



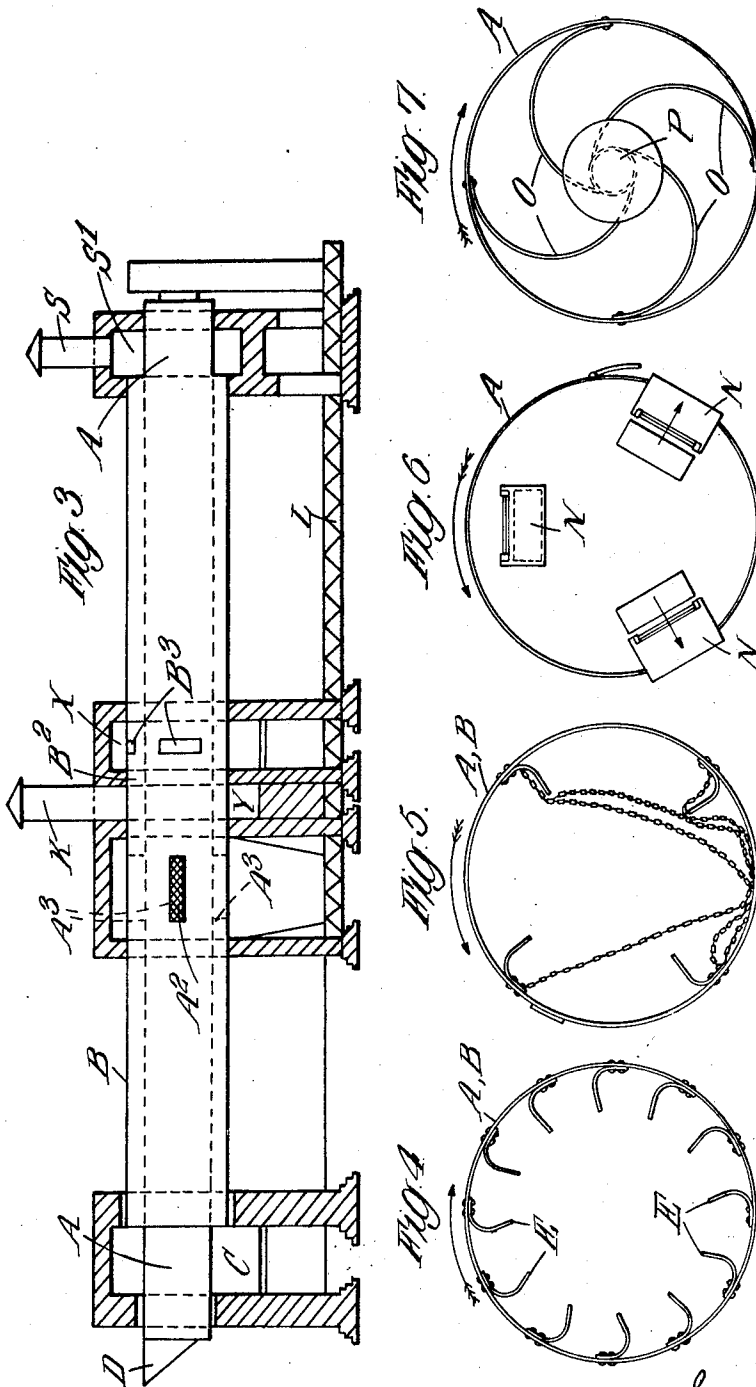
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ROTARY FURNACE OR DRIER

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## ROTARY FURNACE OR DRIER

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8 Claims. (Cl. 34—6)

This invention relates to rotary furnaces or driers of the kind that are particularly applicable for use in the heat treatment of ungraded materials such as for example coal, chemicals, and certain delicate clays. In the heat treatment of such materials considerable difficulty has been experienced in obtaining a uniform heating of the whole of the material under treatment, that is in preventing part of the material from being overheated and part under-heated, and the chief object of the invention is to overcome these difficulties.

