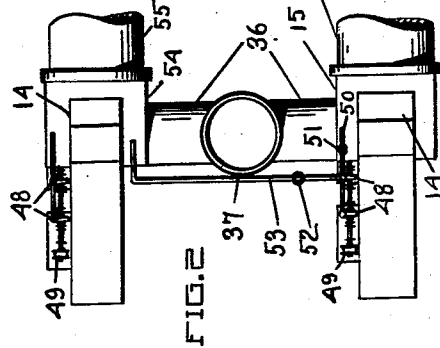
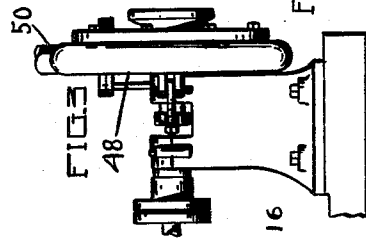
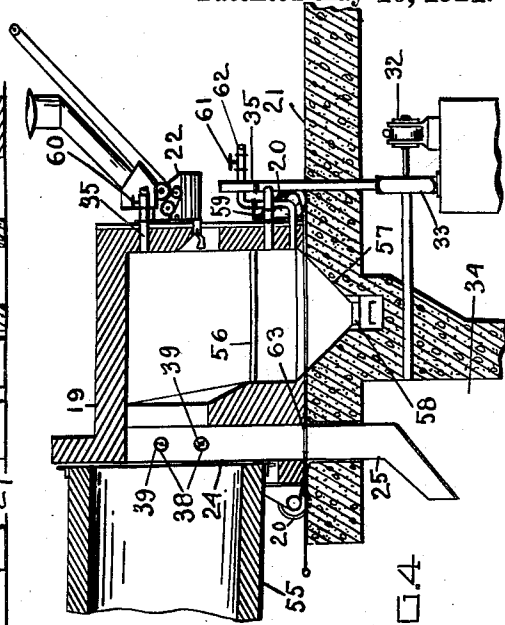
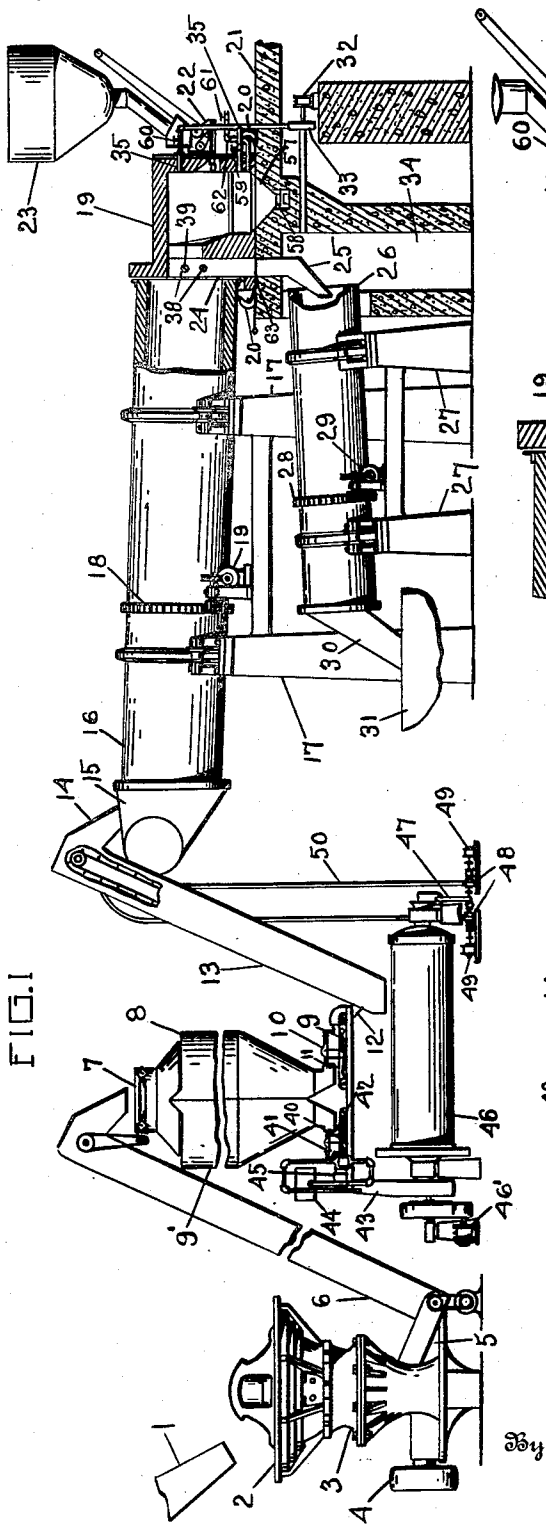


J. C. SCHAFFER.
 LIME BURNING PROCESS.
 APPLICATION FILED JAN. 19, 1917.

1,377,367.

Patented May 10, 1921.



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UNITED STATES PATENT OFFICE.

JOHN C. SCHAFFER, OF TIFFIN, OHIO.

LIME-BURNING PROCESS.

1,377,367.

