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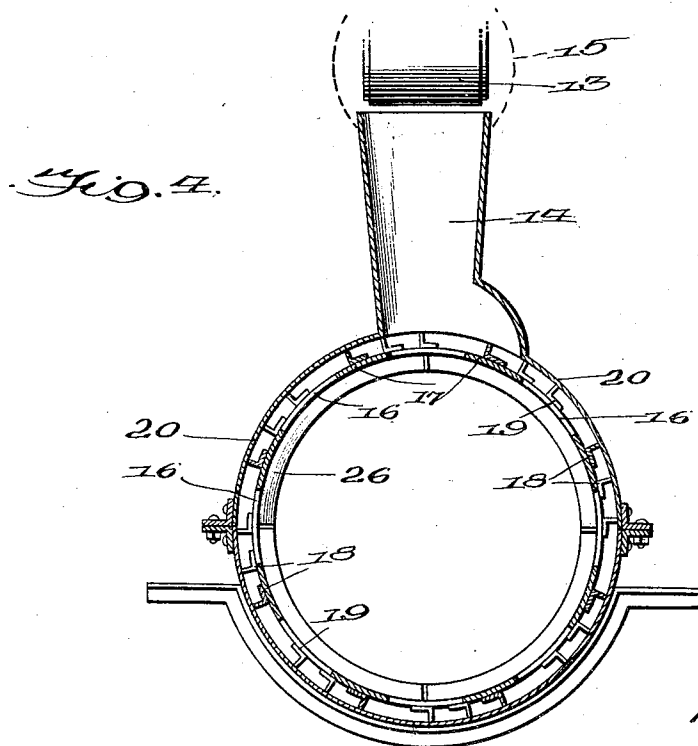
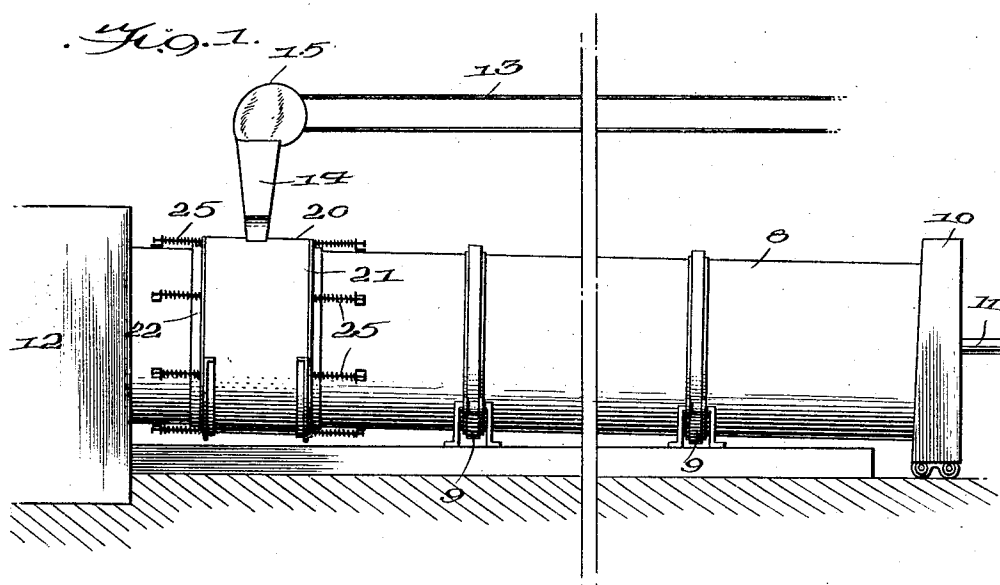
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KILN AND THE LIKE

