

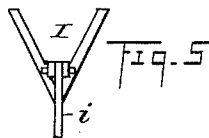
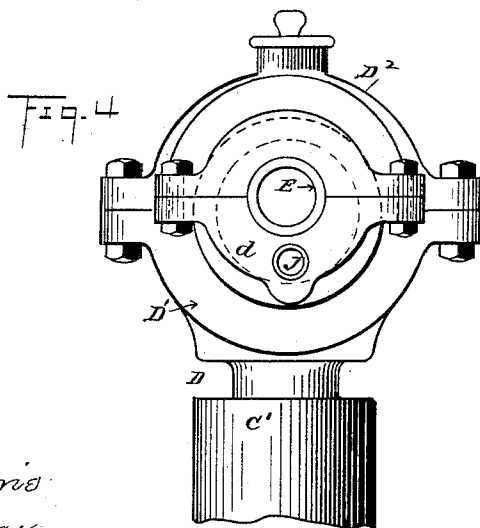
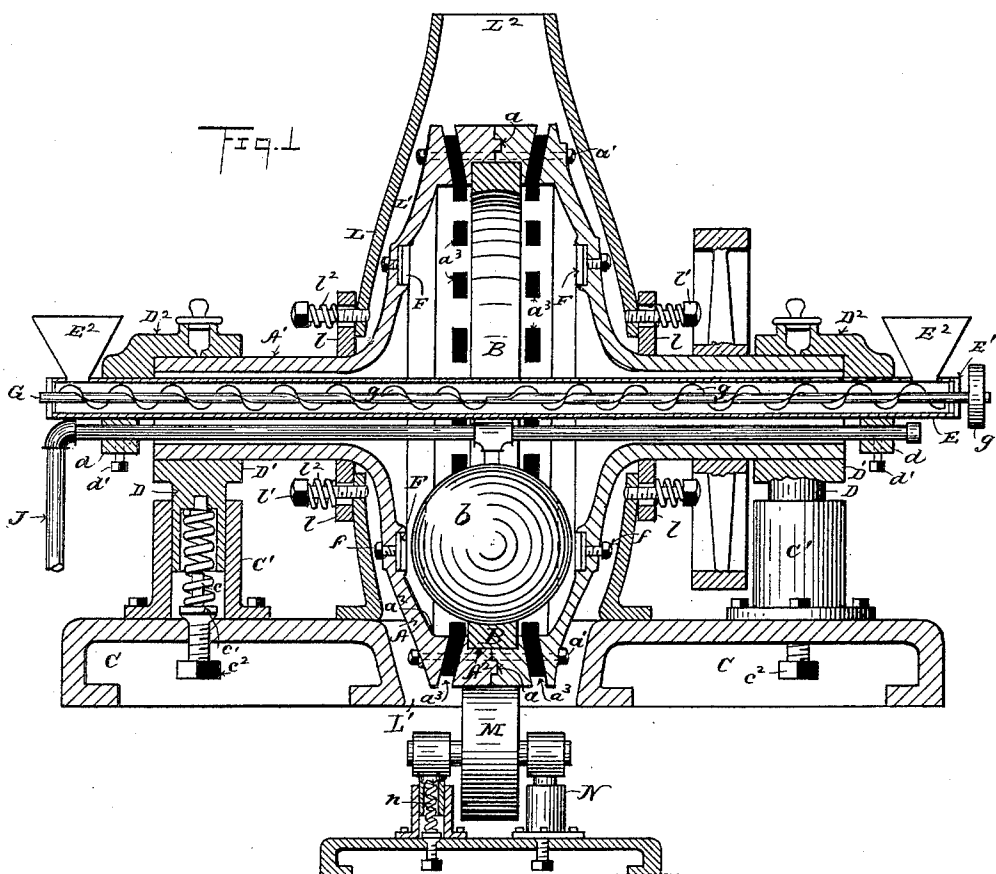
(No Model.)

2 Sheets—Sheet 1.

F. D. CUMMER.
PULVERIZING MACHINE.

No. 432,984.

Patented July 29, 1890.



