

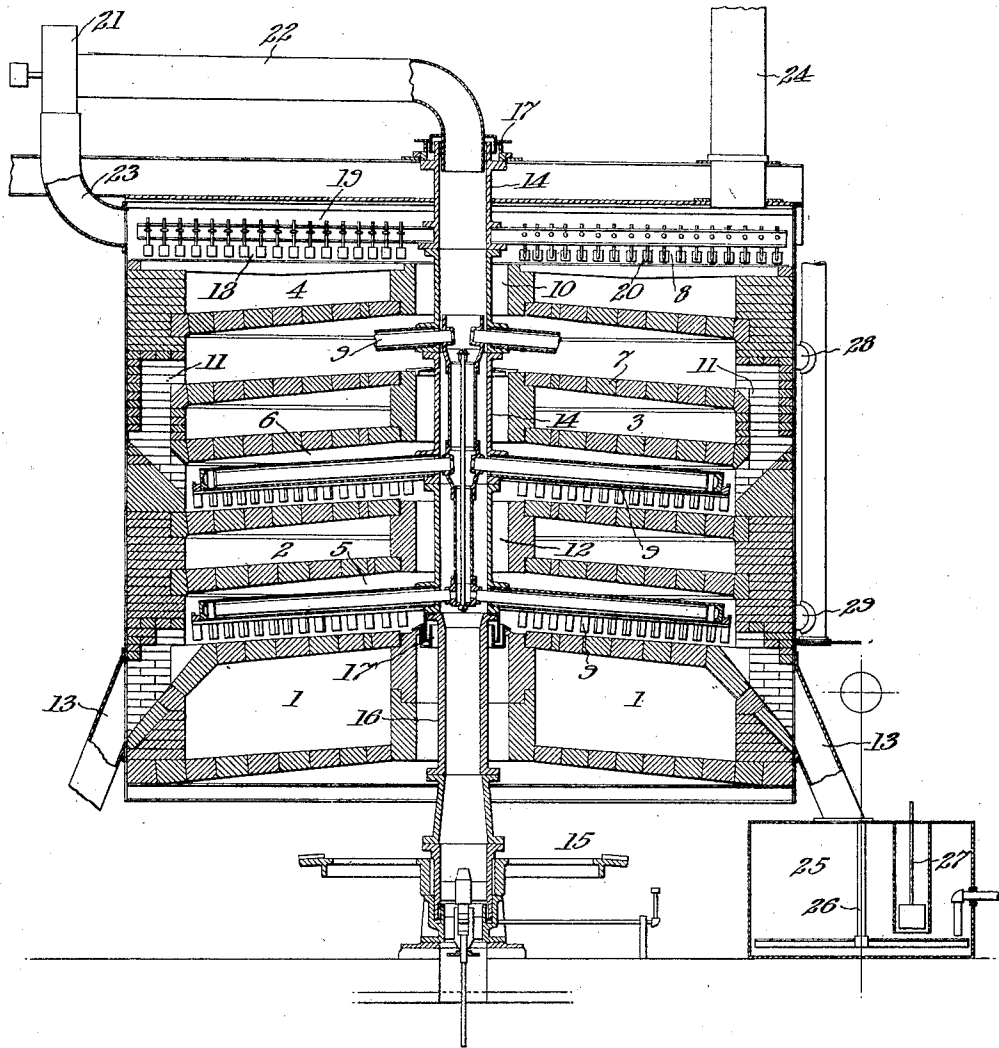
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APPARATUS FOR DRYING AND HEATING

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRYING AND HEATING.

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The invention relates to the drying or heating or the drying and heating of materials, and particularly to the continuous treatment of materials which heretofore it has been possible to dry or heat only in a non-continuous manner.