Filed Jan. 9, 1930

2 Sheets-Sheet 1



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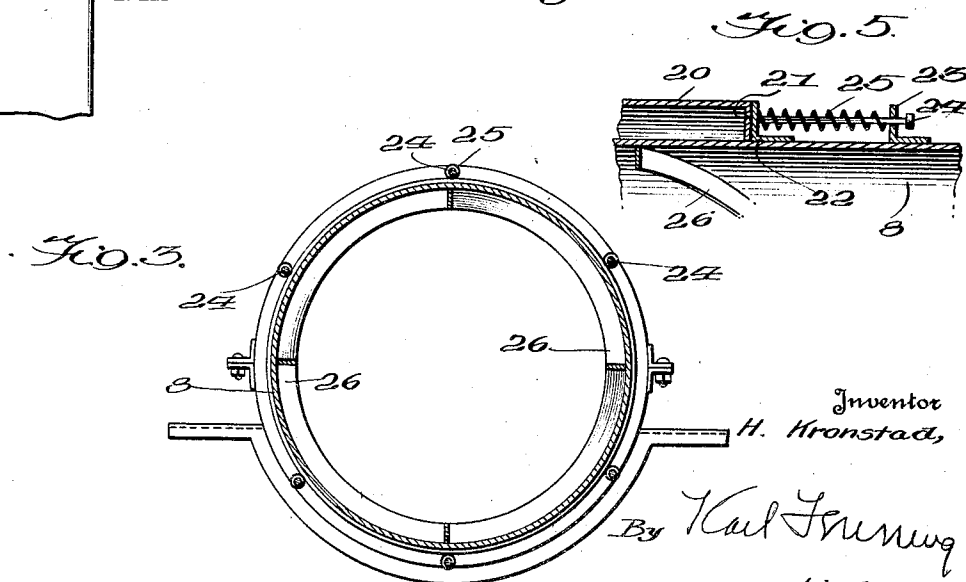
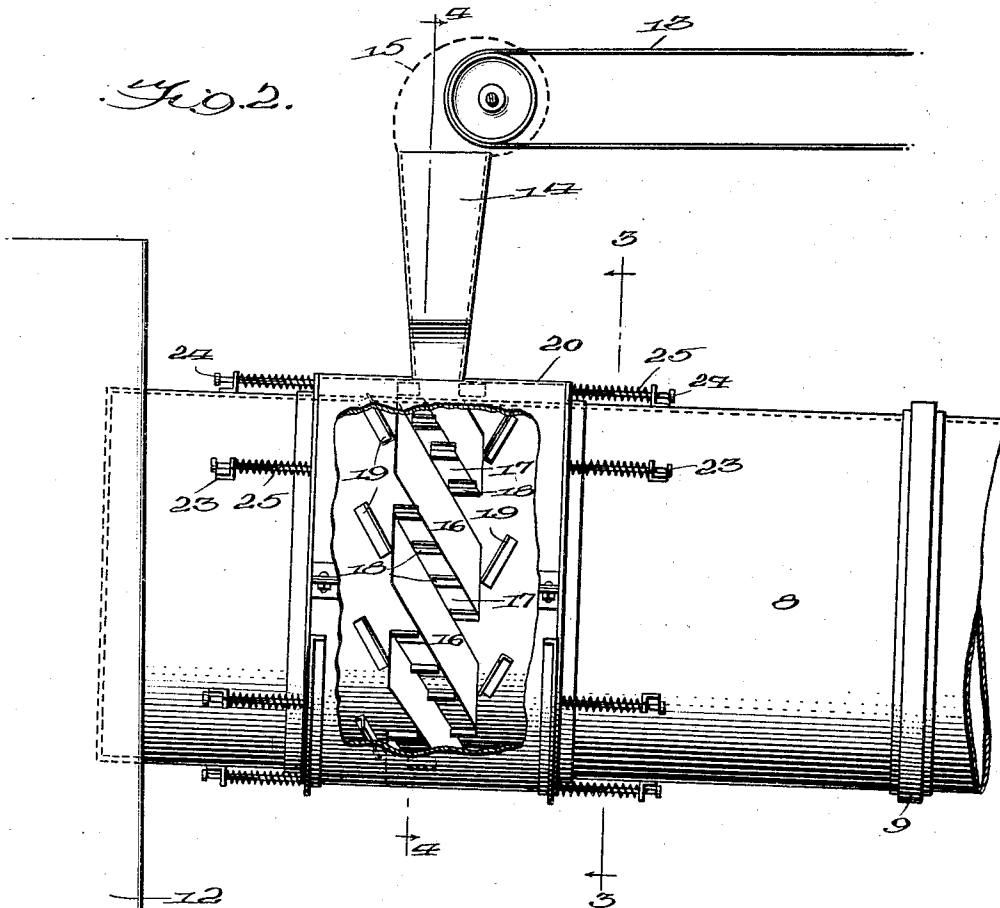
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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KILN AND THE LIKE

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The present invention relates to feeding material to and treating it in kilns and the like and especially to such devices as include a rotary cylinder in which material is to be treated together with a possible auxiliary treatment of the material. The character of the material to be introduced is not essential to the invention. It may be granular, powdered, fluid, slurry or any other form. The treatment the material is to receive in the kiln or other device into which it is fed is largely immaterial as far as the present invention is concerned; it may consist of heating, drying, calcining, clinkering, grinding, polishing or any other treatment.