According to the invention the finer grades of material leave or are extracted from the furnace or drier at a place or places intermediate the ends of the furnace or drier and the coarser grades continue to pass therethrough, thereby allowing the completion of the heat or drying treatment of the coarser grades of material to be effected in the remaining part thereof. In order to obtain a uniform heating of the material the heating agent, which may consist of flue gases from a furnace or furnaces or heated air is preferably supplied to the furnace or drier at one or more points intermediate its ends as well as at its inlet end thereby avoiding the necessity of a high initial temperature of the heating agent in order to maintain the temperature of the material above a certain predetermined value at its final delivery point from the furnace or drier. The heating of the material within the furnace or drier may be effected by causing the flue gases to come into intimate contact with the material under treatment, the latter being preferably subjected to a churning movement or agitation during its passage through the furnace or drier. If desired, however, in cases where it is not desirable for the heating agent to come into actual contact with the material itself such heating agent may be led along an annular passageway or passageways formed in the furnace or drier.

In order that the said invention may be more clearly understood and readily carried into effect the same will now be more fully described with reference to the accompany drawings, in which:—

Figure 1 is a longitudinal section through a rotary furnace or drier embodying the invention;

Figure 2 is a plan of a modified form of the furnace of drier illustrated in Figure 1;

Figure 3 is a side elevation of another modification; and

Figures 4, 5, 6 and 7 illustrate details to be described.

Referring first to Figure 1, the rotary heating furnace or drier comprises two cylindrical drums

A, B, arranged about a common axis slightly inclined to the horizontal. The drum A is of smaller diameter than the drum B, and is located in and rigidly secured to the latter—for example by means of distance pieces (not shown). The inner drum A extends within the drum B to about half the length of the latter and its inner end A<sup>1</sup>, and the portion B<sup>1</sup>, of the drum B surrounding it, are perforated so that the finer grades of the material under treatment (which is fed through the furnace from left to right) gravitate through the perforations to the exterior of the chamber on to a screw conveyor L whereby the said finer grades are transported to the right hand or outlet end of the chamber and delivered into a suitable bin or container M. The coarser grades of the material are retained and caused to undergo a further heat treatment in the remainder of the drum B. The heating agent consists of the products of combustion of a coal or coke fired furnace C, the latter being preferably of the known regenerative type having means for controlling the secondary air so that cold air may be used for damping purposes or hot air for combustion purposes. As an alternative, when the products of combustion as the heating agent are liable to spoil the product, heated air can be substituted and brought to the drier by means say of tubes or ducts from an air heater. The heated gases are admitted to the left hand or inlet end of the drum A and the material to be treated is fed into the drum A at the same end by means of a chute D and travels through the drums by reason of the inclination of the latter to the horizontal. The drum A and the right hand portion of the drum B are provided with means whereby the heated gases are caused intimately to mix with the material; for example (as shown in Figure 4) the drums are provided with a set of plates or baffles E secured to and extending inwardly from the inner surfaces of the drums whereby the material is lifted as the drums rotate and caused to fall in curtains or sheets through which the heated gases pass. If desired two or more sets of such plates or baffles may be used in which case they are preferably arranged longitudinally of the drums and each plate or baffle of one set is preferably in staggered relation to a plate or baffle of an adjacent set so that upon rotation of the drums the material falls and a plurality of staggered longitudinal curtains of falling material results. Alternatively or additionally chains may be secured within the drums as shown in Figure 5, these chains being arranged in such a manner that if they remain rigid they would