In the heat-treatment of certain classes of materials, for example filter-press cakes, lithopone green cake, etc., it is practice to effect this in stationary shelf-driers by the aid of direct or indirect heat. It is common practice to separately dry materials in stationary pan driers with direct or indirect heat and subsequently dump the dried materials from the receptacles or trays in which they were dried and then to transfer the dried materials into heating apparatus, more commonly known as muffling furnaces, which are usually hand-operated, and there heat the materials while lying in a quiescent state, except for occasional stirring by means of hand-operated paddles or bars, for a definite period of time at a specific temperature. After such treatment, the materials are usually withdrawn from the furnaces by hand into quenching apparatus where they are quickly drowned in water to prevent oxidation.

It is well recognized in the industry that the above operation is not entirely efficient. In the usual hand muffle, above referred to, the material to be muffled with the exclusion of air, is unevenly heated. That portion of the material that touches or lies in close proximity to the hot floor or walls of the muffle and also that portion of the charge that is most directly exposed to the heat radiated from the roof of the muffle may be excessively heated while other portions may receive an insufficient amount of heat or at least a considerably smaller amount of heat than the aforementioned portions. Continuous stirring or frequent intermittent stirring is out of the question since entrance of air through the doors would cause oxidation and would detrimentally affect the quality of the material. No satisfactory compromise by which sufficient stirring with exclusion of air may be effected, is possible by the old mode of operation above mentioned.

It is the primary object of the invention to provide an apparatus for and a mode of heat-treating material of the type above re-

ferred to in a continuous manner in such a way that the material is substantially uniformly exposed to the available heat while air is substantially excluded.

It is another principal object to provide an apparatus by which the operations of preliminarily drying and of subsequently heating the material may be carried out economically at the same time in a continuous manner.

The invention will be more clearly understood by reference to the accompanying drawing, the single figure of which represents a vertical sectional view, somewhat diagrammatic in certain respects, of one embodiment of the furnace.

In the drawing is illustrated a furnace resembling in a general way certain well-known types of ore roasting and calcining furnaces. The furnace which may be cylindrical is provided with a combustion chamber 1 suitably connected in a well known manner by flues with a series of fire-flues 2, 3, 4, which with the combustion chamber serve to heat the material compartments or shelves 5, 6, 7 and the auxiliary shelf 8, respectively.

Each of the heating compartments is provided with rabblés 9 which rake the material under treatment and effect its progressive movement from the top of the furnace to the bottom, as is well understood in the metallurgical industry. Thus the material is fed at the center onto the shelf 7 through the chute 10 and is moved outwardly across the sloping shelf 7 by the rabblés to the peripheral passages 11 through which it descends to the shelf or compartment 6. The rabblés in this compartment advance the material toward the center chute 12 whereby it is transferred to the compartment 5, and so on until the material is finally discharged from the furnace as by means of chutes 13.

The rabble-arms are connected to a hollow rotatable tube 14 disposed centrally of the furnace, and the tube is rotated at the desired speed through suitable driving mechanism indicated generally at 15 and a connecting tubular support 16. Suitable glands or stuffing-boxes 17 are provided at the top and bottom between the rotating tube and the stationary parts of the furnace.

Air, or in some instances a neutral or even a reducing gas, is admitted to the tube 14 at

its lower end and becomes heated in its upward travel through contact with the tube and rabble-arms.

Above the upper fire-flue 4 an auxiliary shelf 8 is provided. In the closed compartment 19, of which shelf 8 forms the bottom, suitable rakes or rabbles 20 are provided and rotation of the rabble-arms is effected by means of the rotatable tube 14 to which they are connected. The material to be treated is introduced at some point along the periphery of the shelf 8 and is continuously advanced to the central chute 10 whereby it is introduced into the furnace proper, as above indicated. The heated air or gas rising through the tube 14 is propelled by a blower 21 through pipes 22 and 23 to the shelf 8, and is removed at the opposite side through the stack 24.

Numeral 25 indicates a suitable quenching-tank which may be provided with a stirrer 26 and a level controlling float 27.

Part or all of the gases may be withdrawn from the heating compartments, and for this purpose suitable outlets 28, 29 are provided.