An embodiment of the invention has been tested applied to feeding material to a rotary kiln used for the manufacture of cement and without indicating that the invention is to be limited to such mechanism it will be illustrated and described with especial attention to its use for such purpose.

The usual kiln now employed in commercial and industrial plants for the manufacture of cement consists of a long cylinder which rotates about its axis and which is slightly inclined to the horizontal. The inclination of the cylinder tends to feed the material received and treated from the higher end to the lower end. As the cylinder rotates it lifts material on the bottom of the cylinder and causes it to fall downward and forward. It is common in such cylinders to augment this forward movement by providing on the inner surface of the cylinder spirally arranged strips or angle irons which as the cylinder rotates tend to lift and force the material forward toward the lower end of the cylinder. This spiral feeding mechanism may be entirely omitted or may be arranged throughout the entire length of the cylinder or only in a portion, preferably that portion toward the entrance or receiving end of the material.

In such a cylinder for the treatment or manufacture of cement a high temperature is maintained with the ultimate purpose in view of calcining and clinkering the materials to make the cement. Ordinarily in order to maintain this high temperature fuel

of some sort, such as oil, powdered coal, natural gas or the like, is forced into the cylinder at its lower end and combustion takes place within the cylinder. Any other suitable means may be employed for heating the cylinder and its contents. In order to properly combust the fuel and conduct the heat through the cylinder so that it may come in contact with the cement-making material a considerable draft is necessary or desirable and any obstruction in the cylinder which protrudes into the path of the heated gases of combustion tends to interfere with the draft and impedes the proper functioning of the apparatus.

The devices now in use generally feed the cement-making materials into the upper end of the cylinder. A hopper or the like is arranged above this upper end and a more or less inclined chute extends therefrom downward and into the end of the cylinder thus forming an obstruction to the draft. Possibly because of the inclination, it has generally been found that material being fed through the hopper and the chute will clog unless it is forced downward through the chute by some such means as a screw propeller. Such an arrangement means enlarging the chute and consequently causing it to obstruct the draft for the outgoing gases to an additional material extent. In as much as the chute extends into the highly heated gases, it has frequently been found desirable to cool the chute by means of a surrounding water jacket which in turn increases the size of the chute and further obstructs the draft for the combustion and the outgoing gases. In order to have the outlet of the chute as far along the axis of the cylinder as possible, the chute generally extends substantially entirely across the diameter of the cylinder making in all a very material obstruction to the passage of gases. In as much as the material at best, by this construction, is fed to the cylinder very near to its upper end there is a tendency for the material to pile up at that end and instead of all passing downward through the cylinder some of it may fall out of it at the upper end. In order to avoid this there is generally provided at

the upper end of the cylinder a retaining ring which is an annulus arranged throughout the circumference of the cylinder and extending inward so as to hold in any material which may accumulate at the upper end of the cylinder. This retention ring by projecting into the cylinder decreases the outlet or mouth of the cylinder and cooperates with the feeding chute to further reduce and impede the draft.

The materials which are to be calcined and clinkered to form cement are ordinarily ground to a more or less fine powder before they are introduced into the cylinder so as to make this treatment easier. This grinding may be done dry and so a dry powder produced. The grinding process, however, is aided and made more economical by adding water to the material so that instead of a dry powder is produced a more or less fluid mass which is technically known as "soup" or "slurry". In this condition the material is easily handled and may conveniently be fed into the cylinder for calcining and clinkering. The evaporation of the contained water, however, absorbs a considerable amount of the heat in the cylinder and such procedure has been found uneconomical. The preferred procedure, therefore, is to effect a preliminary drying of the slurry which generally is done by a vacuum or suction process which removes a large proportion of the water, leaving a sticky, pasty mass referred to as "slurry cake" and which when fed into the cylinder may be calcined and clinkered without too great a waste of heat for water evaporation. No matter what is the form of the material when fed to the cylinder it is gradually dried and finally calcined and clinkered in its passage from the upper end to the lower or outlet end of the cylinder. The blast of heated gases passing through the cylinder inevitably lifts and carries with it some of the material in the form of a more or less fine powder and usually this powder is collected in a settling chamber at the upper end of the cylinder and re-fed to the kiln requiring mechanism which performs a function technically unnecessary in the calcining and clinkering operation.

