No. 652,329. Patented June 26, 1900.

G. RAYMOND.

PULVERIZING MACHINE.

(Application filed June 5, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

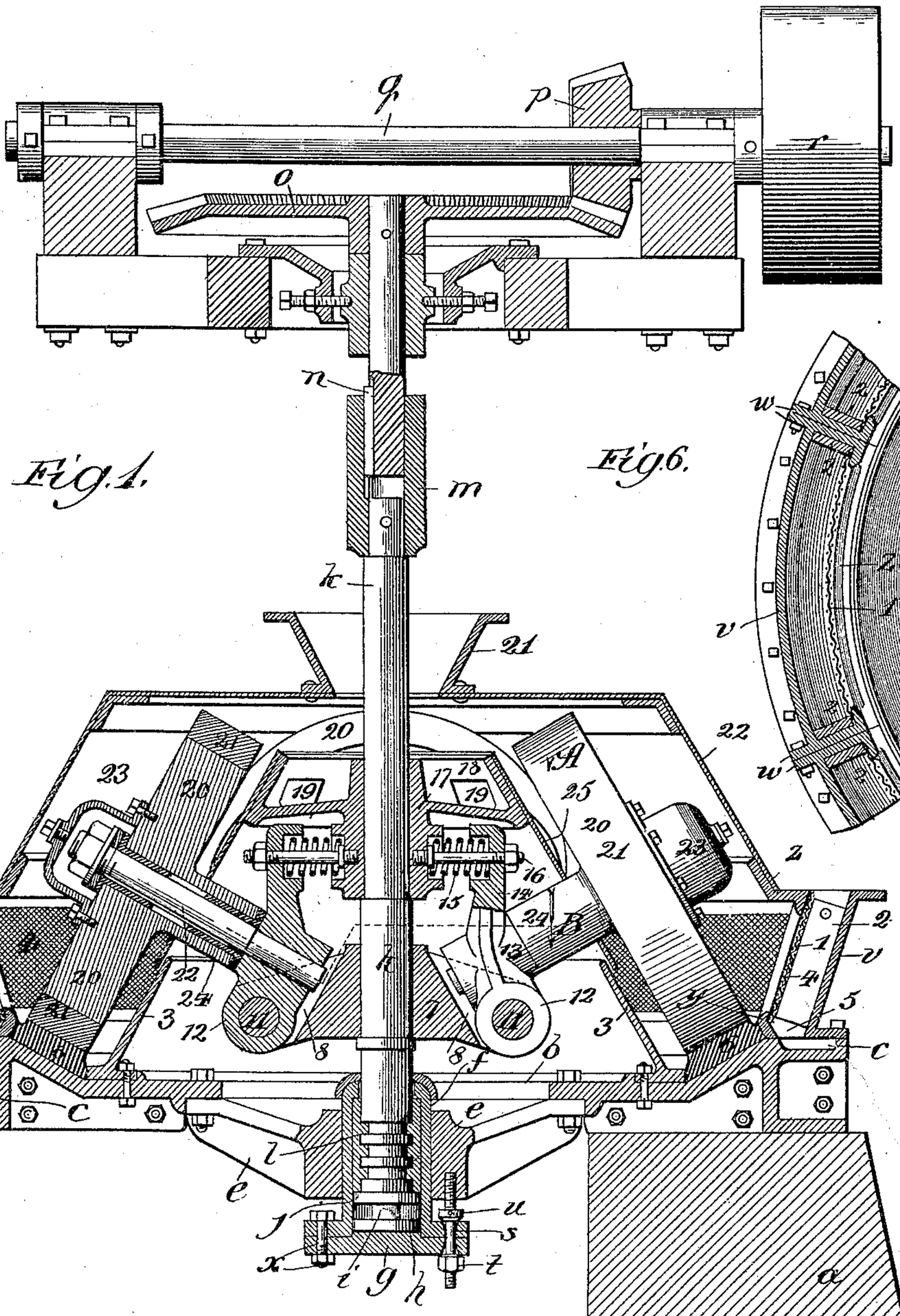

Fig. 6.

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Fig. 2.