In the use of the apparatus described, for example for the drying and heating of green lithopone containing usually about 40% water, the material in wet, sticky condition is fed continuously to the outer edge of the auxiliary shelf 8 and is advanced toward the center chute 10 by the revolving rabbles. During its passage across the shelf the raw lithopone is subjected to hot gas introduced through pipe 23. This operation serves to dry the material, or lithopone in particular, and enables the lithopone to be fed directly to the calcining chambers in a dry condition and without access of air, the muffles of the furnace being preferably kept under a plus pressure to prevent entrance of air from the outside. Arriving on the hearth 7 the rabbles 9 rake and distribute the material and move it progressively to the peripheral chutes 11 which convey it to the outer edge of the shelf next below across which it is advanced by the rabbles 9 to the center chute 12, and so on until the lithopone has traversed all of the heating compartments when it is finally discharged through the chutes 13 into one or more quenching-tanks 25.

It will be understood that the number of shelves may be varied to meet the requirements of the particular use of the apparatus and that other details may be variously and considerably modified.

The proposed apparatus and method make it possible to more completely prevent the access of air and oxygen to the interior of the muffle since the rabbling is done without the necessity of opening any doors. It further prevents the material from becoming over-heated locally on account of the mass of material in the muffle being constantly

moved and mixed by the rabbles so that no portion of the mass remains in the hotter localities of the furnace long enough to become superheated. It also accomplishes a very thorough mixing, thereby improving the evenness and bettering the quality of the material by making it thoroughly homogeneous so that in the product from this apparatus there is no over-roasted or segregated material which would make the product locally vary in chemical or physical properties.

The apparatus is particularly advantageous for handling material which requires the exclusion of air from the heating chambers during the heating operation, such as is the case with lithopone. Where a combination drying and heating operation is carried out, the auxiliary shelf provides an efficient and highly economical means of reducing the moisture content of the wet material fed to the furnace.

I am fully aware that the type of furnace by means of which I carry out the objects of the invention is generally well known and I do not claim any novelty in regard to the details of the furnace proper. I have selected this type of furnace merely because it is particularly well adapted for the purposes of the invention. The salient feature of the invention is the arrangement and the mode of operation by which air is substantially excluded from the material in its passage from the drying chamber 19 through the muffles below it.

Claims:

1. Apparatus for drying and heating wet material, comprising a substantially closed heating chamber, means for passing the material through the chamber, including a gas passage in thermal contact with the heating chamber for passing a hot gas into contact with the material, before the latter enters the heating chamber, under conditions preventing flow of air into the chamber.

2. Apparatus for drying and heating wet material, comprising a closed furnace having an inlet at the top and an outlet near the bottom, a preliminary heating chamber connected to the inlet, means for passing material successively through the preliminary heating chamber and the furnace and means including a gas passage in thermal contact with the furnace for passing a hot gas through the preliminary heating chamber under a pressure greater than atmospheric pressure.

3. A furnace for the drying and heating wet material comprising a furnace of the multiple closed hearth, revolving rabble type including a plurality of superposed closed heating chambers in series relation, means defining a gas heating passage through the furnace for preheating a gas out of contact

with the material, means for drawing gas from said passage into the uppermost heating chamber and means for withdrawing gases from the said uppermost heating chamber at such a rate as to maintain a positive pressure in the chambers of the furnace.

4. A furnace for drying and heating wet material, comprising a furnace of the multiple closed hearth, revolving rabble type including a drying hearth and a plurality of superposed closed muffles below the said hearth and in series relation therewith,

means defining a gas heating passage through the furnace for preheating a gas out of contact with the material, a gas outlet from the drying hearth zone and means between the said passage and the drying hearth for forcing the preheated gas over the material thereon and through the outlet.

5. Apparatus according to claim 1, including means for quenching the hot material in a liquid without access of air.

In testimony whereof, I affix my signature.
WALTER G. GRAVES.