WITNESSES
Belleville S. Loring
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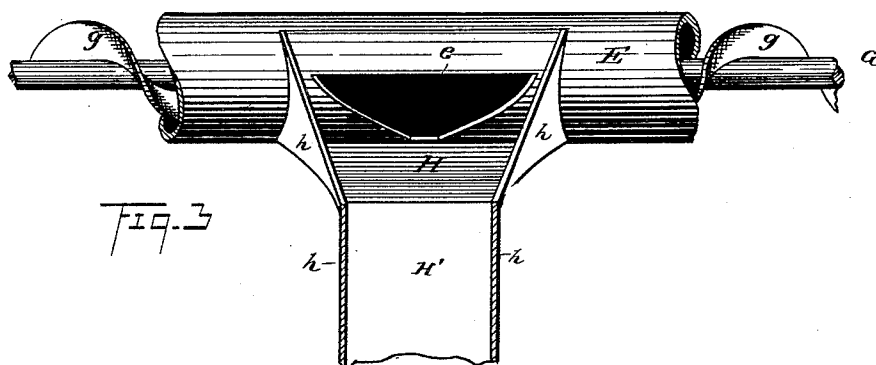
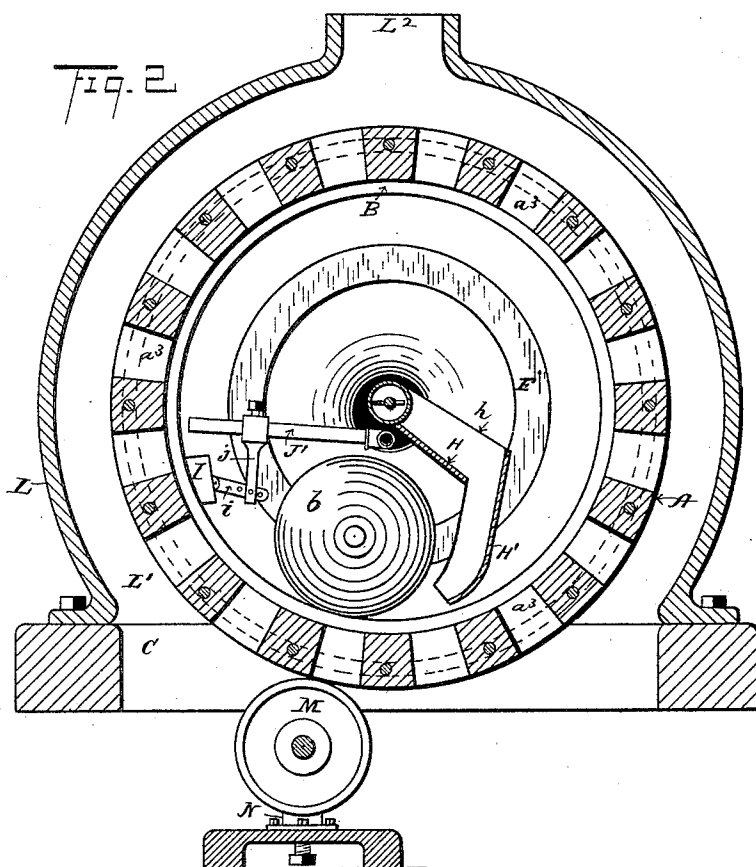
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WITNESSES

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UNITED STATES PATENT OFFICE.

FRANKLIN D. CUMMER, OF CLEVELAND, OHIO.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 432,984, dated July 29, 1890.

Application filed November 26, 1889. Serial No. 331,619. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN D. CUMMER, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Pulverizing-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 pertains to make and use the same.

My invention relates to improvements in pulverizing-machines, such machine comprising in the main a rotating casing inclosing a circular track, on which track operates a gravity-ball, suitable means being had for feeding the material onto the track in front of the ball and for removing the material from the track after the passage of the ball.

My invention also relates to the details of construction hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section through the center of the machine. Fig. 2 is a section. Fig. 3 is an enlarged side elevation in detail of the central portion of the feed-pipe or conveyer-tube. Fig. 4 is an enlarged end elevation of one of the journal-boxes. Fig. 5 is a plan in detail of the scraper.

A A represent large dish-shaped metal flanges bolted together near the periphery thereof, with their concaved sides facing each other, each flange having a hollow trunnion A' and having internal annular shoulder A². The engaging-faces of these flanges are turned off accurately in a lathe and having annular tongue and groove, as shown at *a*, for mutual engagement, by reason of which tongue and groove the securing-bolts *a'* may be rough, and the holes for these bolts may be cored, as these bolts have not to sustain any shearing strain.

