May 1, 1934. A. HASSELBACH 1,957,138

APPARATUS FOR TREATING CEMENT SLURRY AND THE LIKE

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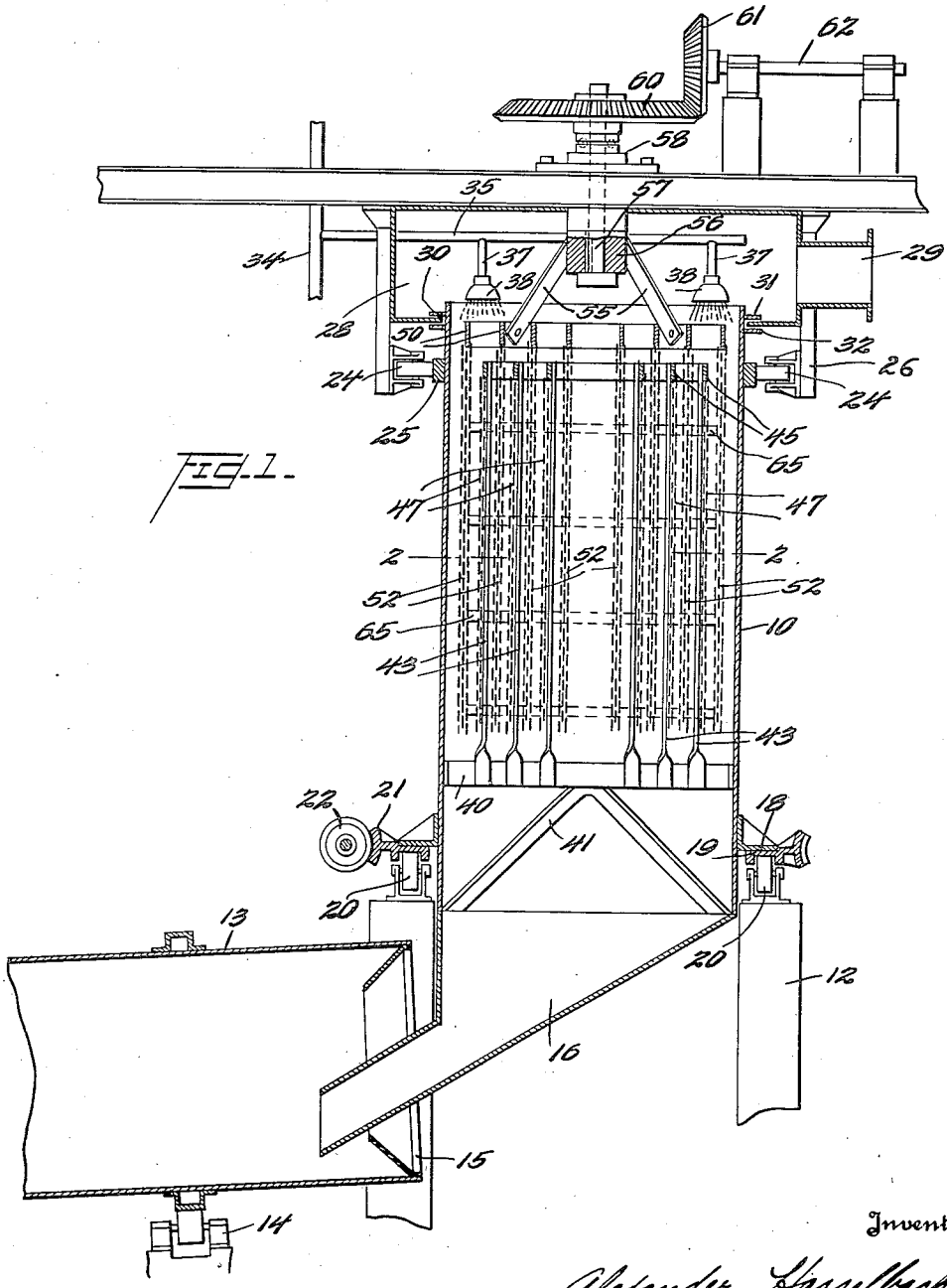


FIG. 1.

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FIG. 2.