Specification of Letters Patent.

Patented May 10, 1921.

Application filed January 19, 1917. Serial No. 143,207.

To all whom it may concern:

Be it known that I, JOHN C. SCHAFFER, a citizen of the United States of America, residing at Tiffin, Seneca county, Ohio, have invented a new and useful Lime-Burning Process, of which the following is a specification.

This invention relates to treating material, more particularly for continuous handling at a determined rate to form definite mechanical or chemical combinations.

This invention has utility in the handling or mixing of rock or mineral products being especially adapted to the complete treatment of stone from a quarry or other source, providing means for separating the material to desired grades, feeding continuously the material at a constant rate for heat treatment in the production of a high grade, uniform character product.

Referring to the drawings:

Figure 1 is a side elevation, with parts broken away, of an embodiment of the invention in a calcining plant for the production of oxid from a carbonate as of calcium or magnesium;

Fig. 2 is a fragmentary view in plan of the material receiving ends of a pair of kilns of the installation;

Fig. 3 is a front view on an enlarged scale of the pump or means for elevating the material to the kilns; and

Fig. 4 is a sectional view on an enlarged scale of the furnace.

The chute 1 may be a source of supply for the general run of rock as coming from the quarry, said rock being delivered to the hopper 2 of the crusher 3, driven by the pulley 4. The material from this crusher 3 passes by the chute 5 to the elevator 6 for delivery to the screens 7, from which the large particles tail over to the bin 8 as a sorted size while the under size particles pass through the screen and are delivered to the bin 9' as a second sorted size within a determined range of uniformity.

The material from the bin 8 may pass as a continuous stream to the belt 9 having the scale beam 10 determining the position of the gate 11 whereby the material from the bin 8 passes at a constant weight rate by the chute 12 to the elevator 13 from which it is delivered by the chute 14 to the end breeching 15 of the rotary kiln 16 anti-frictionally mounted on the supports

17 and having its gear 18 driven by the motor 19.

The end of the kiln 16 remote from the end 15 is closed by the furnace 19 movable toward and away therefrom upon the rollers 20 carried upon a platform 21. This furnace 19 is provided with a stoker 22 supplied with fuel from the storage bin 23. The furnace 19 is provided with a by-pass duct 24 which, with the furnace in position abutting the kiln 16, registers with the discharge chute 25 for handling of the heated material from the lower end of the kiln 16 to the higher receiving end of the rotary cooler 26, anti-frictionally mounted on the pedestals 27 and having its gear 28 driven by the motor 29. In the rotation of this cooler 26, the material is progressed there-through for being conducted by the chute 30 to the storage bin 31.

To assist in the action of the cooler, motor 32 is provided to drive the suction fan 33 having its duct in communication with the heated air chamber 34 at the open material receiving end of the cooler 26. The suction upon this chamber 34 pulls cold air through the cooler 26 thereby assisting in extracting the heat from the tumbling particles therein. This warm air drawn from the chamber bin to the fan 33 is conducted by the duct 35 to the furnace 19 in such heated volume that the combustion from the furnace is projected into the kiln for distributing the calcining heat therealong and rendering less local the complete combustion region. These products of combustion passing through the kiln 16 are discharged into the breeching 15 and from thence by the ducts 36 to the up-draft stack 37 as a draft provision for assisting gas travel through the kiln in addition to the forced draft from the pump 33. The temperature adjacent the furnace in the kiln may be tempered by cold air inlets 38 having manually controllable dampers 39 therein.

The material from the bin 9' of the finer grading or sorting is discharged to the belt 40 similar to the belt 9. The weight rate of this discharge is controlled by the scale beam 41 similar to the scale beam 10 controlling the position of the gate 42 similar to the gate 11. This weighed constant supply of material from the bin 9' is delivered to the chute 43 with a definite amount of water from the tank 44 measured thereto by the

pump 45 driven from the actuator for the belt 40. This moisture addition is for the purpose of moistening the material so that it will not fly away and while this moistening may be by slight moistening for elevator handling, it may also be a moistening in excess. The moist material is discharged to the tube mill 46 driven by the motor 46' for additionally subdividing a mass in the production of a paste or slurry, discharged from the tube mill 46 to duct 47 for handling by the pump 48 and motor 49 for elevating the material by duct 50. This pump and motor for elevating the paste are in duplicate for emergency trouble or increasing the capacity.

The duct 50 may discharge into the end breeching 15 of the kiln 16 or with valve 51 of pipe 50 closed and the valve 52 in pipe 53 open, this elevated slurry may be conducted into the end breeching 54 of the kiln 55 parallel to the kiln 16. In this duplication of the kiln 16 there may be various sortings as to size for continuous operation in each grade or size. Again, the bins 8, 9' for such number of sizes from different screens as may be desirable may have a capacity for a definite running of the rotary kiln or kilns say one day, that one size may run one day, then the bin which is sufficiently charged to provide a day's run may be used for the next day and such mode of allotment followed for continuous allotment of the installation with the advantage of uniform grading.