B is a metal track-ring having a concaved internal face adapted to fit gravity-ball *b*. The shoulders A² are faced off to correspond with the exact external diameter of ring B; also, faces *a*² of the flanges inside the shoulders are faced off, so as to bear evenly against the edges of the ring. Each flange A has a series of discharging-openings *a*³, cored therein, the two series of openings extending from

the inside to the outside of the casing past the two edges of ring B and terminating at or near the periphery of the casing.

F F are guide-bands located inside the casing and opposite to the axis of ball *b* and in close proximity to the latter to prevent the possibility of any material lateral displacement of the ball. These bands are preferably detachable, and are movable in the direction toward and from the ball, the bands being secured to the casing by means of suitable bolts or studs—for instance, as at *f*. By shimming or blocking the bands away from the casing the bands are adjusted to give slight clearance to the ball, and such adjustment of the bands may be had from time to time as the ball and band become worn away by use.

The pillow-blocks, in which trunnions A' A' are respectively journaled, are constructed as follows:

C is a bed-plate, on which are mounted hollow standards C'. These standards are bored to fit nicely plungers D. Each plunger terminates above in a half-box D', to which is secured in the usual manner cap D², these two members constituting a journal-bearing for a trunnion A'. Each plunger D rests on a spring *c*, the latter in turn resting on a plate *c'*, this plate fitting loosely inside the standard. An adjusting-screw *c*² engages the under side of plate *c'*, by manipulating which screw the one spring or the other may be elevated to level the axis of the machine. The springs shown are of the spiral variety; but this is not material—as, for instance, rubber springs will answer the purpose.

The gravity-ball of a large-sized machine would likely weigh from two to three tons or even more, and with the casing revolving at a high speed the ball, in mounting, crushing the material, will produce more or less jarring and hammering or pounding, all of which will cause excessive strain and vibration of the trunnions and cause the trunnions in time to crystallize and break were these trunnions held in rigid journal-boxes; but by the employment of the elastic support for the journal-boxes of the machine the parts may recoil and vibrate a trifle without doing material harm.

E is a horizontal feed-pipe or conveyer-box

extending preferably through the bore of the two trunnions, this feed-pipe being located as near the upper walls of the trunnions as is practicable. For supporting this feed-pipe I provide as follows: The outer ends of cap D² aforesaid overhang the ends of the trunnions, and to the under side of these overhanging sections are bolted caps *d*, the bore of the two caps being adapted to fit the feed-pipe and hold the latter in the position aforesaid close to the upper walls of the trunnions. The ends of pipe E are closed by means of heads E', and these heads have central holes, in which is journaled the shaft G. Upon the latter are mounted two conveyer-worms *g g*, respectively right and left handed, for conveying the material from the ends of the pipe toward the longitudinal center thereof. The pipe E is provided with hoppers E², and shaft G outside of the feed-pipe is provided with a driving-pulley *g'*. Pipe E at the longitudinal center thereof is provided with a triangular opening *e*, through which the material is discharged onto apron H. This apron is rigidly attached to and supported by feed-pipe E. The apron slopes downward toward the track, as shown, and discharges into spout H', the side pieces *h h* serving to connect the apron and spout, these side pieces converging as they extend downward, so that the lower section of the spout is something less in width than the track. The spout has a sharp incline, as shown, and near the bottom curves toward the gravity-ball, by reason of which construction the material discharged from the spout has a rapid movement in the direction that the track travels. It is desirable to distribute the material evenly over the face of the track, and to this end is provided first the triangular opening *e'* aforesaid, the extremes of this opening being located well up the side of the feed-pipe, and the lower wall of the opening extending spirally down the pipe, as shown, so that the central portion of the opening extends well under the pipe. The wings of the conveyer-worms in advancing the material along the feed-pipe will also carry up and pile the material along one side of the pipe, and hence as one of these wings sweeps past opening *e* the discharge will commence at the outer end or upper portion of the opening and continue along down the slope thereof, so that the quantity of material discharged by a passing wing is not discharged in a bunch, but is distributed for some distance along the apron.

