H. BESSER.

GRINDING MACHINE.

APPLICATION FILED APR. 19, 1909.

980,587.

Patented Jan. 3, 1911.

2 SHEETS—SHEET 1.

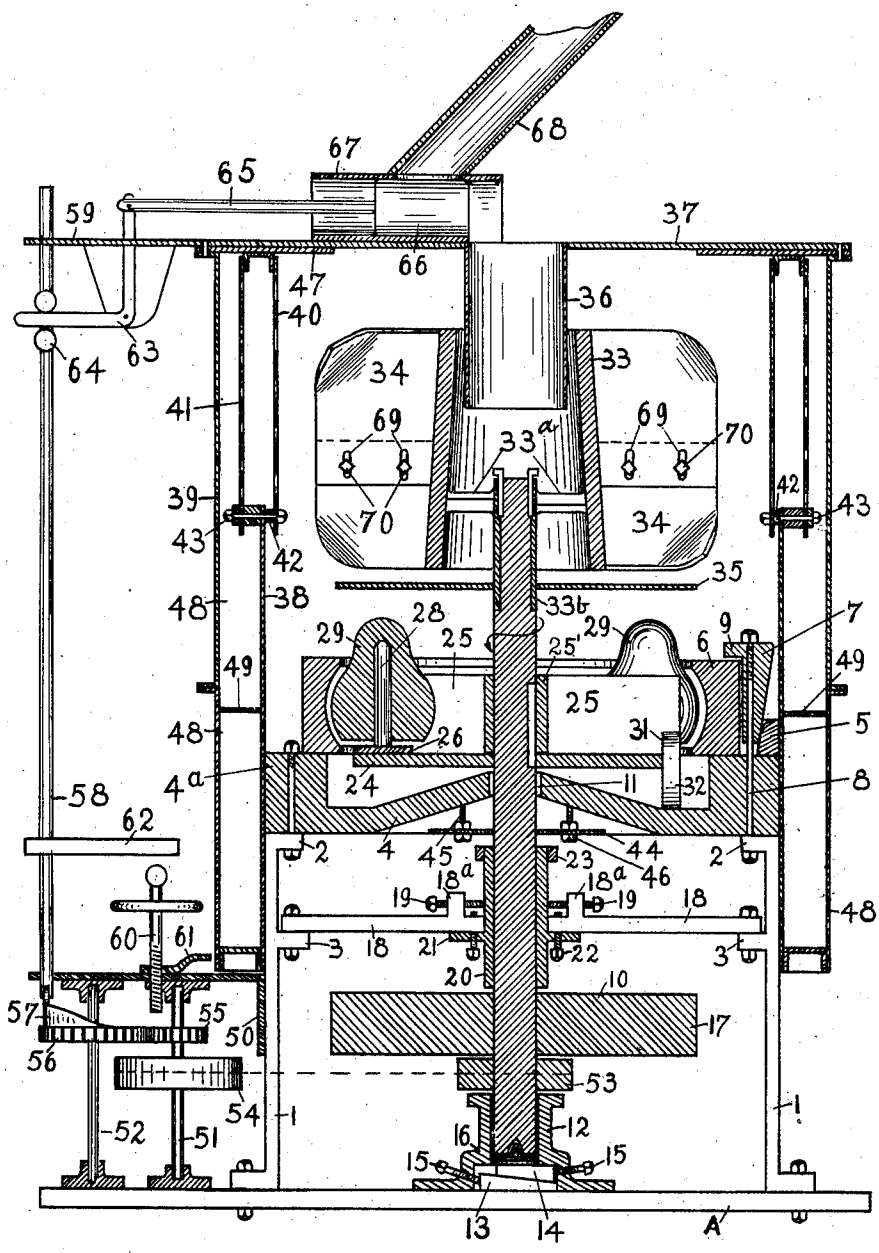

Fig. 1

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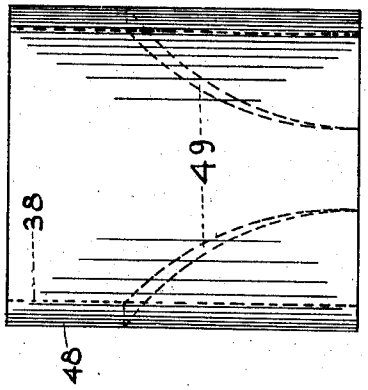

