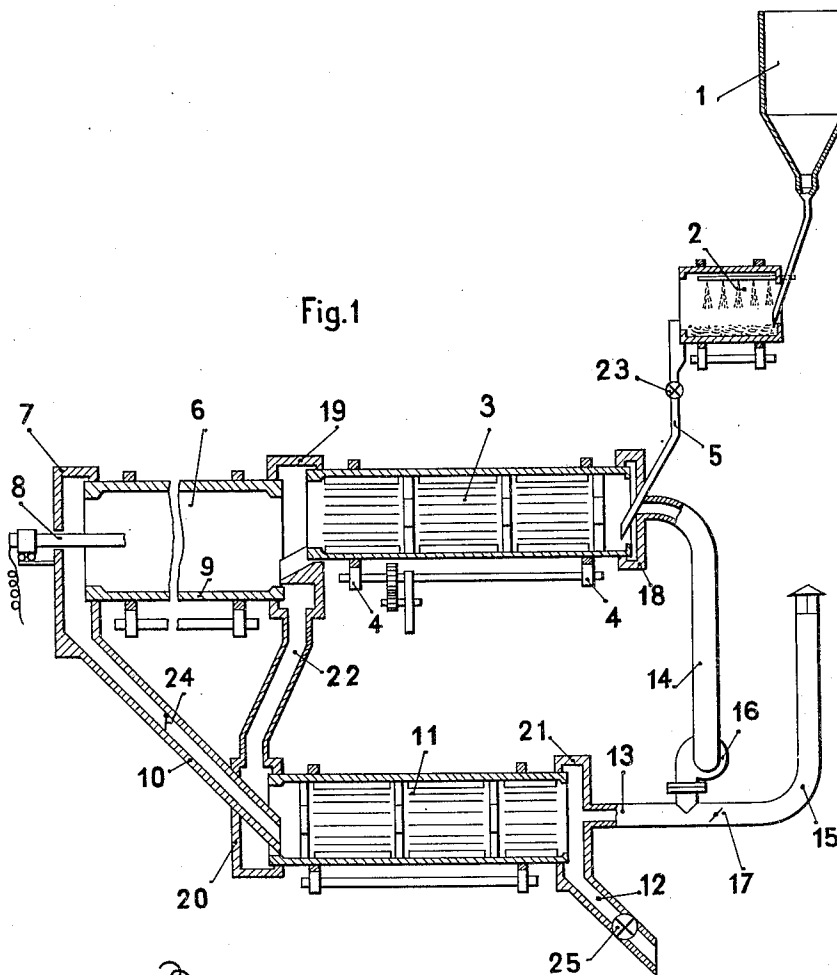
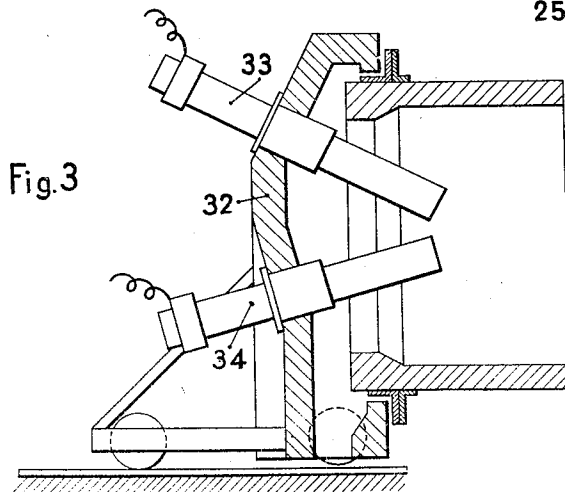


June 20, 1944.