form a worm in the reverse direction to the flow of the material. These chains act as a worm to retard the progress of the material through the drums and as they fall tend to break up large pieces of material. The right hand or outlet end of the drum A is provided with means whereby the heating gases are exhausted. Such means consist of a conical or funnel shaped gas collector F arranged concentrically within the drum A and communicating by radial pipes G with a chamber H which is connected by a duct J to a fan whereby the gases are passed to an outlet flue K. The material under treatment passes by the said gas collector and as aforesaid the finer grades of the material, which more readily undergo the heat treatment or are more readily dried as the case may be gravitate from the drum through the said perforations on to the conveyor L. The right hand or outlet end of the drum A is substantially closed to prevent the heating gases from passing from the drum A into the drum B and such end is formed with apertures or openings which are provided with gravity controlled closures N (see Figure 6 which is an elevation of the right hand end of the tube A) so arranged that during the rotation of the drums the closures N, positioned below the material, are opened to permit the coarser grades of the material to pass therethrough into the drum B. In an alternative form, illustrated in end elevation in Figure 7, a series of radially arranged curved blades or plates O are provided at the outlet end of the drum A which are adapted, consequent upon the rotation of the drums, to receive the coarser material and carry it towards and through a central aperture P into the drum B. The coarser material is caused to undergo further heat treatment in the drum B by the admission thereinto of heating gases which pass through the left hand portion thereof around the tube A and come in contact with the coarser material which, as already stated, enters the tube B adjacent to the outlet end of the tube A. The gases entering the tube B around the tube A are supplied from one or more furnaces (not shown but similar to furnace C) through a passage C<sup>1</sup> to the annular space C<sup>2</sup> around the extreme left-hand end of the tube A whence the gases are drawn into the open end of the tube B. The gases passing through the tube B are withdrawn therefrom through a duct Q by a fan R and expelled by the fan into an outlet flue S. The coarser material is finally ejected at the outlet or right hand end of the drum B on to the conveyor L whence it is passed with the finer material to the container M. For supporting the drum B it is provided with external riding rings T supported by idler rollers T<sup>1</sup> carried in suitable bearings; and for rotating the drums, a gear U is secured to the drum B and is driven by suitable means, for example by spur gear or a chain drive.

In the modification illustrated in Figure 2 the tube B is of such a length that it encloses only the right hand or outlet end of the drums A and heating gases are supplied from a second regenerative furnace V through the duct W to a chamber X surrounding the adjacent ends of the drums A and B, from which chamber the heating gases pass into the open end of the drum B.

When it is not desirable for the heating gases to come into contact with the material to be heat treated by reason for example of the nature or properties of the latter, the modified arrangement illustrated in Figure 3 may be used, in which the drum A extends through the full

length of the drum B and its inlet end extends completely through the furnace C, the chute D being arranged outside the furnace, so that the heating gases pass only through the drum B which forms an annular passageway around the drum A. The finer grades of the material pass from the drum A through perforated rectangular plates A<sup>2</sup> and rectangular ducts A<sup>3</sup> and fall on to the conveyor L. The drum B is sealed at B<sup>2</sup> by an annular partition located between the two drums and provided with openings through which the heating gases pass into the chamber Y and from there they pass into the flue K. Heating gases from a chamber X (corresponding to the chamber X in Figure 2) pass into the drum B through openings B<sup>3</sup> therein and exit into chamber S<sup>1</sup> and from there into the flue S.

The control of the heating effect of the gas upon the material to be treated may be effected by the provision of dampers in the flues or conduits through which the said heating gases pass.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A rotary heater comprising two concentric rotary tubular chambers a part at least of one being located within the other, apertures in the inner chamber at a distance from the inlet end thereof and localized at at least one part that is within the outer chamber, and similarly localized apertures in the outer chamber adjacent to the apertures in the inner chamber, so that material to be treated passes through a predetermined length of the heater in one chamber whereupon the finer grades of material leave the heater and the whole of the remainder of the material then passes through a further predetermined length of the heater in another chamber.

2. A rotary heater comprising an outer rotary chamber, an inner rotary chamber located within the outer chamber so that the inlet ends of the chambers are adjacent and the outlet end of the inner chamber is within and part way along the outer chamber, means for supplying heating agent into the inlet ends of each chamber, heating agent removing means located at the outlet end of the inner chamber, means for removing the heating agent located at the outlet end of the outer chamber, means for supplying material to be treated into the inlet end of the inner chamber, an escape for the material from the outlet end of the inner chamber into the outer chamber, and openings in the outlet end of the inner chamber and in the adjacent part of the outer chamber to permit escape of the finer grades of material from the heater at that part thereof.