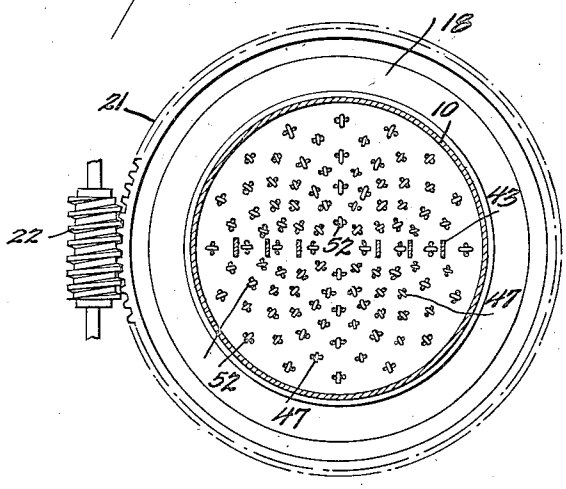
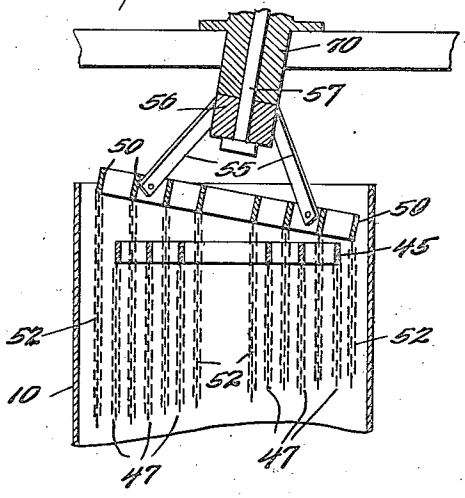


FIG 3.



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Patented May 1, 1934 1,957,138

UNITED STATES PATENT OFFICE

1,957,138

APPARATUS FOR TREATING CEMENT SLURRY AND THE LIKE

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Application December 26, 1930, Serial No. 504,972
In Germany December 30, 1929

9 Claims. (Cl. 222—7)

This invention relates to apparatus for the heating and drying of materials of a powdered or granular nature while in semi-liquid or pasty form and is particularly applicable to the treatment of cement slurry. It is an object of the invention to provide apparatus of this character which is simple and inexpensive to construct, which requires little attention on the part of the operative, and which will treat large quantities of material rapidly and effectively.

It is common practice to prepare raw materials such as cement in the form of a paste or slurry prior to their introduction into the kiln in which the heat treatment is applied, and it has been heretofore proposed to dry this slurry before the same is introduced into the kiln, the material reaching the kiln in the form of dry lumps, grains, or powder in readiness for the roasting process. While in the form of a slurry, the raw material is exceedingly difficult to handle since it is essential that all portions of the material be exposed to the action of the heat or heated gas in order to effectively complete the drying. When large masses of raw material are to be dried rapidly, the pasty condition of the material retards the passage of heated gas therethrough and frequently results in the formation of large lumps which cannot be properly burned in the kiln.

It is therefore the purpose of the present invention to provide an apparatus which will thoroughly agitate the raw slurry or pasty mass during the preliminary drying operation.

A more specific object of the invention is the provision of apparatus whereby hot gases may be conducted from a kiln and through the slurry as it passes toward the kiln, this apparatus being constructed in such manner as to ensure a thorough agitation and breaking up of the larger lumps of material as the drying progresses.

A further object of the invention is the provision of a drum into one end of which the slurry may be introduced, and flexible agitating means within the drum movable relatively thereto and relatively to each other for the purpose of distributing the slurry to permit the passage therethrough of heated gas and to ensure discharge of the slurry in a thoroughly dried and nearly pulverulent condition.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a sectional view of one form of apparatus constructed in accordance with the principles of the present invention;

Figure 2 is a sectional view on the line 2—2 of Figure 1; and

Figure 3 is a fragmentary sectional elevation illustrating a slightly modified form of construction.

For the sake of simplicity, the material which the apparatus herein described is intended to treat will be referred to as slurry, it being understood that this apparatus is useful in connection with the drying and heat treatment of any powdered or granular material in a moist or liquid suspended condition.

Referring now more specifically to the drawings, in which a simple embodiment of the invention is disclosed for the purpose of illustrating the principles underlying the invention, it will be observed that the drying operation is carried out within a drum or chamber 10 which is preferably circular in form and which may be supported on a base or foundation 12 adjacent a conventional kiln 13. The kiln selected for illustration in the drawings is of the rotary type and is journalled on the customary bearings 14 for rotation about an axis slightly inclined to the horizontal. The kiln is open at its upper end 15 to receive the material to be treated and a discharge flue 16 directs the material into the kiln, this discharge flue being disposed directly beneath the lower end of the drum 10 as shown in Figure 1 of the drawings. The flue may be mounted in any conventional manner and is preferably stationary.

It will be understood that the manner in which the connection between the kiln 13 and drum 10 is effected forms no essential part of the present invention, it being only necessary that the structure be such that the hot gases from the kiln will be directed upwardly through the drum and that the dried material within the drum be conveyed into the kiln. For instance, the connection may be effected in accordance with the disclosure of the prior patent to Hornsey No. 1,606,125, granted November 9, 1926.