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PLANT FOR TREATING RAW MATERIALS IN THE
MANUFACTURE OF CEMENT AND THE LIKE
Filed July 28, 1942

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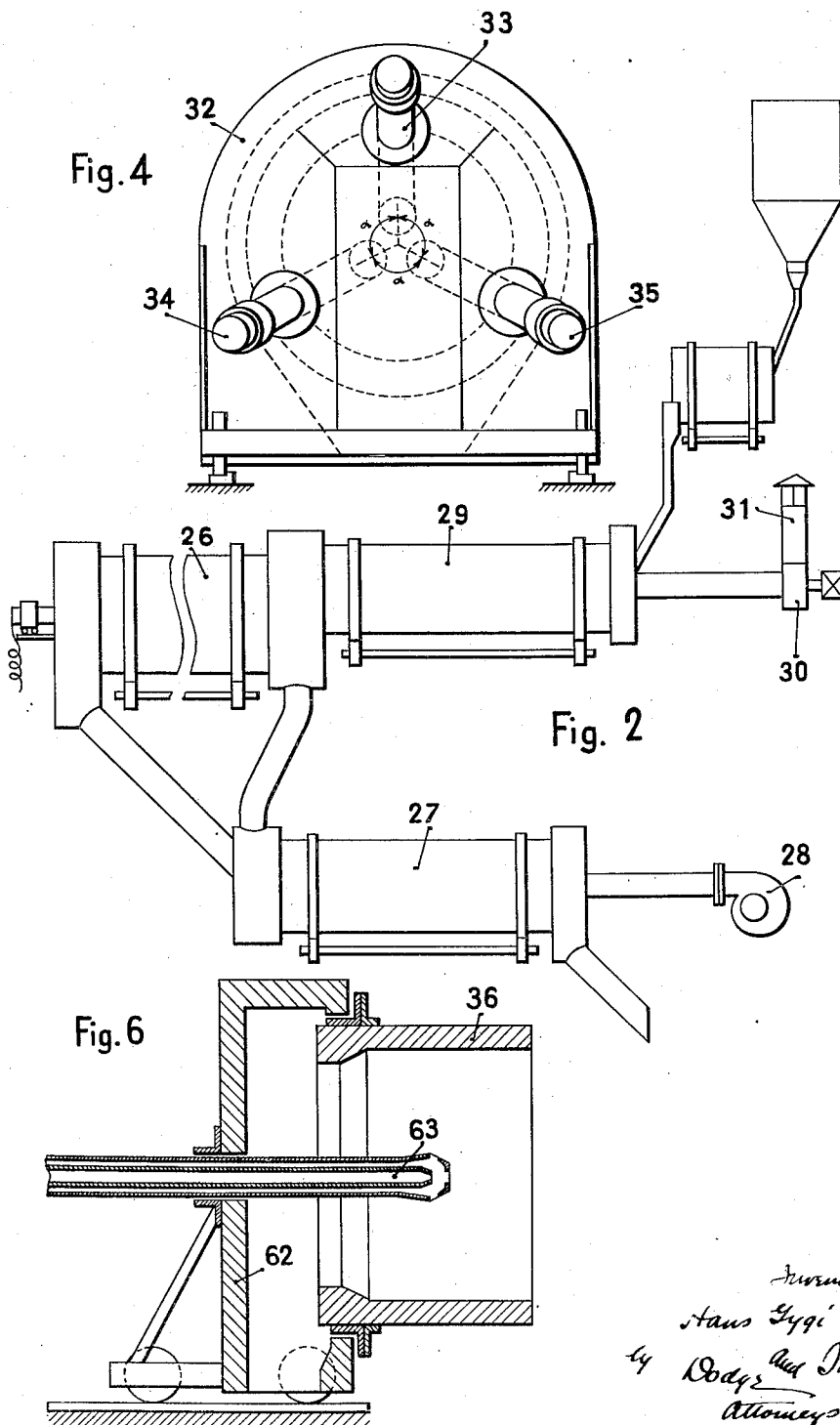
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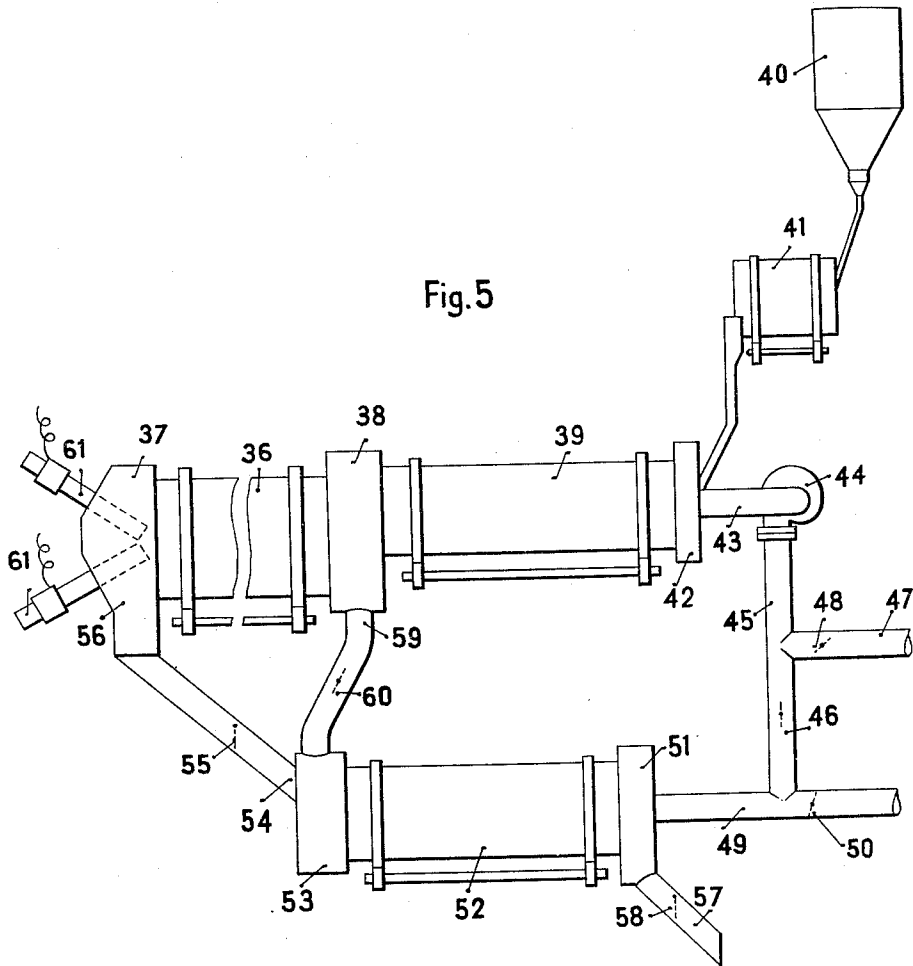
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Fig.5