The present invention is intended to overcome the objections inherent in the apparatus as above described and to accomplish the feeding and calcining and clinkering of the material in a more effective, efficient and economical manner.

By the present invention the feeding mechanism is so placed that it produces no permanent obstruction within the cylinder and does not reduce or impede the draft therethrough. In addition to this, the present invention may tend to collect and keep in the cylinder any powder or dust carried by the blast of the heated gases thus possibly to an extent doing away with the necessity for the auxiliary

dust-feeding apparatus. The arrangement may effect a desirable treatment of the material fed.

While the feeding mechanism of the present invention is adapted to material ground dry or to slurry or to the slurry cake from which some of the moisture has been removed or to material in any other suitable form, it has been found economical to feed the material in the condition known as "slurry cake" and the description of the operation will be made with that in mind.

With the objects and purposes thus indicated together with others in view, an embodiment of the present invention may include a hopper or similar device into which may be fed by any suitable means the prepared material to be fed to the kiln. Such a hopper or receptacle will preferably be arranged above the kiln so that material fed into it may fall by gravity into the kiln although when desired there may be employed any well known screw-feeding device or other means for forcing the material from the hopper into the kiln. The open end of the hopper away from the kiln, when desired, may be closed or sealed. The open or outlet end of the hopper may rest directly upon the kiln or may be connected thereto by means of a flue or other suitable conduit. Below the opening of the hopper the rotating cylinder may be provided with a series of openings which as the hopper rotates will in succession come under the hopper so that material therefrom will fall through the openings in the cylinder. Preferably these openings are arranged diagonally to their path of travel and so close together in the cylinder shell that there will always be one or parts of two or more openings directly under the open end of the hopper so that material passing through the hopper may always be fed directly into the cylinder. Associated with the openings on the strips of shell between them or on the portion surrounding them or on both may be arranged cleats or vanes, possibly in the form of angle irons, to collect and deliver into the openings material falling from the hopper on the portion of the shells surrounding the openings. These surrounding vanes may be arranged at appropriate angles so that as the cylinder rotates they may force the entrapped material, urged by gravity, into and through the openings into the cylinder.

Material thus falling through the cylinder will tend to form a more or less complete pervious curtain across the area of the cylinder with out materially impeding the draft and, especially if in the form of slurry or slurry cake, will tend to collect from the gases the entrained dust and retain it in the cylinder. Because of the inclination of the cylinder the holes in their travel across the bottom of the apparatus may not be directly

under the receiving openings in the top portion of the shell but will be somewhat above them. The tendency, therefore, of the entering material will be to fall on the interior of the cylinder toward the lower end thereof. It may happen, nevertheless, that some of the material may fall through the openings at the bottom of the cylinder. It may be desirable, therefore, to provide a casing connected with the outlet of the hopper and entirely surrounding the cylinder and covering the holes therein to catch any material passing out of the holes at the bottom of their travel so that the vanes or angle irons carried by the cylinder may collect material at the bottom of the casing and carry it upward as the cylinder rotates until gravity draws it into the cylinder through adjacent openings. Such casing also prevents the escape of gases from the cylinder through openings not sealed by the material in the hopper.

The vanes on the exterior of the cylinder may serve the additional purpose of breaking down and grinding material between the cylinder and the casing and assist in mixing and stirring up the material where grinding or drying may be part of the process being performed, or in polishing where such is a function of the apparatus.

In order to conserve the heat and more effectively regulate the draft and prevent exudation of material at the outer side of the casing means may be provided for effecting a seal between the casing, the hopper and the rotating cylinder.

In the accompanying drawings Figure 1 is a side elevation of a kiln and charging device embodying the present invention. Fig. 2 is a similar side elevation of a portion of the apparatus on an enlarged scale and partly broken away so as to show additional portions of the mechanism. Fig. 3 is a transverse vertical section of the line 3—3 of Fig. 2. Fig. 4 is a similar transverse vertical section on the line 4—4 of Fig. 2. Fig. 5 is a detailed view partially in section showing the seal for the casing.