This slurry or paste supplied to the rotary kiln is heated and agitated in its progress through the kiln. This action upon the paste serves to cause the material to gather into nodules of approximate uniformity in size due to the tempered or mild heating for gradual elimination of the moisture. The continued heating of these nodules evaporates the moisture therefrom resulting in these nodules being quite porous, thereby providing large area for heat exposure in the elimination of the carbon dioxide when calcium carbonate is converted to calcium oxide at the still higher temperature approaching the range for moisture vapor decomposition. These nodules as well as the particles when subjected to this heat treating or calcining, by-pass the furnace for delivery to the cooler and from thence to the storage bin or shipping station. Instead of exploding at entrance into the kiln, the tempered or gradual action permits the formation of the nodules and tempered treatment thereof.

The furnace 19 when rolled up into position as to the end of the rotary kilns, has the discharge from its grate bars 56 register with the chute 57 in the platform 21 that the ashes may be conducted to the conveyer 58.

The plant is efficiently operable as a unit

in the elimination of waste material and effective for high grade uniform production due to the constant feed rate and uniformity in character of material supplied.

The moistening of the material tends to temper the treatment in a manner improving the product not only as to its final result but in the nature of a reaction producing such result. This tempering may be further controlled not only by the valves 59, 60 in the force draft heated air duct below and above the grates of the furnace but by the valve 61 in steam line 62 below the grate in the furnace. The control of the valves from the line 35 is made more effective by the position of damper 63 in by-pass duct 24 insuring any desired regulation of the draft to the rotary kiln from the furnace with the discharge of material from the kiln clogging above the damper 63.

What is claimed and it is desired to secure by Letters Patent is:

1. In a heat treatment device embodying a rotary kiln provided with a material supply end, a remote discharge end, and a cooler for the material discharged from the kiln, the combination of a furnace having a combustion chamber outside the kiln, said furnace being by-passed by said discharge to the cooler from the kiln, a grate for the furnace, and controllable steam supply means below the grate for humidifying the heating action of the furnace in extending a tempered combustion region from the furnace into the kiln.

2. In a heat treating device embodying a rotary kiln provided with a material supply end, a discharge end remote from the supply end, a rotary cooler disposed to receive material discharged from the kiln, control means for regulating the opening between the kiln and cooler, the combination of a furnace having a combustion chamber outside the kiln and in communication with the kiln between the control means and the kiln, and means for measuring a moisture supply to the kiln whereby the combustion action of the furnace may be uniformly effective through uniform rate of supply.

3. A material handling installation including a device for sorting material as to size, actuating means for progressing such sorted material at a uniform rate, means for giving a definite amount of moisture to such sorted material, means for feeding at will different sizes of such sorted material to a kiln, said kiln for receiving a continuous flow of such sorted material at one end from said actuating means, a furnace in communication with the kiln at the other end, means for discharging material from the kiln past the furnace whereby continuous uniform flow of heat treated material is had from the kiln, and controllable means for supplying moisture for maintaining humid heat

conditions in the kiln during material treatment.

4. In the production of quick lime, first means for subdividing carbonate material, 5 second means for receiving subdivided material from the first means for sorting the subdivided material as to size, third means for receiving sorted subdivided material from the second means for continuously 10 progressing at a determined rate said sorted subdivided material, means for measuring a supply of moisture into said material, and a kiln for receiving a continuous supply at the determined rate of the measured mois- 15 ture carrying material in establishing uniform treatment by maintaining the furnace action uniform.

5. In the conversion of a mineral carbonate to an oxid, the heating of said carbonate 20 by establishing a combustion region upon a grate, forcing steam into the combustion region from below said grate, thereafter mingling the gases from the steam with the products of the combustion producing a 25 burning region, and continuously progressing said carbonate at a determined rate through said burning region produced by said products of combustion and mingled gases from the steam.

30 6. In the continuous heat treatment of an alkaline earth material of a uniform size, the progression of said material at a uniform rate, and heating said material during said progression, said heating being by combustion 35 gases supplemented with steam passed

through a fuel bed before mingling with the combustion gases.

7. In the continuous treatment of an alkaline earth carbonate, the progression thereof at a uniform rate into a maintained 40 tempered heat extending throughout the duration of the treatment, said tempering of the heat being brought about by passing steam through a fuel bed from which bed combustion had taken place for supplying 45 heat tempered by said steam.

8. The method of treatment of limestone embodying the continuous supply and progression thereof, establishing combustion in a furnace to heat said stone, and tempering 50 the heat from said furnace by supplying moisture through the burning fuel of said furnace.

9. The continuous process of converting alkaline earth carbonate to oxid embodying 55 the progression of such material in a heat zone, tempering the heat of said zone by passing moisture through the fuel bed, and the formation of said material into oxid in passing through said zone. 60

10. The process of burning limestone to produce quicklime including the continuous flow at a definite rate of limestone into a rotary kiln during rotation of said kiln, and 65 subjecting said kiln throughout its interior extent to a tempered heat by supplying steam into a fuel bed to pass from the fuel bed with combustion gases into the kiln.

In witness whereof I affix my signature.

JOHN C. SCHAFFER.