The wings of the two worms meet at the center of opening *e*, and the wings of the two worms are arranged relatively to each other, so as to sweep alternately past the opening; hence the discharge commencing at the one end of the orifice is approximately uniform adown the incline thereof, and is followed by a like discharge commencing at the other end of the orifice, whereby a continuous and approximately uniform discharge is had of the material onto the apron. The tremulous move-

ment of the apron caused by the jar of the machine, in connection with the elastic supports of the pillow-blocks aforesaid, causes the material to dance along the broad and slightly-inclined apron, thereby contributing materially to the equal distribution of the material, and the result of these distributing agencies is a continuous and even distribution of the material over the face of the track. Coarse material—such, for instance, as ore, rock, &c.—is of course first passed through a rock-breaker or other suitable device and reduced to small size, and the weight of ball *b* is such as to crush and grind the material in once passing over it, whereby much of the material is at once pulverized. With pulverizing-machines where a ball, wheel, or roller is used for the purpose, the tendency is to pack the pulverized material into a hard mass upon the track, and this mass must be removed from the track after the one passage of such ball, wheel, or roller, otherwise such mass would so far resist the further pulverizing of the packed material that the process would be extremely slow. I therefore provide a V-shaped scraper I and a blower-pipe J to clear the track after the passage of ball *b* over the material. Pipe J, for better support, had better extend through both trunnions, and for this purpose cap *d* aforesaid have lateral holes for receiving this pipe. Pipe J at the center is provided with a T and branch pipe J', the latter discharging onto the track just behind the scraper. An arm may be connected to pipe E for attaching the scraper, or preferably, as shown, an arm *j* is clamped to pipe J', this arm being connected with link *i*, that in turn connects with the scraper. An air blast or jet of superheated steam, either of which would be effective in clearing the track, after the mass of material has been removed by the scraper, is introduced through pipes J J'. The material removed from the track is discharged by centrifugal force through the peripheral opening *a*³ aforesaid.

L is a stationary casing inclosing the revolving casing. Casing L has a large discharging-opening L' below, and in case, as is frequently desirable, a separation of the pulverized from the unpulverized material is effected by suction, case L is provided with a large opening and nozzle at L², preferably on top, such nozzle connecting with the suction-pipe. (Not shown.) Owing to the vibration of the trunnions casing L cannot fit these trunnions closely, and as it is desirable in case of suction that the air shall all pass up from below I provide packing-blocks *l*, preferably of wood, these packing-blocks fitting the trunnions nicely. These blocks are secured by bolts or studs—for instance, as shown at *l'*—to the casing, and the holes in the packing-block through which these bolts extend are considerably larger than the bolts. Slight springs *l*² are placed upon the bolts outside the packing-blocks, the tension of

these springs being sufficient to hold the packing against casing L, and at the same time to allow the packing to slide on the casing to accommodate the vibratory movement of the trunnions. This packing device is simple, inexpensive, and easily renewed, and can be kept sufficiently tight for the purpose, as a slight leakage through the packing would do no particular harm.

Many varieties of dry pulverizing-machines are objectionable on account of the dust. With my improved construction and by means of the stationary casing this difficulty is substantially overcome. The discharge below should be into a closed receptacle where, if necessary, a separation may be effected, and from whence the coarser material may be returned to the hoppers. The internal face of the track is intended to travel, say, from a half-mile to a mile per minute, and hence the material discharged through the peripheral openings a^2 will be sprayed out and dashed against the stationary casing, from which it will be readily understood that the conditions are most favorable for effecting a separation by suction.

The stationary and revolving casings had each better be provided with man-hole and plate, (not shown,) by removing which plates access can be had to the inside of the machine for adjustment, repairs, &c. In this connection I will add that by loosening caps d pipe E may be turned on its axis to adjust the position of the apron and spout H'; also, by loosening set-screws d' pipe J may be turned on its axis for adjustment.

With the machine running at high speed, if, for instance, a hammer, cold-chisel, or other object or substance not easily crushed were inadvertently fed into the machine, it would cause extra strain on trunnions A', and to prevent this I provide as follows:

M is a heavy cylindrical metal wheel, the trunnions of which are journaled in pillow-blocks N, the latter being constructed, like the bearings D, with springs n , constituting an elastic support for wheel M. The periphery of wheel M is adapted to engage and travel on the face of the revolving casing, wheel M being located approximately opposite the ball, as shown. In case of a sudden separation of the gravity-ball from the track, other conditions being equal, the recoil of the ball and the recoil of the casing, including the track, would respectively be inversely in proportion to their respective weights.

With the revolving casing supported, as shown, as against downward recoil by the inertia of wheel M, if the latter were of the same weight as the gravity-ball, trunnions A', in case the gravity-ball were suddenly lifted from the track by a hard substance passing between the ball and track, these trunnions would sustain only their normal working strain or approximately such.