The apparatus consists of a main rotary cylinder 8 which may be of any suitable dimensions and which is carried so that it may rotate upon bearings indicated at 9. The means for rotating the cylinder may be of any suitable form and are not illustrated as such devices are well known in the art. At the lower end of the cylinder is the usual outlet chamber 10 through which the calcined or clinkered material may be removed. Fuel or heated gases may be introduced in any suitable well known way. Through the chamber 10 and possibly entering the cylinder 8 may be a pipe or other conduit 11 through which fuel may be introduced into the cylinder 8 to heat and eventually calcine and clinker the materials which combine to make cement. At the other or upper end of

the cylinder 8 may be provided a dust chamber 12 connected with the stack or chimney, not shown. In ordinary course the products of combustion of the fuel will pass through the cylinder and up the chimney. If any cement or cement-making material or other dust is carried by the draft beyond the upper end of the rotary cylinder 8 it may be entrained or collected by any suitable or well known means in the chamber 12 and discarded or again fed into the rotary cylinder.

When working with materials which have been ground wet the slurry with its high water content may be fed by any suitable means, not shown, on to a traveling belt carrier 13 which may be operated by any suitable or well known mechanism. While on the conveyor belt the wet slurry may be operated on by the usual vacuum or other apparatus, not illustrated, to remove the desired amount of water. Any other suitable means may be employed to pretreat the ground materials but this forms no part of the present invention. The partially dried slurry cake may then be fed by the conveyer belt 13 to the cylinder or into the hopper 14. Where the conveyer belt 13 joins the hopper it may be covered by an enclosing hood 15 of any suitable material forming a seal. That portion of the shell of the cylinder 8 which lies immediately under the hopper 14 may be provided with a series of holes or openings 16 giving access to the interior of the cylinder 8. The holes 16 will be arranged preferably in a band around the cylinder so that as it rotates the holes preferably at the topmost point of their travel will come one after the other directly under the outlet or bottom of the hopper 14. As shown, the width of the holes in a direction parallel to the axis of the cylinder is somewhat greater than the width of the opening of the hopper 14. This arrangement is preferred but is not essential to the invention. With this arrangement of course it is clear that there may be very little tendency for material coming from the hopper to accumulate on the shell of the cylinder 8 at the sides of the holes for the reason that the spread of the material as it leaves the hopper 14 may not be further than the sides of the holes 16.

The portions of the shell of the cylinder 8 which intervene between the holes 16 are shown at 17 as being materially less in area than the holes 16 and this is a preferable arrangement but not essential to the invention. The intervening strip 17 may profitably be as narrow as possible while still retaining the necessary strength to avoid rupture or dissolution of the shell. It is obvious that by reducing the area of the section 17 the opportunity for material coming from the hopper 14 to lodge on the strip 17 is reduced. The edges of the strips 17 form end walls to the holes 16 and are inclined at an angle to

the line of their circumferential travel and an effect of this is to cause the edge of the strip 17 to have a shearing action upon the material fed from the hopper 14. Likewise by this inclined arrangement or the narrow separating strips or both generally portions of more than one of the holes 16 will underlie the opening of the hopper 14 so that there will be two directions that material on a strip 17 and coming from the hopper may fall. This materially reduced the chance of material piling up on the strips 17. This arrangement will facilitate the entrance of the material into the cylinder 8.

On the strips 17 may be placed vanes or plates 18 which are illustrated for convenience as angle irons suitably attached to the shell of the cylinder. While their number is not essential four of these vanes 18 are shown on each of the strips 17 and they are arranged so that their operating faces are substantially at right angles to their line of travel and they are staggered so that the four irons on any one strip together will cause a clean sweep of the bottom of the hopper 14 in their passage therethrough. As each strip 17 passes under the hopper 14 some material will be delivered on to it. Some of this will fall into the cylinder through adjacent holes 16. The material that remains on the strip 17 may be caught by the angle irons 18 and carried forward until as the cylinder 8 turns about its axis the material will fall by gravity into an adjacent opening 16.

In order to further insure complete feeding of the material fed in from the hopper 14 angularly disposed vanes 19, taking the form of angle irons in the drawing, may be arranged on the shell 8 at the sides of the openings 16. The vanes 19 will tend to entrain any material which may fall beyond the sides of the holes 16 and carry and divert it until gravity causes it to fall along the incline of the vanes 19 into an adjacent opening 16. By this arrangement material may be surely and positively fed from the hopper 14 into the interior of the cylinder 8. Since the material in the hopper 14 has a vertical movement its advance may generally be insured by gravity alone but when desired suitable force-feeding mechanism may be employed in the hopper 14.

