

July 30, 1940.

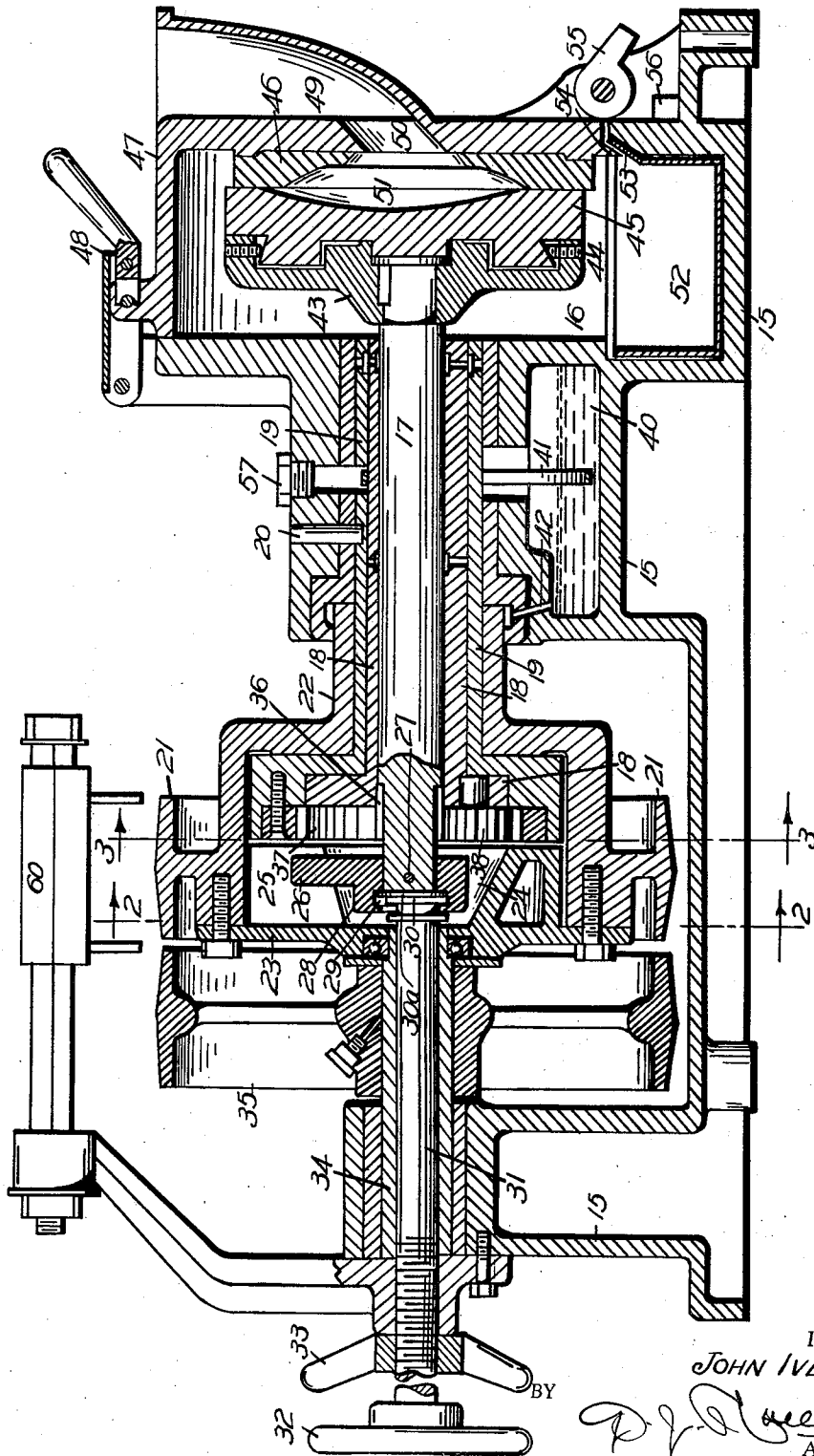
J. IVES

2,209,696

PULVERIZER

Filed April 25, 1938