Fig. 2

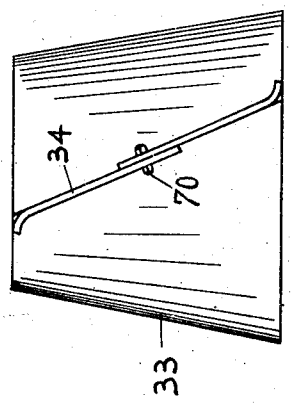

Fig. 3

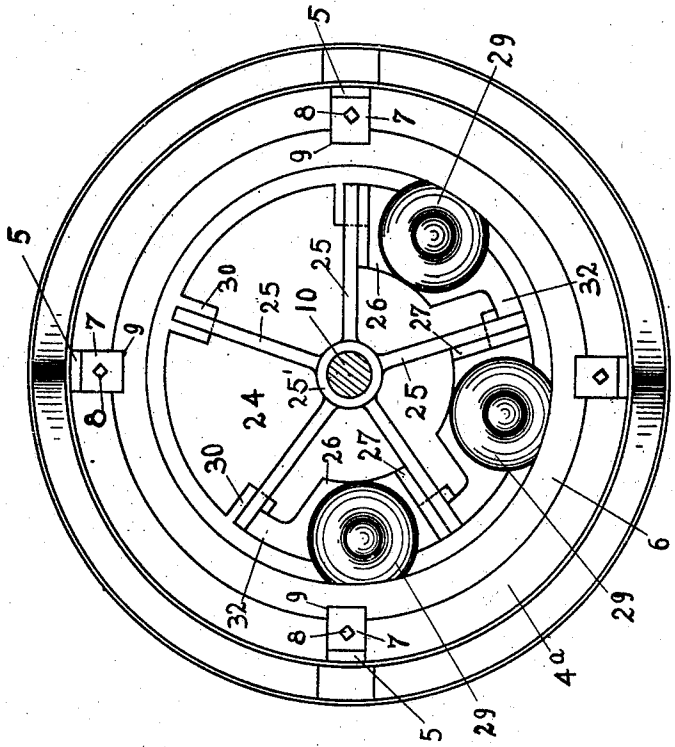

Fig. 6

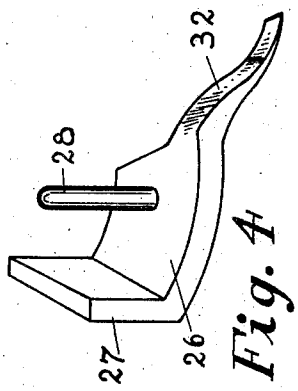

Fig. 4

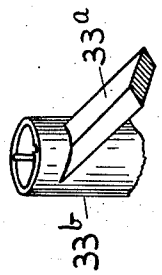

Fig. 5

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GRINDING-MACHINE.

980,587. Specification of Letters Patent. **Patented Jan. 3, 1911.**

Application filed April 19, 1909. Serial No. 490,863.

To all whom it may concern:

Be it known that I, HERMAN BESSER, a citizen of the United States, residing at Alpena, in the county of Alpena and State of Michigan, have invented certain new and useful Improvements in Grinding-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to grinding machines, one object being the provision of a machine wherein the material is inevitably ground to a fine air-floated powder.

Another object is the provision of improved means for permitting the automatic yielding of the grinding rolls in case refractory material lodges between the rolls and the grinding ring.

A further object is the provision of a loose, non-tilting, rotatable grinding roll.

A still further object is the provision of a friction reducing mechanism for revolving the roll.

Another object is the provision of means for causing imperfectly ground material to be subjected to successive grindings until it is sufficiently pulverized.

Still another object is the provision of means for mechanically abstracting the material when pulverized to a sufficient fineness and screening the same.

A further object is the provision of means for returning the material to the grinding rolls if not sufficiently pulverized.

A still further object is the provision of means for regulating the supply of air to the machine.

Another object is the provision of adjustable means for mechanically feeding material to the machine.

To these and other ends, therefore, my invention consists in certain novel features and combinations such as will be more fully described hereinafter and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical cross-sectional view through a machine constructed in accordance with my invention and illustrating one form which it may assume, Fig. 2 is a fragmentary side view of the casing showing a discharge hopper, Fig. 3 is an edge view of one of the wings, Fig. 4 is a perspective view of the shoe carrying the roll, Fig. 5 is a detail view showing the angular spoke, and Fig. 6 is a top plan view of the rotary table.