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UNITED STATES PATENT OFFICE

2,351,677

PLANT FOR TREATING RAW MATERIALS IN
THE MANUFACTURE OF CEMENT AND THE
LIKE

Hans Gygi, Wildegg, Switzerland

Application July 28, 1942, Serial No. 452,630
In Switzerland August 9, 1941

11 Claims. (Cl. 13—10)

This invention relates to a plant for the heat treatment of different kinds of raw materials, particularly for the burning of cement, alkaline earth carbonates, for example limestone, magnesite, dolomite, etc., in a plant comprising a rotary kiln heated by means of an electric arc.

According to the prior art, in kilns heated by means of electrical energy air of high temperature was forced through the kiln, such air having been previously preheated in a heat-exchanger by heat given off from the heated material leaving the kiln and afterwards re-heated by means of electrical energy. The present invention is based on the conception that the use of air as a heat conveyor in a kiln involves several disadvantages. Thus, for example, noxious nitrogen compounds form in the kiln which impair the quality of the final products. Furthermore, rather considerable quantities of heat are carried out of the kiln by the air forced through the latter, whereby such heat can be transmitted in a preheater only at a low temperature drop to the raw material to be preheated. As a consequence of this the preheater has to be designed of very generous dimensions in relation to the kiln which involves greater heat losses, large space requirements and increased investment costs for the plant. In order to comply with the above mentioned conception, the heat treatment in a rotary arc kiln is effected according to the present invention without any supply of air or other gases, i. e. it is effected in a CO₂-atmosphere, so that the heat produced by the electric arc is transmitted almost entirely by radiation alone. Furthermore, according to the present invention the inner surface of the liner of the electric arc kiln acting as an indirect heating surface is made of such size that the highest temperature of this surface does not exceed 1550° C. in the course of a revolution of the kiln.