While a hopper has been described it may be replaced by any suitable or convenient collecting or feeding arrangement or it may be omitted entirely and material admitted directly from the conveyer 13 to the cylinder or it may be delivered in any other way and the term hopper as used in the claims is intended to include any device for delivering material to the cylinder.

Connected with the mouth of the hopper 14 is a casing 20 which surrounds and encloses the cylinder 8 and is spaced far enough there-

from to not bind against the vanes 18 and 19. It is desirable that there be provided a seal between this casing and the cylinder. As shown in Fig. 5 the casing 20 has an annular flange or edge 21 which is turned inwardly and extends toward the shell of the cylinder 8. An annular ring 22 surrounds the cylinder 8 and is free to slide longitudinally thereon. A series of lugs 23 rising from the shell of the cylinder 8 carry bolts 24 extending into the annulus 22. Surrounding the bolts 24 and lying between the lugs 23 and the annulus 22 are coil springs 25 which keep the annulus 22 in close contact with the annular edge 21 of the casing 20 and thereby form a seal. Any other suitable seal may be used.

The material in the cylinder may be fed forward toward the right of Figs. 1 and 2 in the usual way by the rotation of the inclined cylinder lifting the material and thrusting it forward. The inner walls of the cylinder 8 may be provided with spirally arranged vanes or angles 26 of the usual well known character which will aid in feeding the material as received from the hopper 14 toward the outlet chamber 10 of the cylinder. These vanes may extend from the inlet end of the cylinder past the openings 16 and any suitable distance therebeyond as is well known in the art and so move forward substantially all of the material fed into the cylinder.

The holes 16 as they travel about the cylinder, however, reach its lower portion and any material directly above the holes will of course have a tendency to fall out and into the bottom part of the casing 20. It will be remembered that the cylinder 8 as usually used in the art may be inclined so that the portion shown at the left of Fig. 2 is higher than the portion shown at the right of that figure. The result of this is that any material falling vertically from the hopper 14 into the cylinder may tend to fall not through a hole 16 at the bottom but on to a portion of the cylinder at the right thereof as shown in Fig. 2 so that a relatively small portion of the material may find its way into the bottom of the casing 20. Whatever material does reach the bottom of the casing 20, however, may be engaged by the vanes 18 and 19 as they move with the rotating cylinder. The material so engaged will be lifted and carried up upon the vanes 18 and 19 or rolled between them and the casing until they reach such a position that the angular arrangement of the vanes will allow the material to be forced by gravity into the cylinder 8 through directly adjacent openings 16. This intermediate manipulation of the material may be an advantage in some proceedings.

The vanes have been illustrated inclined as is most expedient when the cylinder rotates so that the holes visible on the front of the

cylinder in Fig. 2 will rise and pass under the hopper 14 and then down the back of the rotating cylinder but other suitable arrangements may be made.

5 In will be observed that the tendency of the mechanism will be to produce a delivery of material from the hopper 14 into the cylinder 8 in such a way that the entering material will form a curtain covering more or
10 less the entire cross-section of the cylinder. The cool entering material especially if somewhat moist as slurry cake, when it meets the heated gases passing through the cylinder will have a tendency to extract
15 therefrom any loose dust entrained and carried thereby so that with this arrangement there may be a minimum amount of dust to be collected in the settling chamber 12.

20 It has been demonstrated in actual operative practice that with this device the stiff slurry cake can be fed continuously into the kiln without danger of packing or interrupting the operation and causing delays no matter what the stage of drying or exhaustion of the water in the slurry cake may be.
25 The device will rake it up and carry it back to the openings continuously. Incidentally the device expedites the breaking up of the slurry cake and its assembly into balls in the cylinder in which form it may be acted upon
30 most advantageously by the heated gases. A more or less similar advantageous manipulation of the fed material may take place no matter what is its character.

35 As stated, the apparatus is adapted in addition to mere feeding to the cylinder, to the polishing of material polished by rotation and shaking either alone or in connection with the inclusion of grinding or polishing
40 materials such as balls or otherwise; and to the grinding and mixing of materials when no other treatment is required.