Success in the manufacture of Portland cement depends, more than upon all other features of the process, in extremely fine grinding of the raw materials. The material is dried and calcined at white heat generally in revolving cylindrical kilns from which it issues in clinker. By grinding this clinker to fine powder, the finished cement is obtained. My invention is adapted both for grinding the raw material and for grinding the clinker.

Referring to the drawings, 1, 1 indicate the legs of a machine, such legs carrying the laterally projecting lugs 2, 2 and 3, 3. A pan 4 rests upon and is bolted to the upper lugs 2, 2, the bolts passing through the raised rim or periphery 4^a of the pan. The central portion of the pan is elevated conically, leaving an annular path between the raised peripherv and the conical elevation. The raised periphery is also provided at intervals with beveled standards 5, one only of which is shown.

A grinding ring 6 having a concave inner face is seated on the raised periphery 4^a of the pan and as one means for retaining the ring firmly in place against movement, I provide the wedges 7 inserted between the beveled faces of the standards 5 and the outer face of the ring, such wedges being held in place by the bolts 8 which extend through the raised periphery and through certain of the lugs 2. The wedges may be provided with lips 9 adapted to take over the upper edge of the grinding ring and assist in retaining the ring in position against vertical movement.

A vertical shaft 10 passes through an enlarged opening 11 formed centrally of the pan 4. The lower end of the shaft is received in a step bearing 12 and rests upon a pair of superposed wedges 13, 14, held in place by set screws 15, the upper wedge being adjustable relative to the lower. Wearing plates 16 may be interposed between the upper wedge and the lower end of the shaft. The shaft carries a pulley 17 driven from any suitable source, and in order to properly support the shaft, I may use the following construction.

Spider arms 18 are bolted at their outer ends to the lugs 3, 3, the inner ends of the arms lying adjacent the shaft 10 and provided with ears 18^a, carrying set screws 19,

adapted to engage the sections of a bearing sleeve 20 inserted between the inner ends of the arms and the shaft and inclosing the latter. The bearing sleeve sections are each flanged as at 21 and receive set screws 22 passing through the extreme inner ends of the spider arms. The set screws 19 hold the bearing snugly against the shaft and at its upper end the bearing is held together by a clamp 23. The grinding mechanism may be arranged as follows: A table 24 is keyed to the shaft above the pan 4, the table being substantially circular in shape and above the table, a hub 25′ is keyed to the shaft, the hub being provided with radially extending wings 25 resting upon and dividing the table into a plurality of compartments. A shoe is loosely received in each compartment, such shoe comprising a segmental-shaped plate 26 having a back 27 lying parallel with and engaged by the adjacent wing 25. A post 28 is carried by the plate, such post extending to a plane above the upper face of the grinding ring 6 and having a roll 29 journaled thereon, the upper end of the roll being closed against the admission of dust to its bearing on the post. The convex face of the roll is adapted to correspond with the concave face of the grinding ring and the post is located so near to the outer edge of the shoe that the surface of the roll projects some distance beyond the outer edge of the shoe and of the table as well. The periphery of the table is recessed as at 30, such recesses extending past the ends of the respective wings which are also recessed as at 31. These recesses accommodate a plow 32 carried by the shoe and extending downward at an angle through the recesses, the extreme free end of the plow lying adjacent the annular path formed in the pan. By so mounting the roll on the shoe that the roll projects over the outer edge of the shoe, the roll will prevent the engagement of the shoe and ring. When the rolls are worn down, new ones can easily be substituted. The rolls engage the ring only and are not subject to wear from contact with any other element, the backs 27 of the shoes carrying the rolls being engaged by the wings to revolve the rolls. This arrangement operates to reduce the power necessary to revolve the rolls.

By extending the post to a point above the upper surface of the ring, the roll is prevented from tilting or tipping and rotates upon the post as a center. If the pushing wings engaged the roll, more power would be consumed in revolving the rolls, owing to the increased area of frictional contact. The post, if of less height than the ring, or if of even height therewith, would be subject to excessive wear at its upper end and would permit the roll to tilt, thus decreasing the area of contact betwen the roll and ring. By arranging the post so that its upper end lies above the point of contact of the roll and ring, the wear is evenly distributed on the post. It will also be observed that the bore of the roll is a trifle shorter than the length of the post so that the roll rests on the upper end of the post. Thus the post serves as a pivot on which the roll rotates and the small area of contact between the post and roll reduces friction and makes the roll easily rotatable, there being very little wear at the contact point of the post and roll. The shoe resting loosely on the table can recede, carrying the roll with it in case the plow meets with resistance in its path of movement and also in case refractory material lodges between the roll and the ring.