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

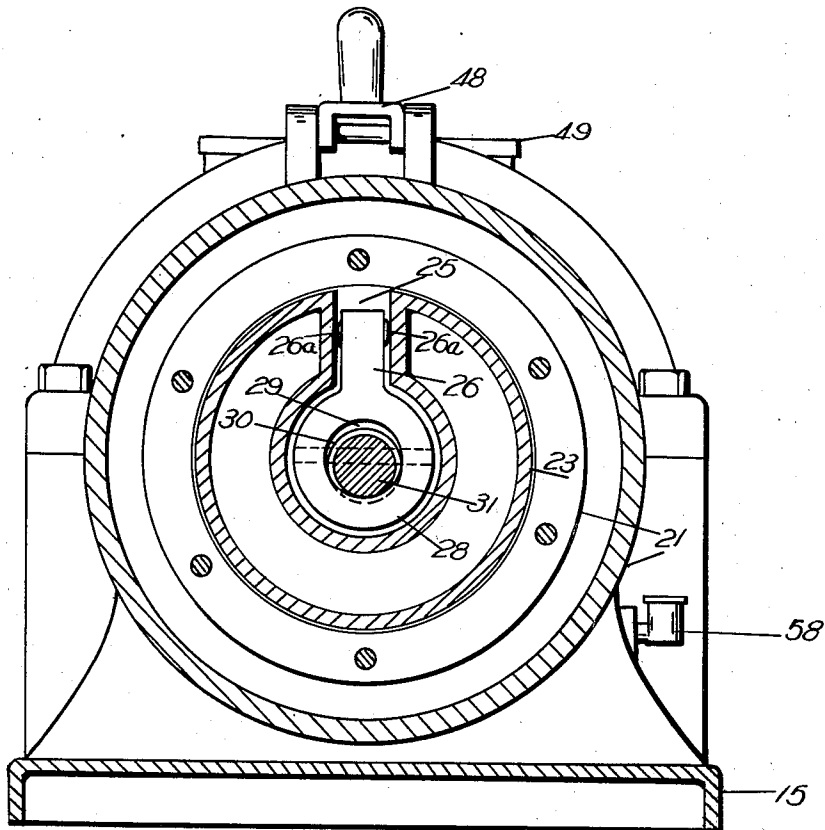


Fig. 2.