It is found desirable under certain circumstances to rotate the drum 10 to further the agitation of the material which passes therethrough during the drying operation and for this purpose the drum may be mounted by means of an annular flange 18 encircling the same and secured thereto, this flange being provided with an annular track 19 which rides on rollers 20 supported for free rotation on the base 12. Formed integrally with or secured to the track 19 is a worm

gear 21 which meshes with and is driven by a worm 22 rotated from a source of power. At its upper end the drum may be firmly centered on its rotational axis by means of rollers 24 which engage a track 25 secured to or integral with the drum 10. The rollers 24 are carried by or depend from a frame member 26 which is fixed as regards the remainder of the apparatus and which extends across the upper end of the drum 10.

In order to provide for the withdrawal of the heated gases from the upper end of the drum, a chamber 28, which may be conveniently mounted on the frame member 26, is provided with a flue 29. This chamber has a large circular aperture 30 in the bottom wall thereof through which the drum extends and laterally projecting annular flanges 31 and 32 carried by the drum at its upper end cooperate with the bottom wall of the chamber to provide a seal.

The raw material or slurry is introduced through the conduit 34 and through the wall of the chamber 28 into a second conduit 35 which is preferably annular in form. Discharge pipes 37 depend from the annular conduit 35 at a number of points about the periphery of the drum 10 and are provided with suitable nozzles 38 for spraying the material downwardly to ensure substantially uniform distribution of the material throughout the interior of the drum.

In order to prevent too rapid movement of the slurry through the drum and resulting insufficient drying thereof and to ensure the proper agitation of the slurry, the interior of the drum is preferably provided with agitation means of the type illustrated in Figure 1 of the drawings. This agitation means may conveniently consist of a frame member 40 extending transversely across and within the interior of the drum 10 and secured at its ends to the opposite walls of the drum. This frame member may be braced in any suitable way, for instance by means of struts 41 secured to the base of the drum. Vertically extending frame members 43 are secured at their lower ends to the transversely extending frame member 40, the last named members preferably consisting of metal bars or strips which are twisted at their lower ends as shown in Fig. 1 so that the major portions of the strips face the inner walls of the drum. At the upper end of these strips is secured a series of concentric annular supporting members 45, from each of which depends a plurality of circumferentially disposed chains 47, these chains hanging downwardly within the drum 10 and terminating at a point slightly above the transverse frame member 40. A similar series of concentric supporting members 50 are disposed above the supporting members 45 and are each similarly provided with a plurality of depending chains 52, the supporting members 50 being disposed in staggered relation with the supporting members 45 as regards the radius of the drum 10 so that the chains 52 and the chains 47 alternate radially of the drum 10. The supporting members 50 may be carried in any convenient manner by the frame member 26, for instance by means of struts 55, and are preferably provided with a cross tie (not shown) to retain them in their proper concentric relation. The struts 55 are carried by or formed integrally with a boss 56 which is keyed to a rotatable shaft 57 supported in bearings 58 in the frame member 26. Secured to the upper end of the shaft 57 is a bevel gear 60 which meshes in turn with a bevel gear 61 secured to a driving shaft 62 so that rotation of the shaft 62 will serve to effect rotation of the supporting members 50 and the chains 52 carried thereby. The rotating chains 52 may be connected to each other at intervals in their length by a series of concentric elements 65 corresponding to the concentric supporting members 50 in order to prevent entangling of the chains of the two systems, and if desired, similar provision may be made with respect to the chains 47 carried by the concentric supporting members 45. While the parts designated by the reference characters 47 and 52 have been referred to as chains in order to simplify the description, it will be understood that they may assume other forms although it is preferable to provide a series of flexible elements as distinguished from rigid agitating members.

The operation of the device illustrated in Figure 1 will now be apparent from the above description. When the shaft 62 and the worm 22 are rotated, either in opposite directions or in the same direction at different rates of speed, the depending chains 47 and 52 will thoroughly agitate the slurry which collects thereon by a combined shaking and rubbing action and as fast as the slurry dries it is ground or crumbled into small lumps or powder and falls into the flue 16 at the lower end of the drum 10 from whence it passes into the rotating kiln 13. The slurry contained within the drum 10 is agitated so as to permit free passage of the hot gases from the kiln therethrough and at the same time premature delivery of the slurry to the kiln 13 is prevented by the retarding action of the depending chains.