The table lies closely adjacent the pan and as it rotates, the inclined plows pick up the partially ground material and feed it between the ring and roll for regrinding. The material travels up the plows into the respective compartments, the recesses 31 permitting the passage of such material beneath the wings. The shape of the pan is such as to shunt all material falling thereinto, onto the annular path traversed by the plows.

The upper end of the shaft carries a sleeve or hopper 33, connected by beveled spokes 33^a to a hub 33^b on the shaft. The sleeve is wider at its lower than at its upper end and is provided with inclined vanes 34, 34, secured to its outer periphery. The sleeve extends above the upper end of the shaft, and between the lower end of the sleeve and the table, is located a distributer plate 35, extending out over the upper ends of the rolls. A chute 36 depending from a cover 37 extends into the upper end of the sleeve.

The operation of so much of my invention is as follows: Motion being imparted to the shaft 10, the table 24 will be rotated, the wings 25 pushing the roll-carrying shoes in a circle. Centrifugal force operates to throw the shoes outward, whereupon the rolls rotatably engage the grinding ring to crush material fed between the surfaces. Material is fed into the chute 36, whose lower end depends into the sleeve 33, which in turn deposits the material on the distributing plate 35, whence it is delivered to the rolls. The material banks up on the grinding ring as shown and forms a cushion to protect the shell 38 inclosing the machine from injury from the material whirled off of the distributer plate. This banked material also operates to shunt the clinker directly to the contacting surfaces of the rolls and ring.

The object of introducing the material from the chute into the sleeve is to avoid its dissipation by the whirling current of air from the vanes 34. The beveled spokes assist in pushing the material down and by enlarging the discharge end of the sleeve, the tendency of centrifugal force to throw

the material out and hold it against the inner periphery of the sleeve is overcome. By leading the material to the distributer plate in the manner set forth, it does not have to contend with the upward and outward set of the air current from the fan.

The material, after passing down between the rolls and the ring, falls into the pan 4, and such of the material as is not fine enough to be floated by the current of air from the fan, collects in the annular path where it is engaged and caused to travel up the inclined plows 32 by which it is again delivered to the rolls and subjected to further grinding, such action being continued until the material has been ground to a fine powder, capable of being air-floated.

In order to determine whether the material has been ground to a sufficient degree of fineness, I may provide the following construction. The shell 38 surrounding the machine extends upward preferably to a point above the distributer plate 35 and carries a peripherally extending ring 39. A coarse screen 40 and a fine screen 41, both cylindrical in form and arranged concentrically, are secured at their lower ends to the upper end of the shell. These screens are removable so that screens of different mesh may be substituted therefor. The lower end of the fine screen is bolted to the periphery of the ring 39, but the lower end of the coarse inner screen is spaced apart from the upper end of the shell by means of short cylinders 42 through which pass the bolts 43 connecting the fine screen 41 to the ring 39. The coarse screen, therefore, is spaced apart from the shell so that material which passes through the coarse screen but is too large to pass through the fine screen, is returned to the grinding rolls for further treatment.

The screens encircle the fan and in order to cause the fan to suck up the fine material and then discharge it laterally against the coarse screen, I preferably bend the lower outer corners of the blades forwardly in the direction of travel of the vanes and bend the upper outer corners rearwardly, whereby, when the material has been drawn into the fan, it is discharged laterally from the upper end of the fan. Any other form of fan capable of performing this function may be substituted for that shown.

The enlarged opening 11 arranged centrally of the pan admits air to the machine and in order to control the suction force of the fan, I provide a combined air regulator and dust cap 44 adjustably supported beneath the pan and under the opening by the bolts 45 and nuts 46. This air regulator consists of a sectional disk which, by being brought closer to or spaced farther from the annular opening 11, to admit more or less air, decreases or increases the suction power of the fan and thereby regulates the degree of fineness to which the material shall be ground.

The coarse screen is supported by the bolts 43 only, but the fine screen is connected to the under face of an annular ring 47, the outer edge of which is secured to the upper end of an outer cylindrical wall 48 surrounding the shell and the screens. The ring 47 supports the cover 37.

Converging partitions 49 located in the space between the shell and the wall form hoppers in which the material passing through the fine screen is caught and led to suitable discharge openings.

The wall 48 is preferably made in sections to facilitate access to the screens without dismantling the entire machine. Furthermore, by removing the cover 37, access is had to the grinding machinery, to repair the rolls and shoes, and it is possible to remove and replace the grinding ring without disassembling the screens, to which end the grinding ring is made of less diameter than the inner coarse screen.