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4 Sheets-Sheet 3

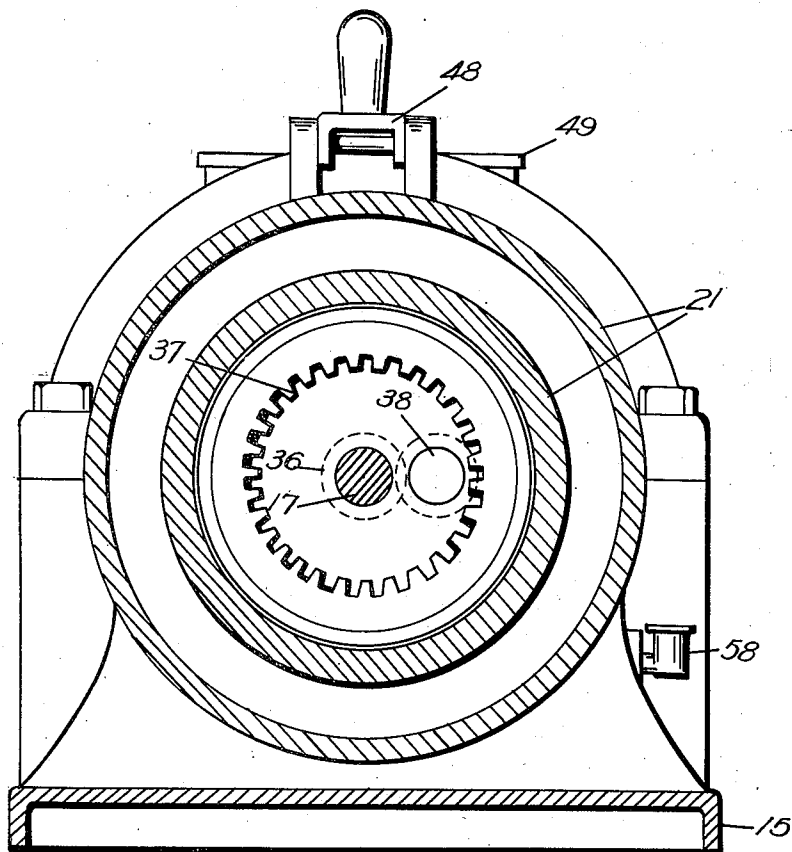


Fig. 3.

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4 Sheets-Sheet 4

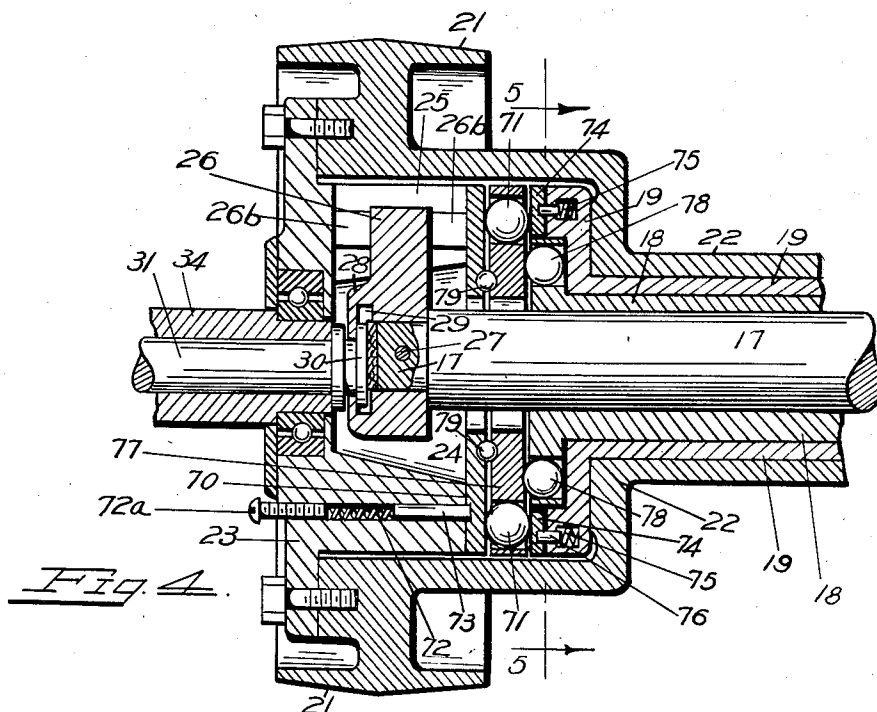


Fig. 4.

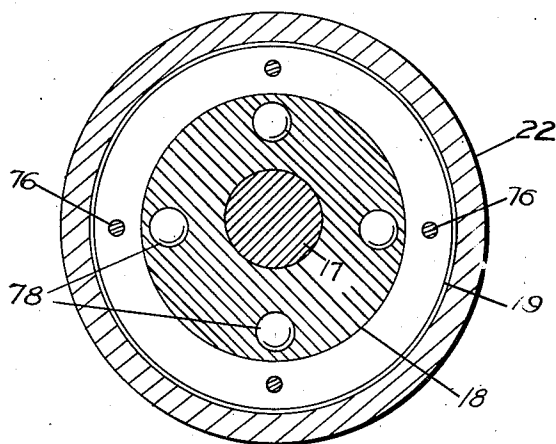


Fig. 5.