3. A rotary heater comprising an outer rotary chamber, an inner rotary chamber located within the outer chamber so that the inlet ends of the chambers are adjacent and the outlet end of the inner chamber is within and part way along the outer chamber, means for supplying heating agent into the inlet ends of each chamber, a funnel and radial pipes arranged for removing the heating agent from the outlet end of the inner chamber, means for removing the heating agent from the outlet end of the outer chamber, means for supplying material to be treated into the inlet end of the inner chamber, and an escape for the material from the outlet end of the inner chamber to the outer chamber.

4. A rotary heater comprising an outer rotary chamber, an inner rotary chamber located with-

in the outer chamber so that the inlet ends of the chambers are adjacent and the outlet end of the inner chamber is within and part way along the outer chamber, means for supplying heating agent into the inlet ends of each chamber, a funnel and radial pipes arranged for removing the heating agent from the outlet end of the inner chamber, means for removing the heating agent from the outlet end of the outer chamber, means for supplying material to be treated into the inlet end of the inner chamber, and an escape for the material from the outer end of the inner chamber into the outer chamber, and openings in the outlet end of the inner chamber and in the adjacent part of the outer chamber to permit escape of the finer grades of material.

5. A rotary heater comprising an outer rotary chamber, an inner rotary chamber located within the outer chamber so that the inlet ends of the chambers are adjacent to each other and the outlet end of the inner chamber is within and part way along the outer chamber, means for supplying heating agent into the inlet ends of each chamber, a funnel and radial pipes arranged for removing the heating agent from the outlet end of the inner chamber, means for removing the heating agent from the outlet end of the outer chamber, means for supplying material to be treated into the inlet end of the inner chamber, at least one opening in the inner chamber to permit escape of the material from the outlet end of the inner chamber into the outer chamber, means associated with said opening to prevent passage of heating agent but allowing restricted passage of the material, and openings in the outlet end of the inner chamber and in the adjacent part of the outer chamber to permit escape of the finer grades of material from the heater.

6. A rotary heater comprising an inner rotary chamber through which the material to be treated passes, a continuous outer rotary chamber surrounding the inner chamber, means for supplying heating agent into the outer chamber at one point thereof, means for removing the heating agent at another point so that a predetermined

length of the inner chamber is heated, means for supplying heating agent into and removing it from the outer chamber so as in a similar manner to heat another predetermined length of the inner chamber, apertures in the inner chamber in at least one localized place along its length, corresponding apertures in the outer chamber and walls connecting the inner and outer chambers together at the apertured parts so as to permit escape of the finer grades of material without the latter coming into contact with the heating agent.

7. A rotary heater comprising an outer rotary tubular chamber through which heating gases are passed, an inner rotary tubular chamber of only slightly smaller diameter than the outer chamber and at least a part of which inner chamber is located concentrically within the outer chamber, apertures in the inner chamber at some distance from its inlet end, apertures in the adjacent part of the outer chamber, heating agent supplying and removing means for heating the inner chamber from its inlet end to the apertures, and heating agent supplying and removing means for heating the outer chamber from the apertures to its outlet end.

8. A rotary heater comprising an outer tubular chamber through which heating gases are passed, an inner tubular chamber of only slightly smaller diameter than the outer chamber, and at least a part of which inner chamber including its outlet end is located concentrically within the outer chamber, apertures in the inner chamber at some distance from its inlet end, apertures in the adjacent part of the outer chamber, a closure wall to the outlet end of the inner chamber, at least one outlet aperture in the closure wall so as to permit restricted escape of the material being treated from the inner chamber into the outer chamber, heating agent supplying and removing means for heating the inner chamber from its inlet end to the apertures, and heating agent supplying and removing means for heating the outer chamber from the apertures to its outlet end.

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