In order to obtain the greatest efficiency, as much material should be fed to the mill as is discharged therefrom and any skilled operator can tell by the sound of the rolls whether the machine is working to capacity or not.

As one means for providing a mechanical feed, I may mount a bracket 50 on one of the legs 1, between which bracket and a base A extend two parallel shafts 51, 52, the ends of which are received in step bearings on the base and bracket respectively. A pulley 53 on the shaft 10 is connected to a pulley 54 on shaft 51, which shaft in turn carries a gear 55 meshing with a large gear 56 on shaft 52. The large gear 56 is equipped with an arc-shaped incline 57 engaged by the lower end of a rod 58, guided near its lower and upper ends in the brackets 50 and 59, respectively. The bracket 50 carries an adjustable screw 60 held in place by a lock nut 61. The upper end of the screw lies in the path of movement of an arm 62 carried by the rod 58.

A bell crank 63 is pivoted to the bracket 59, one arm of the bell crank being received between two stops 64, preferably rollers, on the rod 58. The remaining arm of the bell crank is pivotally connected to the plunger rod 65 of a plunger 66, operating in a trough 67 to which a spout 68 leads. The discharge end of the trough lies above the chute 36. Rotation of the gear 56 brings the incline 57 under the lower end of the rod 58 to raise the latter and force the material in the trough into the chute 36. The throw of the plunger is adjusted by raising or lowering the screw 60. Normally the plunger closes communication between the trough and spout 68.

By adjusting the screw 60, the operator

can feed just as much material to the machine as is desirable and can vary the quantity as the quality of the material to be ground varies in hardness. Also, it is obvious that the feed may be changed without shutting down the machine.

In order to provide means for varying the air pressure, I may make vanes 34 adjustable. To this end, I make each vane of two or more sections, one of which is provided with slots 69, to adjustably receive the fastening bolts 70, whereby the vanes can be overlapped more or less to vary their area. It is evident that other changes might be made in the form and arrangement of the several parts described without departing from the spirit and scope of my invention.

Having thus fully disclosed my invention, what I claim as new, is:—

1. A grinding machine comprising a suitably supported grinding ring, a rotatable table, means for rotating the table, wings of a height approximately equal to the height of the grinding ring and dividing the table into a plurality of compartments, a shoe loosely received in each of the compartments, and a roll carried by the shoe and adapted to engage the grinding ring.

2. A grinding machine comprising a suitably supported grinding ring, a rotatable table, means for rotating the table, shoes loosely received on the table, posts carried by the shoes, rolls journaled on the posts, the upper ends of the posts extending to a point above the point of contact of the roll and ring, the upper ends of the rolls being imperforate and resting on the upper ends of the posts, the lower ends of the rolls normally lying out of contact with the table, and means against which the shoes rest.

3. A grinding machine comprising a suitably supported grinding ring, a rotatable table, means for rotating the table, wings dividing the table into a plurality of compartments, a shoe loosely received in each of the compartments, the shoe comprising a plate, a roll journaled on the plate, and a back carried by the plate and spaced apart from the roll, the wing adapted to engage the back.

4. A grinding machine comprising a grinding ring, a rotating table, shoes loosely received on the table, rolls mounted on the shoes, the table provided with recesses, inclined plows carried by the shoes and loosely projecting through the recesses, the shoes and plows movable relative to the recesses, and a receptacle into which the plows project.

5. A grinding machine comprising a grinding roll, a rotating table, shoes loosely received on the table, radial wings dividing the table into compartments, the shoes being movable in the compartments, the periphery of the table provided with recesses formed at the juncture of the outer ends of the wings therewith, a receptacle beneath the table, and inclined feed members supported by the shoes and adapted to project into the receptacle.

6. A grinding machine comprising a supporting means, a receptacle received on the supporting means, the receptacle provided with a rim, a grinding ring seated on the rim, beveled standards on the rim, adjustable wedges having their outer faces only inclined, the wedges received between the standards and the outer face of the ring, the inner faces of the wedges being parallel with the outer periphery of the ring, lips on the wedges, the lips taking over the ring, fastening means extending parallel with the longitudinal axes of the wedges to hold the wedges releasably in position, and suitably supported grinding rolls coöperating with the ring.

In testimony whereof, I affix my signature in presence of two witnesses.

HERMAN BESSER.

Witnesses:
FRED R. TRELFA,
J. R. MCHARG.