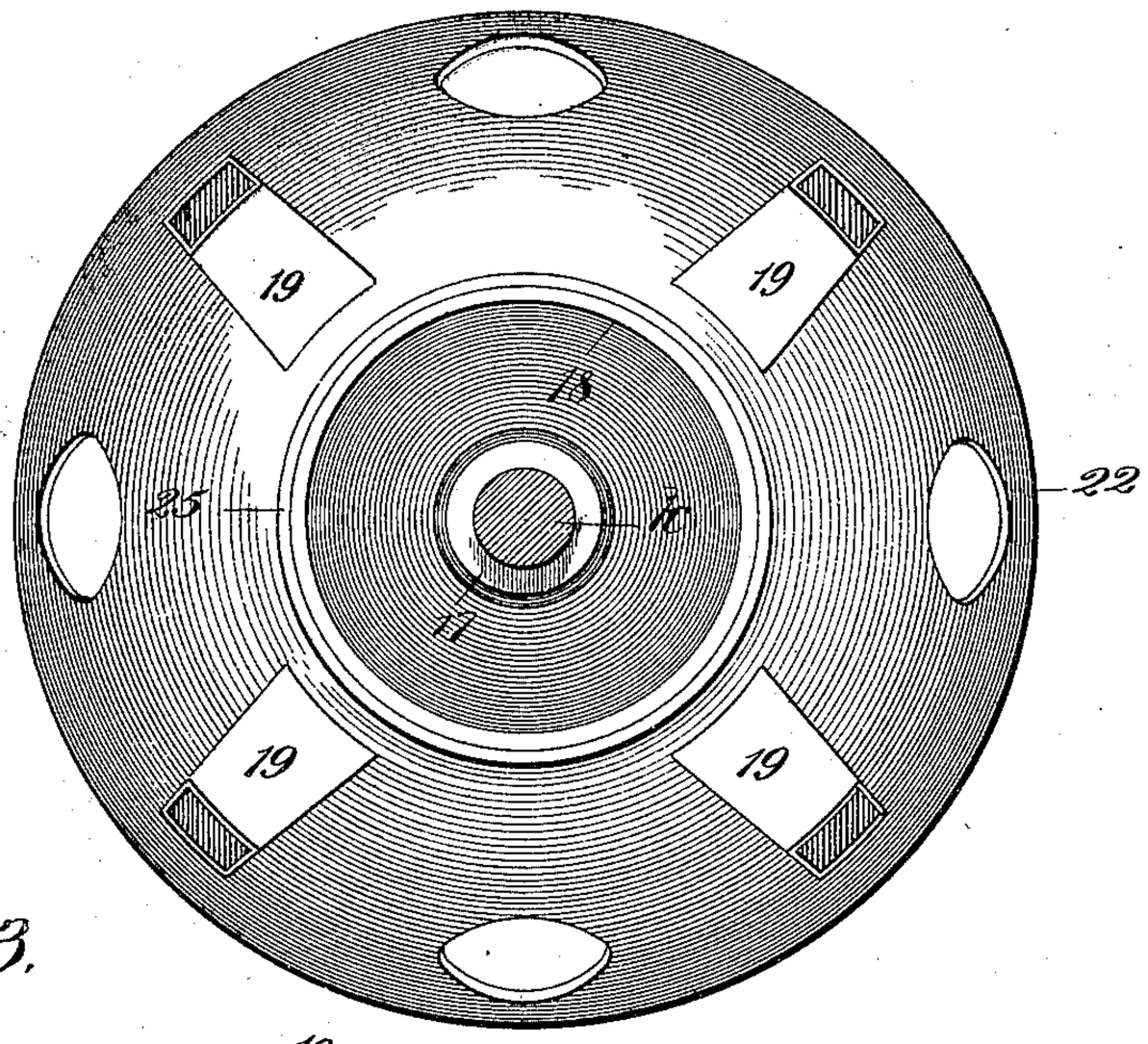


Fig. 3.