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UNITED STATES PATENT OFFICE

2,209,696

PULVERIZER

John Ives, Denver, Colo., assignor to The Denver Fire Clay Company, Denver, Colo., a corporation of Delaware

Application April 25, 1938, Serial No. 204,085

6 Claims. (Cl. 83—8)

This invention relates to improvements in pulverizers, more particularly of the type intended for preparation of ores, minerals and the like for assaying and chemical analysis.

It is a principal object of the present invention to provide a compact and simplified pulverizer having a gyratory grinding element cooperative with a stationary grinding member.

Another object is the provision of a pulverizer having a tightly closed grinding chamber to assure the salvage of all material pulverized therein.

A further object is to provide a device of this character having a novel and simplified mechanism for producing an optimum movement of the grinding element.

A still further object is to provide a pulverizer having unusually efficient means for adjusting the relative positions of rotary and stationary grinding members.

Still another object is the provision in a device of this character, for the collection and removal of pulverized material by novel means.

Still another object is to provide a pulverizer having a hinged cover for the grinding chamber, provided with an inlet to the chamber and with an efficient locking mechanism to assure a tight seal of the chamber during operation.

Other objects and advantages reside in details of design and construction which will be more fully disclosed in the following description and in the drawings wherein:

Figure 1 is a central longitudinal section through a typical pulverizer built according to the present invention;

Figure 2 is a transverse section taken approximately along the line 2—2 of Figure 1;

Figure 3 is a transverse section of the same taken along line 3—3 of Figure 1;

Figure 4 is a longitudinal section illustrating a modified type of drive; and

Figure 5 is a transverse sectional view along line 5—5 of Figure 4.

In the drawings reference character 15 denotes a general supporting housing providing bearing supports for the moving parts of the machine and a closed grinding chamber 16 that houses the grinding elements. A shaft 17 is eccentrically journaled in a rotary sleeve 18 which in turn is suitably journaled in a stationary sleeve 19 that is supported in the housing. A pin 20 holds the sleeve 19 stationary. A driving element, which in the instant case is in the form of a pulley 21, is provided with an extended hub 22 that is journaled on the stationary sleeve 19. On the side of the pulley opposite the hub is attached a

cover element 23 that is provided with a hollow center 24 and a radial slot 25 that provides a driving surface for an arm 26 that is provided with non-metallic driving contacts 26a and that is securely fastened to the shaft 17 as by a pin 27. The arm 26 is carried on a hub 28 that projects beyond the end of the shaft 17 and is recessed and under-cut as at 29 to provide a swivel connection for a flange 30 on a non- gyratory screw 31. A thrust element such as a fiber disk 30a is positioned in the recess between the end of the shaft 17 and the end of the screw 31.

The end of the screw 31 that is opposite the flange is provided with a hand wheel 32 and a lock nut 33, and around the screw is a sleeve 34 that provides a journal bearing for a loose or idler pulley 35 and a second bearing for the rotary driving element 21.

On the shaft 17 are cut or splined elongated gear teeth 36 to form a so-called "sun" pinion. Positioned around these teeth is a stationary internal gear 37, and a planet pinion 38 that is journaled on the eccentric sleeve 18 meshes with the "sun" pinion and the internal gear to transmit rotary movement from the shaft to the sleeve so that the sleeve will rotate at a reduced speed and impart a gyratory movement to the shaft 17 which is being directly driven at a relatively higher speed about its own axis through the intermediary of the pulley 21 and the arm 26.

An oil reservoir 40 is provided in the housing 15 in which a suitable oil ring 41 receives a supply of oil to be raised and distributed to the shaft and eccentric sleeve, after which the oil returns to the reservoir through a suitable passage shown at 42.