45 While the apparatus illustrated in the drawings has been described as one embodiment of the invention it will be understood that it is done for the purpose of illustration only. The invention is not confined to the details of structure or assembly or relative
50 proportions or purposes of the various elements as shown but may be embodied in many diverse forms of apparatus using elements which separately considered may be old and well known. Some arrangements
55 may be less efficient than the present arrangements but may still embody the invention or a portion thereof.

I claim as my invention:

60 1. In a kiln or the like a hopper, a cylinder rotating under the hopper and provided with an aperture adapted to pass under the hopper as the cylinder rotates, end walls for the aperture arranged at an angle diagonal to the path of travel, and means adjacent the aperture to collect and feed by gravity additional
65 material coming from the hopper.

2. In a kiln or the like a hopper, a rotary cylinder under the hopper and provided with an aperture adapted to pass under the hopper as the cylinder rotates, end walls for the aperture arranged at an angle diagonal to the path of travel, means adjacent the aperture to collect and feed by gravity additional matter from the hopper, and a seal for the hopper and aperture.

3. In a kiln or the like a hopper, a seal for the hopper, a cylinder rotating under the hopper and provided with a series of apertures in a band adapted to pass under the hopper as the cylinder rotates, end walls for the apertures arranged at an angle diagonal to their path of travel under the hopper, means between the apertures to receive material from the hopper and carry it and to deliver it through the apertures and a seal for the hopper and the apertures.

4. In a kiln or the like a hopper, a seal for the hopper, a cylinder rotating under the hopper and provided with a series of apertures in a band adapted to pass under the hopper as the cylinder rotates, end walls for the apertures arranged at an angle diagonal to their path of travel under the hopper, means between the apertures to receive material from the hopper and carry it to deliver it through the apertures and a seal surrounding the cylinder and engaging the hopper.

5. In a kiln or the like a hopper, a seal for the hopper, a cylinder rotating directly under the hopper and provided with a series of apertures in a band adapted to pass under the hopper as the cylinder rotates, and means between the apertures to receive material from the hopper and carry it to deliver it through the apertures.

6. In a kiln or the like a hopper, a cylinder rotating under the hopper and provided with an aperture adapted to pass under the hopper as the cylinder rotates and allow matter to drop directly into the cylinder from the hopper, and means adjacent the aperture to collect and feed by gravity additional matter coming from the hopper.

7. In a kiln or the like a hopper, a cylinder rotating under the hopper and provided with an aperture adapted to pass under the hopper as the cylinder rotates, end walls for the aperture arranged at an angle diagonal to the path of travel, means adjacent the aperture to collect and feed by gravity additional matter coming from the hopper, a stationary band for the hopper and aperture, and resilient means carried by the cylinder and engaging the band to form a seal.

8. In a kiln or the like, an inclined rotatable cylinder having a series of holes circumferentially arranged in its shell, diagonally arranged vanes on the shell between the holes, vanes on the shell at the sides of the holes arranged at an opposite angle to the first mentioned vanes, a stationary hopper arranged

above the cylinder and in line with the holes, a stationary casing surrounding the cylinder and covering the holes and vanes and engaging the hopper, rings on the cylinder and sliding longitudinally thereof and engaging the sides of the casing, abutments on the cylinder, springs between the abutments and the rings and holding the rings resiliently against the sides of the casing to form a seal, and means to rotate the cylinder to cause material in the hopper to enter the cylinder through the holes and additional material from the hopper to be caught by the vanes and fed into the cylinder through the holes.

9. In a kiln or the like, an inclined rotatable cylinder having a series of holes circumferentially arranged in its shell such holes having sides at an angle diagonal to the axis of the cylinder, diagonally disposed projections on the shell between the holes, projections on the shell at the sides of the holes arranged at an angle obtuse to that of the disposition of the first mentioned projections, a stationary hopper arranged above the cylinder and in line with the holes, a stationary casing surrounding the cylinder and covering the holes and projections and engaging the hopper, and means to rotate the cylinder to cause material in the hopper to enter the cylinder through the holes and additional material to be caught by the projections and fed into the cylinder through the holes.