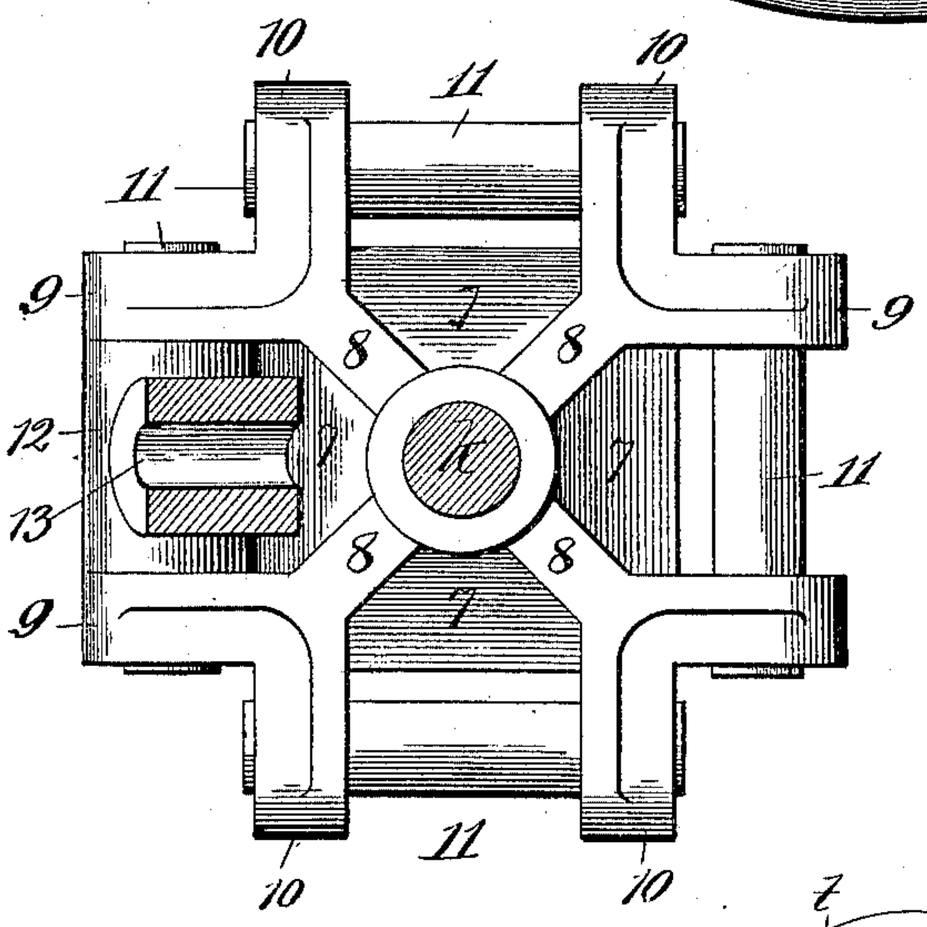


Fig. 4.

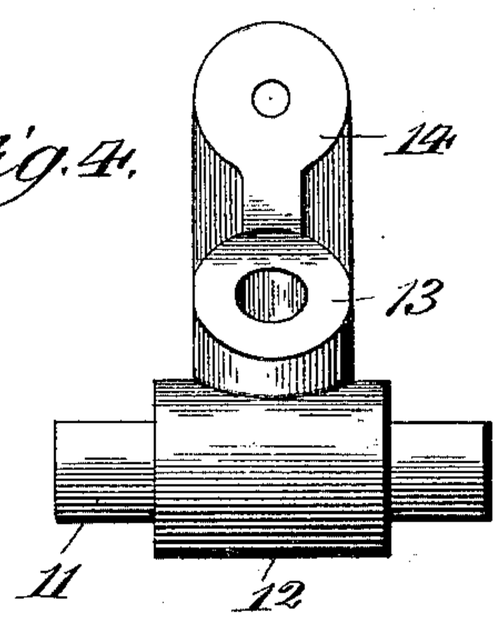
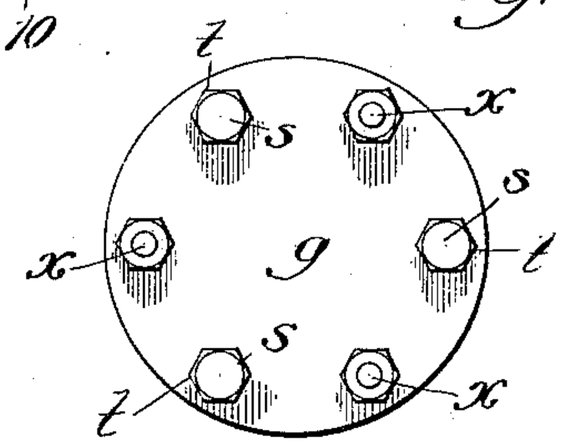


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE RAYMOND, OF CHICAGO, ILLINOIS.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 652,329, dated June 26, 1900.

