be used to the desired extent to equalize or reinforce the gas supply of another unit. The riser 11 may be formed with a suitable vertical extension below the gas pipe 7, this pocket catching any dust or other deposited material and allowing the removal thereof through a suitable door, not shown, without interruption of the burning operation. These producers are of course operated in a well known manner, fuel being introduced into the feeding bells 3, 4, by the manipulation of the valve arms 5, 6, as understood in this art.

The hood 14 is preferably connected with a substantially vertically arranged air chute 21 having a substantially air tight connec-

tion with the hood and supported by a suitable chute frame 22 of any desired construction. This chute is preferably lined with suitable refractory material and formed at its lower end with a substantially level portion in which the clinker may collect and form an inclined bed for itself so as to be discharged without excessive wear into the connected preheating air cooler 24, a suitable curved guide 72 of sheet metal being supported from the flange 45 if desired to prevent contact of the clinker with the collar lining. A suitable door 68 may be provided in the air chute at this point through which any undesirable material from the kiln may be discharged and access to the interior of the air chute secured for inspection and other purposes. The cooler 24 is preferably in the form of a long inclined rotary cylinder mounted on suitable tires 27, 28, cooperating with the bearing or driving rollers 29, 30 so as to slowly rotate the cooler and carry the clinker material up on the internal shelves 35 and ribs 26 and allow the same to drop back with a considerable free fall, if desired. In this way, the air passing through the cooler and air chute may be highly heated by contact with the clinker and otherwise so that on entering the kiln it may, if desired, have a temperature of 1000° or 1200° Fahrenheit, which correspondingly increases the flame temperature and the efficiency of the clinker burning operation in the kiln. This air may be drawn through the kiln and cooler by the stack draft, although it is preferable to force the air into the cooler by suitable means, such as a blower 32 of any desired construction which forces a large volume of air through the blast pipe 31 into the lower end of the cooler. If desired, a suitable cooler hood may be used at the lower end of the cooler as indicated so as to substantially inclose the same while allowing the cool clinker to fall into the elevator buckets 33 mounted on the rolls 34 to discharge the same. In case the lower end of the cooler is not inclosed in this way the air issuing at a pressure of a number of ounces from the end of the blast pipe 31 inside the cooler draws additional air in by injector action and creates an air current through the cooler, air chute and hood into the kiln, maintaining a positive pressure at these points so as to prevent the entrance of cold air at any openings. It is, however, desirable to have a substantially air tight connection between the cooler and the air chute and this may be accomplished as indicated in Fig. 2 by bolting a suitable flange 45 on the side of the air chute and securing a collar 47 on the upper end of the cooler by the reinforcing member 49 and the end flange 48 secured to the shell of the cooler and to the collar 47. A suitable joint ring 46 may be loosely mounted on the col-

lar 47 and its rotation with respect thereto prevented by suitable aligning bolts 50 playing in slots 51 in the ring. This ring may be held tightly in engagement with the flange 5 45 by a number of springs 54 located in suitable recesses in the ring and engaged by the screw studs 55 so that the ring may be pressed against the flange to the desired extent to insure a substantially tight joint 10 without undue friction losses.

Having described this invention in connection with an illustrative embodiment thereof, to the details of which disclosure the invention is not, of course, to be limited, 15 what is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims.

1. In cement burning apparatus, a rotary kiln, a stack, a metal cased dust chamber 20 and flye provided with refractory lining between said kiln and said stack, means to feed cement material through said dust chamber into the upper end of said kiln, a movable hood making a substantially air-tight joint with said kiln, said hood having 25 an air passage and a deflecting arch at the upper end of said air passage to direct air into said kiln adjacent the top of the same, a brick-lined gas burner tube projecting 30 through the face of said hood below said arch and on the ascending side of the kiln axis, an inspection and poke hole in the opposite side of said hood face, a hood door for said hole, a plurality of gas producers located 35 closely adjacent to and having metal cased gas connections substantially in line with said kiln and provided with refractory lining and with clean-out doors leading the producer gas through said burner tube into said kiln 40 without undesirable cooling or deposition losses, said connections comprising a horizontal gas pipe and vertical riser connected with said burner tube and extending above and below said gas pipe, an air chute having 45 a refractory lining and supported adjacent said hood to make substantially tight connection therewith, the lower end of said chute forming a pocket on which a bed of clinker collects and discharges without excessive wear, a discharge and inspection 50 door in the lower end of said chute, a rotary internally ribbed air preheating cooler connected with said chute opposite said door by a substantially air tight connection and a 55 blower to force air for combustion into the lower end of said cooler and through said cooler, chute and hood under pressure so as to enter said kiln to form a highly heated air envelop around the luminous gas flame 60 developed therein and heat said kiln to the clinkering temperature of Portland cement.