To raise the efficiency of the plant to the maximum possible extent, the gases leaving the rotary kiln may advantageously be used to heat a current of gas the greater part of which describes a closed circuit, such current being continuously cooled by a heat exchange with the raw materials to be supplied to the kiln and hereafter reheated by a heat exchange with the heated material discharged from the kiln. When carrying out the method in the last mentioned manner, the gases issuing from the rotary kiln may be introduced into said closed circuit after the above mentioned second heat exchange; furthermore a quantity of gas which corresponds to the quantity of gas generated in the kiln and in

the preheater, may be withdrawn from said circulating current of gas after the latter has been cooled down but before it is reheated. In such a case the quantities of waste gas and consequently also the heat carried off by the latter may be reduced to a minimum.

In certain cases it may, for reasons connected with the manufacturing process, be of particular importance that the burnt material should issue from the cooler at as low a temperature as possible. According to a preferred manner of carrying out the new method the latter purpose may be attained without impairing to any appreciable extent the heat economy of the plant, by adding to the gases of higher temperature issuing from the kiln and as near as possible to the point where these gases leave the kiln, fresh air that has been preheated by a heat exchange with the burnt material discharged from the kiln. The current of gas and fresh air so obtained is then cooled down by a heat exchange with the raw material supplied to the kiln, whereafter said current is discharged to the atmosphere.

In order to obtain a satisfactory product and to prevent the formation of calcium carbide when employing carbon electrodes, an oxidizing agent, for example manganese dioxide (MnO₂), can conveniently be added to the raw material before its granulation for the purpose of oxidizing the particles falling from the electrodes inside the electric arc kiln.

All electrodes are suitably arranged in the head of the rotary kiln at its discharge end. Such an arrangement of the electrodes ensures a steady rise of the temperature in the rotary kiln towards its discharge end. In this manner the required gradual heating of the raw material necessary for the production of a uniformly burnt or sintered product is ensured.

The accompanying drawings show, by way of example and more or less diagrammatically, several forms of plants for carrying out the new method.

In the drawings,

Fig. 1 illustrates partly in a longitudinal section and partly in a plan view a first constructional example of such a plant and

Fig. 2 shows a plan view of a second embodiment.

Fig. 3 illustrates on a larger scale an axial longitudinal section through the discharge end of a rotary kiln provided with three electrodes and

Fig. 4 is an end view of the head provided at the discharge end of the kiln.

Fig. 5 illustrates a further constructional example of a plant in which the kiln can be heated either by means of an electric arc or by means of fuel, whilst

Fig. 6 shows on the same scale as Fig. 3 an axial longitudinal section through the discharge end of a rotary kiln provided with a removable head mounted on wheels in which a fuel burner with means for imparting a whirling motion to the issuing fuel is fitted.

In Fig. 1 the numeral 1 denotes a silo, 2 a granulating drum with a built-in spray and 3 a preheater designed as a rotating drum the axis of which has an inclination of approximately 5% towards the discharge end. This preheater 3 turns on rollers 4 at a speed of 1.5 R. P. M., and inside the same are provided means of known design for intensifying the exchange of heat. The material leaving the drum 2 passes down a chute 5 into the preheater 3. Numeral 6 designates a rotary kiln, the axis of which is likewise slightly inclined towards its discharge end. This kiln 6 rotates at a somewhat lower speed than the preheater 3, as it only makes approximately one revolution per minute. In the head 7 on the discharge end of the kiln 6 electrodes 8 are arranged, only one of which is visible in Fig. 1. The inside surface of the liner 9 provided inside the rotary kiln 6 and serving as an indirect heating surface is so dimensioned that the highest temperature occurring on this surface does not exceed 1550° C. during a rotation of the kiln.

10 denotes a chute down which the red hot, burnt material leaving kiln 6 passes into a cooler 11. This cooler 11 is substantially of the same design as the preheater 3; accordingly means of known kind are likewise provided inside this drum to intensify the exchange of heat. To the cooler 11 are connected a discharge chute 12 and a pipe 13. Two pipes 14 and 15 branch off from the latter, the pipe 14, in which a fan 16 is fitted, discharging into the inlet end of preheater 3, whilst pipe 15, in which an adjustable valve flap 17 is fitted, serves as chimney. 18 denotes an air-tight head provided on the inlet end of preheater 3 and 19 denotes a head which connects the preheater 3 in an air-tight manner to the rotary kiln 6. The cooler 11 has air-tight heads 20 and 21, the first of which is connected through a pipe 22 to the air-tight head 19. In the chutes 5 and 12 are fitted rotary valves 23 and 25 respectively, which prevent atmospheric air from penetrating into the circuit. A non-return valve 24 provided in the chute 10 acts as a sluice, which whilst allowing a discharge of sintered material from kiln 6 into cooler 11, prevents any gas from flowing through said chute 10.