At an end of the shaft 17 is keyed a disk 43 that is provided with a plurality of set screws 44 that engage and hold a rotary grinding plate 45 that cooperates with a corresponding stationary grinding element 46. A hinged cover 47 provides access to the grinding chamber 16 and is securely locked in place during operation by a hand-operated toggle mechanism 48. A feed chute 49 is provided on the cover, which connects with an opening 50 therethrough which leads into a grinding space 51 between the said grinding media. Positioned at the bottom of the chamber 16 is a removable slide or drawer 52 which extends beyond the walls of the grinding chamber 16 and which has an outwardly flanged lip 53 that is adapted to fit closely under the lower edge 54 of the cover 47. A stop element 55 is located on the hinged cover 47 and is positioned to butt against a boss 56 on the main frame 15 to limit

the degree of opening of the hinged cover. A threaded inspection plug 57 is provided immediately above the oil ring 41 for inspection purposes.

In Figures 4 and 5 a ball-drive mechanism is shown as a modified means for transmitting reduced rotary movement to the eccentric sleeve 18. In these figures, reference character 70 denotes a spring-pressed plate or ball-race element that is urged toward a ring of balls 71 by a plurality of springs 72 through the intermediary of sliding pins 73, in cover element 23 of the rotary drive-element 21 and by which it is also driven in unison with said drive-element. Compression of springs 72 is variable by screws 72a. Another opposed race-element 74 is positioned on the stationary sleeve 19 and is spring pressed toward the balls 71 by springs 75 and pins 76. A rotary cage-element 77 is provided for balls 71 and, obviously as the balls are rolled between their races 70 and 74 the cage-element 77 will be rotated at half the speed of the drive element 21.

Another ring of balls 78 is similarly rolled by the cage element 77 to transmit rotary movement at half the number of revolutions per minute thereof, to the eccentric sleeve 18 on which balls 78 are caged. The final rotary movement of the sleeve, in this example, will therefore be one-fourth the speed of the drive element 21. A ring of ball-bearings 79 provides an additional thrust bearing between the race 70 and the rotary cage-element 77, both of which are centrally apertured to clear the oscillatory movements of the shaft 17 and permitting free longitudinal movement of the shaft. In this form of drive, a non-metallic drive-element 26b is positioned in a wall of the slot 25 to transmit driving force from the rotary drive element 21 to shaft-driving arm 26 in a sliding engagement therewith permitting both radial and longitudinal relative movement of the shaft 17, while maintaining driving contact.

Operation

In use ore, mineral or the like of suitable size is fed through the chute 49 and the opening 50 into the grinding space 51 to be acted upon by the rotating and gyrating movements of the grinding member 45 cooperating with the stationary grinding element 46. As the material is reduced in size it is discharged peripherally between the grinding media to fall into the slide or drawer 52 without loss. The toggle mechanism 48 provides a secure lock for the cover 47 to insure against loss of any of the material, which is of great importance in assaying or chemical analysis of a given quantity of material. The space between the moving and the stationary grinding elements is under manual control by means of the thrust screw 31, and the optimum gyrating motion of the rotary grinding element 45 provides a superior grind and prevents the working surfaces of the grinding media from becoming grooved, which would seriously interfere with the efficiency of the pulverizer.

Obviously the rotary driving element, which is shown in the present case as the pulley 21, may be any type of rotary element such as a grooved pulley for a V-belt, and the element 21 may be driven from any suitable motive force. In a machine built according to the present example, a flat belt may be used to drive the pulley 21 when the machine is in operation and it may be shifted to the loose pulley 35 by means of the belt shifter 60 when the pulverizer is not in use, in the well-known manner.

The pulley or rotary element 21 transmits driving torque directly to the shaft 17 so that the shaft rotates in unison with and at the same speed of the pulley 21, while the eccentric sleeve rotates at a reduced speed by virtue of the planetary gearing or ball-drive above described. Since the teeth 36 on the shaft have a longer face than the planetary pinion 38, the shaft 17 may be moved longitudinally to adjust the grinding media without disturbing the mesh of the gears. While the swivel connection between the thrust screw 31 and the shaft 17 is accomplished through the intermediary of the hub 28, obviously any swivel connection between the shaft and the screw would serve the purpose. Since the thrust screw 31 does not gyrate and is located approximately along the center of gyration, the swivel connection between its flange 30 and the undercut opening 29 on the gyrating shaft 17 is constantly maintained so that shaft 17 may be moved longitudinally in either direction through the intermediary of the hand wheel 32 on the screw. When the proper adjustment has been attained the wing lock nut 33 may be used to maintain the adjustment against accidental movement.