10. In a kiln or the like, an inclined rotatable cylinder having a series of holes in its shell, projections on the shell between the holes, projections on the shell at the sides of the holes, a hopper directly above the cylinder and in line with the holes, a casing surrounding the cylinder and covering the holes and projections and engaging the hopper, and means to rotate the cylinder to cause material in the hopper to enter the cylinder through the holes and additional material from the hopper to be caught by the projections and fed into the cylinder through the holes.

11. In a kiln or the like a rotary cylinder having a series of spaced openings arranged diagonally with respect to their line of travel and a hopper arranged above the cylinder so that as the cylinder rotates there is always an opening into the cylinder below the hopper.

12. In a kiln or the like a rotary cylinder having a series of spaced openings arranged diagonally with respect to their line of travel, a hopper arranged above the cylinder so that as the cylinder rotates there is always an opening into the cylinder below the hopper, intermediate strips between the openings, and means on the strips to feed material into the openings as the cylinder rotates.

13. In a kiln or the like, means for feeding material thereto, a rotary cylinder having a

series of aligned circumferential openings of such arrangement and so spaced that some part of one or more openings will at all periods of rotation lie in line with the said means for feeding material through such openings into the cylinder, an end sealed casing enclosing a portion of the cylinder adapted to retain material which might pass outwardly from the cylinder through the openings into the casing, and to prevent the passage of materials or gases outwardly from between the casing and the cylinder and air inwardly, and means on the outer circumference of the cylinder between and adjacent to the feed openings adapted to deliver to the openings fed material not directly entering the cylinder or passing through the openings into the space between the cylinder and the casing.

14. In a kiln or the like, means for feeding material thereto, a rotary cylinder having a series of aligned circumferential openings of such arrangement and so spaced that some part of one or more openings will at all periods of rotation lie in line with the said means for feeding material through such openings into the cylinder, an end sealed casing enclosing a portion of the cylinder adapted to retain material which might pass outwardly from the cylinder through the openings into the casing, and to prevent the passage of materials or gases outwardly from between the casing and the cylinder and air inwardly, and means on the outer circumference of the cylinder between and adjacent to the feed openings adapted to deliver to the openings fed material not directly entering the cylinder or passing through the openings into the space between the cylinder and the casing and to mix, grind or polish material between the cylinder and the casing in addition to the action within the cylinder itself.

15. In a kiln or the like, a hopper, a cylinder rotating under the hopper and provided with apertures adapted to pass under the hopper as the cylinder rotates, the major dimension of the apertures arranged at an angle diagonal to the axis of the cylinder, and means adjacent to the apertures to collect and feed into the cylinder by gravity matter coming from the hopper and not directly passing through the apertures.

16. In a kiln or the like, an inclined rotatable cylinder having a series of holes circumferentially arranged in its shell, diagonally disposed vanes on the shell between the holes, vanes on the shell at the sides of the holes arranged at an angle obtuse to that of the disposition of the first mentioned vanes, a stationary hopper arranged above the cylinder and in line with the holes, a stationary casing surrounding the cylinder and covering the holes and vanes and engaging the hopper, and means to rotate the cylinder to

cause material in the hopper to enter the cylinder through the holes and to cause additional material from the hopper to be caught by the vanes and fed into the cylinder through the holes.

17. In a kiln or the like, a hopper, a rotary cylinder having a series of openings so spaced and arranged diagonally to the line of rotation that as the cylinder rotates there is always an opening or parts of one or more openings into the cylinder directly below the hopper.

18. In a kiln or the like, a hopper arranged above a rotary cylinder having a series of openings so spaced and arranged diagonally to the line of rotation that as the cylinder rotates there is always an opening or parts of one or more openings into the cylinder directly below the hopper, intermediate strips between the openings, and means on or adjacent to the strips to feed into the openings as the cylinder rotates material from the hopper which does not pass directly through the openings.

19. In a kiln or the like, a rotary cylinder, gravity means for feeding material thereto, a series of spaced openings in the cylinder, the spaced openings being so arranged that as the cylinder rotates there is always an opening in the cylinder adjacent to the feeding means so that there is a continuous entry of material into the cylinder, and means adjacent to the openings to feed into the cylinder as it rotates material not passing directly through the openings.

20. In a kiln or the like, a rotary cylinder, means for feeding material thereto, a series of spaced openings in the cylinder so arranged that as the cylinder rotates there is always an opening into the cylinder adjacent the feeding means so that there is a continuous entry of material into the cylinder and means on the cylinder adjacent the openings to feed material thereinto as the cylinder rotates.

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