Referring now specifically to Figure 3 of the invention, it will be observed that the construction is similar to that shown in Figure 1 with the exception that the rotating shaft 57 is mounted in a bearing member 70 for rotation about an axis inclined to the axis of the drum 10, the concentric supporting members 45 being similarly disposed at an angle to the mouth or upper end of the drum. As the shaft 57 rotates it will be apparent that each of the chains 52 are displaced in the direction of the axis of the drum with respect to the adjacent chains 47. In this manner the extent of agitation of the slurry can be considerably increased and the formation of hard lumps which might prevent rapid passage of the slurry through the drum 10 is avoided.

While the invention has been described in more or less specific terms, it will be appreciated that the various elements illustrated in the drawings may be modified to a considerable extent without departing from the principles of the invention and that such further changes are contemplated as fall within the spirit and scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:—

1. In apparatus for drying sludge, the combination with a chamber into the lower portion of which hot gases are introduced, of a plurality of relatively movable chains supported in the chamber and depending freely therein, means for depositing sludge on said chains, and means for agitating said chains to dislodge the sludge therefrom when dried, whereby the hot gases may pass upwardly through a heat filter comprising the chains and the sludge carried thereby to obtain efficient heat exchange between the gases and the sludge.

2. Apparatus for effecting preliminary treatment of material in the form of slurry before delivery thereof to a kiln, comprising a vertically

disposed drum for receiving the slurry at the upper end thereof and delivering the same from the lower end to said kiln, said drum communicating with said kiln whereby hot gases from said kiln are passed upwardly through said drum, means within said drum for retarding the movement of material therethrough, said means comprising a plurality of flexible elements supported adjacent the upper portion of said drum and depending vertically therein, and mechanism for moving said elements with respect to each other.

3. Apparatus for effecting preliminary treatment of material in the form of slurry before delivery thereof to a kiln, comprising a vertically disposed drum for receiving the slurry at the upper end thereof and delivering the same from the lower end to said kiln, said drum communicating with said kiln whereby hot gases from said kiln are passed upwardly through said drum, means within said drum for retarding the movement of material therethrough, said means comprising a plurality of flexible elements supported adjacent the upper portion of said drum and depending vertically therein, and mechanism for imparting relative rotary movement and longitudinal displacement to said elements.

4. Apparatus for effecting preliminary treatment of material in the form of slurry before delivery thereof to a kiln, comprising a vertically disposed drum for receiving the slurry at the upper end thereof and delivering the same from the lower end to said kiln, said drum communicating with said kiln whereby hot gases from said kiln are passed upwardly through said drum, means within said drum for retarding the movement of material therethrough, said means comprising a series of elements supported by said drum and extending longitudinally therein, and a second series of longitudinally extending elements supported independently of said drum for movement relatively to the elements of said first series.

5. Apparatus for effecting preliminary treatment of material in the form of slurry before delivery thereof to a kiln, comprising a vertically disposed drum for receiving the slurry at the upper end thereof and delivering the same from the lower end to said kiln, said drum communicating with said kiln whereby hot gases from said kiln are passed upwardly through said drum, means within said drum for retarding the movement of material therethrough, said means comprising a series of elements supported by said drum and extending longitudinally therein, a rotatable carrier disposed adjacent the upper end of said drum, a second series of longitudinally extending elements depending from said carrier, and means for rotating said drum and carrier relatively.

6. Apparatus for effecting preliminary treatment of material in the form of slurry before delivery thereof to a kiln, comprising a vertically disposed drum for receiving the slurry at the upper end thereof and delivering the same from the lower end to said kiln, said drum communicating with said kiln whereby hot gases from said kiln are passed upwardly through said drum, means within said drum for retarding the movement of material therethrough, said means comprising a series of elements supported by said drum and extending longitudinally therein, a rotatable carrier disposed adjacent the upper end of said drum, a second series of longitudinally extending elements depending from said carrier, and means for rotating said drum and carrier relatively, said carrier being rotatable about an axis extending at an angle to the vertical, whereby said second series of elements will move longitudinally of said drum during rotation of said carrier.

7. The combination recited in claim 4 in which said elements consist of chains, and means for connecting the chains in one of said series at spaced points in the length thereof.

8. In apparatus for drying sludge, the combination with a chamber into which hot gases are introduced, of a plurality of relatively movable chains depending freely along the entire length thereof within said chamber, means for spraying sludge on the chains, and means for agitating the chains to dislodge the sludge therefrom when dried, said last named means comprising a rotatable member disposed in the upper part of said chamber and supporting said chains, and means for driving said member.

9. In apparatus for drying cement slurry prior to the introduction thereof into a kiln, the combination with a chamber through which hot gases are caused to flow, of elongated flexible elements depending within said chamber and supported at the upper ends thereof only, means for depositing slurry upon said elements, and means for agitating said elements to dislodge the slurry therefrom when dried, said last named means comprising a rotating support for said elements.

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