The hereinbefore described plant is operated as follows: In silo 1 powdered raw material is stored to which an oxidizing agent, for example manganese dioxide, is added in sufficient quantities to ensure that the particles dropping from the electrodes inside the electric kiln 6 are oxidized. As a result of this measure no calcium carbide, magnesium carbide or the like are found in the burnt material. The powdered raw material passes from silo 1 into the granulating drum 2 where such a quantity of water is added that the grains have a humidity of 10-15% when leaving the granulating drum. The granulated raw material preliminarily treated in this manner travels over a chute 5 to a preheater 3 and, after being preheated in the latter, into the rotary kiln 6. Calcining of the raw material takes place near the inlet end of this kiln 6, whilst the sintering

of the material is effected in the vicinity of the electrodes 8. The red hot, burnt material passes down a chute 10 to a cooler 11 and, after having been cooled, finally into the open.

The CO₂-gases of high temperature developed in the calcining zone of kiln 6 are utilized for heating the current of gas which fan 16 inhales from preheater 3 through pipe 14 and forces for the greater part through pipe 13 into the cooler 11. The current of gas heated in the cooler 11 flows through pipe 22 into head 19 on the inlet end of the kiln where it mixes with any gases that may escape from the kiln 6. The valve flap 17 in the chimney pipe 15 is adjusted in such a manner that the volume of gas circulated by the fan 16 brings about suitable temperature conditions in the preheater 3 and cooler 11. Through pipe 15 such quantities of carbon dioxide and water vapour are discharged to the atmosphere as are given up to the circulated gas current in the rotary kiln 6 and preheater 3. The various air-tight heads 7, 18, 19, 20 and 21 ensure that no gases can escape to the atmosphere at these points, whilst they also prevent the access of air to the circuit. An appreciable vacuum and a pressure somewhat than the atmospheric only prevail in the head 18 at the inlet end of preheater 3 and in the head 21 at the discharge end of cooler 11 respectively; these heads 18 and 21 must therefore be executed with special care.

Thus, in the described plant, heat treatment in the rotary kiln 6 is carried out without any supply of air or other gases, so that the burning takes place in a CO₂-atmosphere. Consequently, the heat produced by the electric arc is transmitted almost entirely by radiation alone. Hereby any gases which may eventually issue from the electric heated kiln 6 are utilized for heating a current of gas the greater part of which is circulated in a closed circuit. This current of gas is cooled in the preheater 3 by a heat exchange with the raw material supplied to kiln 6 and again reheated in the cooler 11 by a heat exchange with the red hot, burnt material discharged from the kiln 6. To this circulating current of gas are added near the point where the current flows out of pipe 22, the gases eventually issuing from kiln 6. Moreover, a quantity of gas is withdrawn from said current of gas through pipe 15 after it has been cooled down in preheater 3, but before it is re-heated in cooler 11, which corresponds to the quantity of gas generated in kiln 6 and preheater 3.

The plant illustrated in Fig. 2 which likewise comprises an electric kiln 26 heated by means of an electric arc differs from the plant shown in Fig. 1 in that the burnt material is cooled in a cooler 27 by means of fresh air. This fresh air is supplied under pressure above atmospheric to the discharge end of cooler 27 by a fan 28. The CO₂-gas produced in the calcining zone of kiln 26 is mixed with fresh air in the inlet head of the kiln, such fresh air having been previously preheated in cooler 27 by an exchange of heat with the discharged, red hot material. This mixture of gas and air then flows through a preheater 29, after which it is forced by a fan 30 into chimney 31 and finally reaches the atmosphere.