After the material has been ground or pulverized the drawer 52 may be withdrawn for the recovery of the pulverized material. As above pointed out, the toggle mechanism 48 insures a leakproof closure of the hinged cover 47, and the shape and position of the slide or drawer 52, extending beyond the walls of the grinding chamber 16, assures the operator that all material that is ground will fall into the drawer and be available without loss for the next step in the analytical operation. The oil supply for the reservoir 40 may be introduced through an oil cup 58 that is connected therewith.

What I claim and desire to secure by Letters Patent is:

1. A pulverizer of the character described comprising a supporting housing, a rotary sleeve journaled thereon, a shaft eccentrically journaled in the sleeve, a rotary driving element having a hollow extended hub, a shaft-driving arm in internal contact with the element, said element and contact permitting relative radial movement of the arm within the driving element, planetary reduction gearing comprising a stationary internal gear in said driving element, a sun pinion on the shaft and a planet pinion journaled on the sleeve and in mesh with the internal gear and in mesh with the sun pinion, for transmitting rotary movement from the shaft to the sleeve a rotary grinding element on said shaft, and a stationary grinding member cooperative with the rotary grinding element.

2. In a pulverizer of the character described, a rotary driving element having a central opening and a radial opening connected therewith, a shaft having gear teeth thereon and extending into the said central opening, a shaft-driving arm on the shaft in the central opening and extending into the radial opening, an eccentric rotary sleeve-bearing for the shaft, a stationary internal gear around the shaft, and a planetary pinion journaled on said sleeve-bearing and meshing with said shaft gear teeth and meshing with the internal gear providing a gyratory drive for the shaft.

3. In a pulverizer of the character described, a shaft mounted for gyratory and longitudinal movement, a rotary driving element, a shaft-driving arm in driven contact with the element and having a hub provided with an undercut re-

cess extending beyond an end of said shaft, and a non- gyratory thrust screw having a flange in swivel engagement with said recess.

4. In a pulverizer of the character described, 5
a driving pulley having an extended hub, a removable bearing for the other side of the pulley providing a driving surface, a shaft journaled for gyratory movement, and an arm on the shaft in sliding driven contact with said surface.
- 10 5. A pulverizer of the character described comprising a supporting housing, a rotary sleeve journaled thereon, a shaft eccentrically journaled in the sleeve, a rotary driving element, a shaft-driving arm in sliding contact with the element, 15
sleeve-driving mechanism comprising a spring-pressed ball-race rotated by the driving element, a ring of rotary balls contacting the race, a rotary cage-element for the balls, a second ring of rotary balls positioned to be rolled by said 20
cage-element, and a cage for said second ring of balls on the sleeve, for transmitting reduced rotary movement to the sleeve, a gyratory grind-

ing element on the shaft, and a stationary grinding member cooperative therewith.

6. A pulverizer of the character described comprising a supporting housing, a rotary sleeve journaled thereon, a shaft eccentrically journaled 5
in the sleeve, a rotary driving element, a shaft-driving arm in sliding contact with the element, sleeve-driving mechanism inclusive of a ring of rotary balls and a cage therefor on the sleeve, an intermediate ring of balls and a rotary cage 10
therefor positioned between the driving element and the first said ring of balls, the intermediate ring of balls being in rolling contact with said driving element, to transmit reduced rotary movement from the driving element to the ring of 15
balls on the sleeve, said balls on the sleeve being positioned to be rolled by the said intermediate rotary cage, a gyratory grinding element on the shaft, and a stationary grinding member cooperative therewith. 20

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