2. In cement burning apparatus, a rotary kiln, a stack, a metal cased dust chamber 65 provided with refractory lining between said kiln and said stack, means to feed cement

material into the upper end of said kiln, a movable hood making substantially air tight connection with the lower end of said kiln, said hood having an air passage extending 70 through the lower portion thereof and having a deflecting arch at the upper end of said air passage to direct air into said kiln adjacent and substantially parallel with the top of the same, a gas burner tube provided 75 with refractory lining projecting through the face of said hood on one side of the same below said arch, an inspection and poke hole in the opposite side of said hood face, a plurality of gas producers located closely 80 adjacent to said kiln and having metal cased gas connections substantially in line with said kiln and provided with refractory lining and with clean-out doors leading the gases from said producers to said burner 85 tube and discharging the same into said kiln without undesirable cooling or deposition losses, an air chute provided with refractory lining and making a substantially tight joint with said hood, a rotary air preheating cooler 90 connected with said chute by substantially air tight connection, and means to force air for combustion into the lower end of said cooler and through said cooler, chute and hood so as to enter said kiln to form a highly 95 heated air envelop around the luminous gas flame developed therein.

3. In cement burning apparatus, a rotary kiln, a hood having a substantially air tight joint with the lower end of said kiln, said 100 hood having a deflecting arch formed in the upper portion thereof to direct air into said kiln adjacent the top of the same, a gas burner tube having refractory lining projecting through the face of said hood on one side 105 of the same and below said arch, an opening formed on the opposite side of said hood face, a gas producer located closely adjacent to said kiln and having lined gas connections leading the gas from said producer to said burner tube and discharging the same into 110 said kiln without undesirable cooling or deposition losses, a rotary clinker cooler and air chute connecting the upper end of said cooler with said hood and means to force air into the lower end of said cooler and through 115 said cooler, chute and hood under pressure so as to form a highly heated air envelop around the luminous gas flame developed therein.

4. In cement burning apparatus, a rotary 120 kiln a hood making a substantially air tight joint with the lower end of said kiln, an air preheating rotary cooler and air chute having a substantially air tight connection with said cooler and said hood, the lower portion 125 of said chute constituting a pocket on which a bed of clinker collects and is discharged without excessive wear.

5. In cement burning apparatus, a rotary kiln, a hood at the lower end of said kiln, a 130

plurality of producers closely adjacent to said kiln, gas connections having nonconducting lining between said producers and said kiln to feed producer gas into said kiln without undesirable cooling or deposition losses, said connections comprising a substantially horizontal gas pipe connected with said producers, a burner tube extending in said kiln, a riser connected with said burner tube and extending on either side of said gas pipe and cleanouts in said rise substantially in line with said burner pipe and gas pipe.

6. In cement burning apparatus, a plurality of units arranged side by side each comprising a rotary kiln, a hood at the lower end of said kiln, an air preheating rotary clinker cooler below said kiln and air chute connecting the upper end of said cooler with said hood, means to force air for combustion into the lower end of said cooler and through said cooler, chute and hood under pressure to enter said kiln in a highly heated condition for combustion of the fuel gas therein, a plurality of gas producers closely adjacent to said kiln and gas connections substantially in line with said kiln and provided with non-conducting refractory lining between said gas producers and said kiln to discharge the producer gas into said kiln without undesirable cooling or deposition losses and a gas main joining the gas connections of the several kilns and provided with valves adjacent each kiln connection.

7. In cement burning apparatus, a plurality of units arranged side by side each unit comprising a rotary kiln, a hood at the lower end of said rotary kiln, an air preheating rotary cooler below said kiln, means to pass air through said cooler and hood to enter said kiln in a highly heated condition, a gas

producer closely adjacent to said kiln, gas connections between said gas producer and said kiln to feed the producer gas into said kiln without undesirable cooling or deposition losses and a gas main joining the gas connections of each of said kilns and provided with valves adjacent each gas connection.

8. In cement burning apparatus, a plurality of units arranged side by side, each unit comprising a rotary kiln, a hood at the lower end of said rotary kiln, an air preheating rotary cooler below said kiln, means to pass air through said cooler and hood to enter said kiln in a highly heated condition, a plurality of gas producers closely adjacent to said kiln, gas connections between said gas producers and said kiln to feed the producer gas into said kiln without undesirable cooling or deposition losses and a gas main joining the gas connections of each of said kilns and provided with valves adjacent each gas connection.

9. In cement burning apparatus, a plurality of units arranged side by side each unit comprising a rotary kiln a preheating cooler connected with said kiln and means to pass air through said cooler to enter said kiln in a highly heated condition to support combustion therein, a gas producer closely adjacent to said kiln, gas connections between said gas producer and said kiln to feed the producer gas into said kiln eccentrically with respect to said kiln axis and a transversely arranged gas main joining the gas connections of each of said kilns and provided with valves adjacent each kiln connection.

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