In Figs. 3 and 4 a further embodiment is shown of the discharge end of a rotary kiln heated by means of an electric arc. In these figures the numeral 32 denotes a kiln head mounted on rollers so that it can be easily removed in order to facilitate access to the kiln when repairs to its lining have to be made. In the kiln head 32 three

electrodes 33, 34 and 35 supplied with three-phase current are disposed pyramidally in such a manner that they are inclined at an angle α of approx. 45° to one another; this angle α can however be a few degrees more or less than 45° . By arranging all the electrodes in the head on the discharge end of the rotary kiln, a blowing effect on the arc in the axial direction towards the inlet end of the kiln can be attained, as a result of which the kiln liner in the vicinity of the arc is largely protected against local overheating. The lower part of the kiln head 32 is designed in such a manner that the material falling from the kiln may collect therein; from said lower part the material passes down a chute into the cooler, both of which are not shown in these figures, since they correspond to similar parts illustrated in Figs. 1 and 2.

The heating of the kiln can be regulated by changing the strength of the current whilst maintaining its tension constant; this can be brought about by adjusting the distance between the tips of the electrodes.

To prevent plants provided with electrically heated rotary kilns from having to be put out of service for some considerable time, for instance in winter, owing to lack of sufficient cheap current, a fact that might jeopardize the economical working of the whole plant, particularly in view of the relatively high initial costs, the rotary kiln can be designed in such a manner and the plant provided with such auxiliary equipment as to permit heating of the kiln either by means of an electric arc or with the aid of fuel, preferably pulverized coal. In such a case the kiln head on the discharge end must be interchangeable, preferably in such a manner that it can be moved in and out, so that when heating with electrical energy a kiln head fitted with electrodes can be brought into place and when heating with fuel a kiln head in which at least one burner is provided. Since it is possible to change the kiln heads within about an hour, a change-over from, for example, heating with coal to heating with electrical energy or vice-versa does not require much time, thus offering the great advantages that the whole surplus electrical energy whilst it is available can, in practice, be utilized; moreover such a change-over involves only an unimportant drop in output, and finally the heat losses and detrimental effects on the kiln liner occurring when a kiln is allowed to cool down, are reduced to a minimum.

A plant which can be heated by means of an electric arc as also with fuel is illustrated in Fig. 5. In this figure the numeral 36 denotes the rotary kiln, the axis of which is slightly inclined towards the discharge end 37. A head 38 forms a connection between the inlet end of the rotary kiln 36 and a heat exchanger 39 in which gases issuing from rotary kiln 36 gives up waste heat to the raw material which passes into the heat exchanger 39 from a silo 40 through a granulating drum 41 and a head 42. The heat exchanger 39 is likewise slightly inclined towards its discharge end and turns at a somewhat higher speed than the rotary drum 36. To the air-tight head 42 on the inlet end of the heat exchanger 39 the suction pipe 43 of a gas conveying device 44 is connected. The latter forces gas into a pipe 45 in which an adjustable valve flap 46 is fitted; furthermore a pipe 47 in which a valve flap 48 is arranged branches off from pipe 45. In the open position of valve 48 the pipe 45 is connected to the atmosphere through pipe 47. Pipe 45 dis-

charges into a pipe 49 in which a valve flap 50 is fitted; when the latter is in its open position, pipe 49 is connected to the atmosphere. The pipe 49 is connected to the head 51 on the outlet end of a second heat exchanger 52. Numeral 53 denotes the head on the inlet end of this heat exchanger 52, whilst 54 is a chute which connects the head 53 to the head 56 on the discharge end of the rotary kiln 36, so that the material burnt in the latter passes down this chute 54 in a red hot state into heat exchanger 52, which is slightly inclined towards the head 51 and is slowly rotated during operation of the plant. A non-return valve 55 is fitted in the chute 54. The material which reaches the heat exchanger 52 is slowly forced by the latter towards a discharge chute 57 likewise equipped with a non-return valve 58. Numeral 59 denotes a pipe connecting the head 38 to the head 53; in this pipe 59 an adjustable throttle valve 60 is provided.