Application filed June 5, 1899. Serial No. 719,452. (No model.)

To all whom it may concern:

Be it known that I, GEORGE RAYMOND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Pulverizing-Machines, of which the following is a specification.

My invention relates to an improvement in the class of pulverizing-machines in which the rotation about an axis of pivotal grinding-rolls actuates them centrifugally to exert the grinding-pressure against the grinding-die.

Referring to the accompanying drawings, Figure 1 is a broken view, in vertical section, of my improved machine; Fig. 2, a section taken at the line A on Fig. 1 viewed in the direction of the arrow and enlarged; Fig. 3, a section taken at the irregular line B on Fig. 1 viewed in the direction of the arrow and enlarged; Fig. 4, a view in front elevation of one of the pivotal supports detached for a grinding-roll; Fig. 5, a bottom plan view of the disk head on which the vertical rotary drive-shaft bears at its lower end, and Fig. 6 a section taken at the line C on Fig. 1 and viewed in the direction of the arrow.

The foundation for the machine (shown at *a*) may be substantially built of masonry or other suitable material, preferably in annular form, and an opening (not shown) should be provided through the wall of the foundation to permit access to its interior for adjusting parts of the machine, as hereinafter described. On the foundation is supported the annular metal bed *b*, flat or horizontal throughout a portion of the width of the ring and thence inclining at a suitable angle upward to its outer edge, about which is formed an annular discharge-channel *c*, inclining downward from one side of the machine to the opposite side thereof, where it terminates in a spout *d*. To the bottom of the bed *b*, near its inner edge, is bolted a spider-bearing *e*, in which is contained a covered journal-box *f*, shown of cylindrical form, flanged about its lower end and having fastened to its flange by bolts *x x*, of which three are shown in Fig. 5, a base-plate *g*, carrying on its upper side within the bottom portion of the box *f*, which is preferably formed of phosphor-bronze, a metal plate *h*, from which rises a stud *i* to support the removable steel step *j*. In the box *f* is rotatably confined against more than slight vertical movement the lower end of the vertical roll-actuating shaft *k* by means of the annular recesses shown in Fig. 1 as formed at intervals in its lower portion to let into it a filling *l*, such as Babbitt metal, about it in the box. This shaft is shown divided, with its upper section connected to the lower by means of a sleeve *m*, fastened to the latter and connected with the upper section of the shaft by a key *n* to cause the two sections to rotate together, but permit the lower section to be raised and lowered for adjustment without disturbing the upper section and the driving-gear connected with it, shown as a beveled gear-wheel *o*, driven by a beveled pinion *p* on the rotary drive-shaft *q*, carrying a belt-pulley *r*.

Alternating with the bolts *x*, which fasten the disk head *g* in place, are bolts *s*, screwed into the bottom of the bearing-head *e* through the base-flange of the box *f* and through the head *g*, each bolt carrying a nut *t* below the disk head and a collar *u* between said base-flange and bearing-head.

The bed *b* is preferably formed in segmental sections fastened together, as indicated in Fig. 1, and the shell *v* should be similarly formed, as represented in Fig. 6. This shell, which flares upwardly and is flanged about its upper and lower edges, is bolted down, as shown, to the flange, extending about the upper edge of the bed, and each shell-section terminates in radially-inward extending L-shaped ribs *w*, joined at their lower ends by a ring-section *y* and at their upper ends by a ring-section *z*, substantially of the shape in cross-section of an inverted L. A screen 1, also shown as formed in sections, has each section held removably in place about its edges against the outer sides of the rings *y z* and flanges of the ribs *w* by keys 2. An upwardly-tapering annular wall 3 is bolted through its flanged base to the flat section of the bed *b*, adjacent to its upwardly-inclined outer portion, and forms, with the screen 1, an upwardly-flaring chamber 4 for the material to be pulverized and which is divided by the screen from the annular dust-chamber 5,

opening at its bottom into the channel *c* and formed between the screen and outer wall of the shell *v*.