Some modifications may be had without departing from the purpose and spirit of my in-

vention. For instance, what is shown as gravity-ball b might probably be made to operate successfully were it of other form than spherical—for instance, if it were sliced off, as shown in dotted lines, Fig. 1, using only the central zone thereof—and it is probable that a cylindrical wheel and corresponding track could be made to answer the purpose; but I greatly prefer the construction shown, the gravity-ball being approximately spherical.

What I claim is—

1. In a pulverizing-mill, the combination, with a rotating casing mounted in yielding bearings and provided interiorly with a circular track, of a gravity-ball operating on said circular track.

2. In a pulverizing-mill, the combination, with a rotating casing having hollow trunnions and provided interiorly with a circular track, and vertically-yielding bearings supporting said trunnions, of a gravity-ball operating on said track.

3. In a pulverizing-mill, the combination, with a rotating casing having peripheral discharge-openings and provided with hollow trunnions, a circular track located within said casing, and yielding bearings supporting said trunnions, of a gravity-ball operating on said track, substantially as set forth.

4. In a pulverizing-machine, the combination, with yielding bearings, of a rotating casing having hollow trunnions, the latter being mounted in said yielding bearings, a gravity-ball within the casing, and a feed-tube extending through the trunnions and through the casing and having a centrally-located opening for discharging the material in front of the gravity-ball, substantially as set forth.

5. In a pulverizing-machine, the combination, with a rotating casing yieldingly supported in position and having a series of discharging-openings adapted to discharge by centrifugal force, and a gravity-ball operating inside of such casing, of a stationary casing inclosing such rotating and yieldingly-supported casing, such stationary casing having one or more discharge-openings, substantially as set forth.

6. In a pulverizing-machine, the combination, with a rotating casing having an approximately horizontal axis, and a gravity-ball operating inside such casing, of journal-boxes for supporting such casing, such journal-boxes having elastic support, substantially as set forth.

7. In a pulverizing-machine, the combination, with a rotating casing having hollow axial trunnions, and a gravity-ball operating inside such casing, of yielding journal-bearings for supporting such trunnions, substantially as set forth.

8. In a pulverizing-machine, the combination, with a rotating casing having hollow axial trunnions, and a gravity-ball operating inside such casing, of a feed-tube extending through the bore of the hollow trunnions and

discharging inside the rotating casing upon distributing-apron adapted to receive the discharge of such feed-tube, such apron being connected with a spout adapted to convey the material onto the track in front of the gravity-ball, substantially as set forth.

9. In a pulverizing-machine, the combination, with a rotating casing having hollow axial trunnions and mounted in yielding bearings, and a gravity-ball operating inside such casing, of a feed-tube extending through the bore of the hollow trunnions and discharging inside the casing upon distributing-apron, such apron being connected with and supported by such feed-tube, substantially as set forth.

10. In a pulverizing-machine, the combination, with yielding bearings, a rotating casing having hollow axial trunnions, the latter being mounted in said bearings, and a gravity-ball within said casing, of a blow-pipe extending through the bore of said trunnions and discharging onto the track, substantially as set forth.

11. In a pulverizing-machine, the combination, with a rotating casing having hollow trunnions, and a gravity-ball, substantially as indicated, of a blow-pipe extending through such hollow trunnions and discharging upon the track of the gravity-ball, a scraper adapted to engage the track, such scraper being held

in place by attachment connected with the said blow-pipe, substantially as set forth.

12. The combination, with a base, yielding bearings, and a casing rigidly secured to the base, of a rotating casing located within the rigid casing and mounted in the yielding bearings, substantially as set forth.

13. The combination, with a base, yielding bearings, and a rigid casing having side openings therein, of a rotating casing located within the rigid casing and provided with hollow trunnions, which latter pass through the side openings in the rigid casing and plates loosely secured to the rigid casing and embracing the trunnions of the rotating casing, substantially as set forth.

14. In a pulverizing-machine, the combination, with a rotating casing having yielding journal-bearings, and a gravity-ball operating inside such casing, of re-enforcing wheel adapted to engage the periphery of such rotating casing approximately opposite the gravity-ball, such wheel having yielding journal-bearings, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 23d day of September, 1889.

FRANKLIN D. CUMMER.

Witnesses:

CHAS. H. DORER,
GEO. W. KING.