Fig. 5 shows a head 56 on the discharge end 37 of the kiln 36 with inserted electrodes 61 for heating the rotary kiln 36 by means of an electric arc. This kiln head 56 is mounted on rollers in the same manner as the one shown in Fig. 3, so that it can be replaced by the kiln head 62 with built-in burner 63 shown in Fig. 6, which is likewise mounted on rollers. In the latter case a fuel, preferably pulverized coal, may be employed for heating the raw material. It is of advantage to provide a burner fitted with means for imparting a whirling motion to the issuing fuel, since the latter is then burnt with a short flame.

To permit heating of the rotary kiln by means of electrical energy as well as with a solid, pulverized or liquid fuel, the length of the rotary kiln 36 must be such that it amounts to approximately three to four times its diameter. By dimensioning the kiln in this manner those conditions are obtained which are required for producing an entirely satisfactory product when applying either of the two heating methods.

The plant illustrated in Fig. 5 has to be operated as follows: Let it be assumed that the kiln head 56 with the inserted electrodes 61 has been moved into place in the manner shown in this Fig. 5, so that the rotary kiln can be heated by an electric arc. The various valves 46, 48, 50 and 60 are, in this case, adjusted into the positions shown in Fig. 5, i. e. valves 46 and 60 are fully open, valve 50 is fully closed, whilst valve 48 is open to such an extent that the volume of gas escaping through pipe 47 to the atmosphere corresponds to the volume of gas issuing from the kiln 36 and which is supplied to the circulating current in head 38. This circulating current is inhaled by fan 44 from heat exchanger 39 through pipe 43 and is then forced through pipes 45, 49 into the heat exchanger 52 and through pipe 59 back into the head 38 of heat exchanger 39, thereby by-passing rotary kiln 36. The non-return valve 55 provided in chute 54 acts as a sluice allowing a discharge of burnt material from the kiln 36 into the cooling device 52, whilst it prevents any flow of gas through said chute 54.

If, on the other hand, the rotary kiln must, for example, be heated with pulverized coal, the kiln head 62 shown on Fig. 6 is moved into position, the valves 46 and 60 being closed and valves 48 and 50 opened, whilst the non-return valve 55 has to remain constantly open, i. e. has to be fixed in its open position. The fan 44 now ensures that fresh atmospheric air is sucked into pipe 49 and forced into heat exchanger 52 where it is preheated to a high degree by heat given up in this

apparatus from the clinkers discharged into the latter. This preheated air then passes through pipe 54 into the kiln head 56, since the non-return valve 55 now permits such a passage. From the kiln head 56 the fresh air passes into the kiln 36 where it causes a combustion of the fuel. The gases issuing from kiln 36 pass into the heat exchanger 38 where they are cooled down by giving up heat to the raw material supplied to the kiln 36. The cooled gases are finally forced by the fan 44 through pipe 47 into the atmosphere.

When heating by means of an electric arc it follows that no gases circulate through the kiln 36, whereas a current of air previously preheated to a high degree flows through the rotary kiln when the latter is heated with pulverized coal.

It has been found that particularly satisfactory results are obtained when the fan 44 is operated in such a manner that it conveys approximately the same quantity of gas for both kiln heating methods, i. e. the quantity of fresh air inhaled whilst heating with fuel practically corresponds to the quantity of gas supplied to the circuit whilst heating by a supply of electrical energy.

Any desired number of electrodes or burners can be fitted in the kiln head. The use of burners having a relatively short flame has been found to be most suitable. This requirement is fulfilled to a particularly high degree by burners with means for imparting a whirling motion to the issuing fuel.

What is claimed is:

1. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln whereby the kiln serves as a sintering furnace; and means for passing materials to be burned through the kiln, while inhibiting substantial gas flow through said means.

2. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; means for passing materials to be burned through the kiln, while inhibiting substantial gas flow through said means; and means for effecting a heat transfer from material leaving the kiln to material approaching the kiln.

3. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; a heating conveyer; means for supplying solid material to the kiln through the heating conveyer; a discharge from the kiln for the burned materials; means for substantially inhibiting the entrance of gaseous media into the kiln through said discharge; a cooling conveyer

to which said discharge delivers; means forming a flow path which by-passes the kiln and leads successively through the cooling and heating conveyers; and gas circulating means for propelling gas in said flow path and so arranged as to induce gas flow in the heating conveyer in a direction away from the kiln.

4. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; a heating conveyer; means for supplying solid material to the kiln through the heating conveyer; a discharge from the kiln for the burned materials; means for substantially inhibiting the entrance of gaseous media into the kiln through said discharge; a cooling conveyer to which said discharge delivers; means forming a flow path which by-passes the kiln and leads successively through the cooling and heating conveyers in countercurrent to the solid material; and gas circulating means for propelling gas in said flow path and so arranged as to induce gas flow in the heating conveyer in a direction away from the kiln.

5. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; a heating conveyer; means for supplying solid material to the kiln through the heating conveyer; a discharge from the kiln for the burned materials; means for substantially inhibiting the entrance of gaseous media into the kiln through said discharge; a cooling conveyer to which said discharge delivers; means forming a flow path which by-passes the kiln and leads successively through the cooling and heating conveyers in countercurrent to the solid material; gas circulating means for propelling gas in said flow path and so arranged as to induce gas flow in the heating conveyer in a direction away from the kiln, said circulating means being located in substantially the coolest part of the circuit; and a valve controlled vent leading from said circuit adjacent the delivery of said circulating means.

6. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; a heating conveyer; means for supplying solid material to the kiln through the heating conveyer; a discharge from the kiln for the burned material; means for substantially inhibiting the entrance of gaseous media into the kiln through said discharge; a cooling conveyer to which said discharge delivers; means forming a flow path which by-passes the kiln and leads through the cooling conveyer and then through the heating conveyer in countercurrent to solid

material flowing toward the kiln; and gas circulating means capable of discharging at least in part to atmosphere and having its intake connected with the entrance end of the heating conveyer, whereby the circulator tends to withdraw from the kiln any gases evolved therein.

7. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; a heating conveyer; means for supplying solid material to the kiln through the heating conveyer; a discharge from the kiln for the burned material; means for substantially inhibiting the entrance of gaseous media into the kiln through said discharge; a cooling conveyer to which said discharge delivers; means forming a flow path which by-passes the kiln and leads through the cooling conveyer and then through the heating conveyer in countercurrent to solid material flowing toward the kiln; gas circulating means capable of discharging at least in part to atmosphere and having its intake connected with the entrance end of the heating conveyer, whereby the circulator tends to withdraw from the kiln any gases evolved therein; and a connection from the discharge of the gas circulating means to the cooling conveyer, whereby a part of said evolved gases may be caused to flow in the circuit.

8. Plant for the heat treatment of solid raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means and being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln; an inclined rotary tube heating conveyer delivering to said kiln; means for supplying solid material to the entrance end of said conveyer, the last named means being arranged to minimize the entrance of gaseous media; a discharge from the kiln for the burned materials; means for substantially inhibiting the flow of gaseous media through said discharge toward the kiln; an inclined rotary tube cooling

conveyer fed by said discharge; a discharge chute from said cooling conveyer arranged to resist the passage of gaseous media; sealing means in which the ends of said conveyers turn, said sealing means forming part of a flow circuit which by-passes the kiln and leads from the discharge end of the cooling conveyer through that conveyer and to the discharge end of the heating conveyer and thence through said heating conveyer to the entrance end thereof; and gas circulating means for withdrawing gases from the entrance end of the heating conveyer, to maintain sub-atmospheric pressure therein, and discharging at least in part into the cooling conveyer to develop a higher pressure therein.

9. Plant for the heat treatment of raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, and means for producing an electric arc in said kiln, the inside kiln surface acting as an indirect heating means being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln which serves primarily as a sintering furnace.

10. Plant for the heat treatment of raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, a head on the discharge end of said kiln, electrodes arranged in said head, and means for supplying electric current to said electrodes, the inside kiln surface acting as an indirect heating means being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln which serves primarily as a sintering furnace.

11. Plant for the heat treatment of raw materials of different kinds, particularly for the burning of cement, alkaline earth carbonate, magnesite, dolomite and the like, comprising a rotary kiln, a movable head on the discharge end of said kiln, three electrodes arranged pyramidentally in such a manner that they enclose an angle of approximately 45° between one another, and means for supplying a three-phase current to said electrodes, the inside kiln surface acting as an indirect heating means being of such a size that the maximum temperature on said surface does not exceed 1550° C. in the course of a rotation of the kiln.

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