On the inclined outer section of the bed *b* is firmly held against rising between the ring *y* and outer base-flange of the wall 3 a chilled-steel track or die 6, forming a ring, which is also best made up of segmental sections, the upper surface of the die thus sloping inwardly, as shown, to an angle of, say, about thirty degrees.

The shaft *k* carries near its lower end, to rotate with it, a head 7, surrounding the shaft and shown substantially of the shape of a cone-frustum having ribs 8 radiating from it, four of these ribs being shown in Fig. 3, with their longitudinal centers ninety degrees apart, and each terminating in a pair of arms 9 10, extending at right angles to each other. Each pair of arms 9 10 have journaled in them, near their outer ends, a shaft 11 for pivotally supporting the pulverizing-rolls, as hereinafter described. On each shaft 11 is a sleeve 12, provided across its center with a spindle-bearing 13, extended from its upper side into an arm 14, recessed at its inner side to confine one end of a spiral spring 15, surrounding a bolt 16, passing through the arm. By turning a nut on the end of a bolt 16 in one or the other direction the respective grinding-roll may be raised or lowered to adjust it with relation to the die. The inner ends of the bolts 16 are screwed into the lower extension of a hub 17, surrounding the shaft *k*, to rotate with it, and carrying a circular feed-chamber 18, from equal intervals in the wall of which feed-spouts 19 incline downward to discharge into the chamber 4 ahead of the respective grinding-rolls 20, hereinafter described, the material to be pulverized. A feed-hopper 21 surrounds the shaft *k* and is supported on the sheet-metal housing 22, bearing at its lower edge on the angle-ring *z*.

The grinding-rolls 20, of which four are preferably used and which should be very massive and heavy, weighing each, say, five thousand pounds, carry chilled-steel rims 21 and are rotatably supported on spindles 22, covered at their outer ends by the lubricant-confining dust-caps 23, passing through the centers of the rolls, through hollow stems 24, projecting from the roll-centers, and into the bearings 13, wherein they are confined against axial rotation. The stems 24 and spindles within them also pass through openings in a sheet-metal hood 25, depending from about the feed-chamber 18 and lapping at its lower edge the circular wall 3.

The operation is as follows: The material to be pulverized is introduced into the hopper 21, whence it enters the supply-chamber 18, from which it drops into the pulverizing-chamber 4. The shaft *k*, under rotation by the gearing connecting it with the drive-shaft *q*, carries with it the rolls 20, which grind the material in their path against the die 6, and the pulverized material passing through the screen 1 enters the chamber 2 and channel *c*, from which it escapes at the spout *d*.

It will be seen that the weight of the rolls bears on the die 6, and that owing to the manner in which the rolls are connected with their actuating-shaft, near its lower end, whereby the spindles 22 incline downward from the centers of the rolls to the shaft, the centrifugal force tends to augment the pressure of the rolls against the die, thus materially adding to that due to the inherent weight of the rolls, and the faster the speed at which the shaft *k* is driven the greater will be the increase of pressure from centrifugal force. Moreover, the grinding pressure of the rolls is further increased by the outward pressure against the arms 14 of the springs 15, which, however, do not prevent the desired yield of the rolls on their pivots 11, and to the weight of the rolls is added that of the shaft *k* and parts connecting them with it, since the tendency of the centrifugal action of the rolls is to lift the shaft *k*, (to the extent of the slight vertical movement it has in its bearing,) and thereby throw its weight and that carried by it upon the rolls to increase their grinding pressure accordingly.

With the structure formed in sections, as suggested and preferred, as parts become impaired by wear they may be readily removed and replaced by others. Any unevenness in wear on the die 6 may be compensated for to even the track of the rolls by turning the bolts *s* to raise or lower, as required, the box *f*, with the shaft *k* and parts carried by it, the sectional construction of the shaft enabling it to be thus raised and lowered, as hereinbefore suggested, without disturbing the driving-gear.

As will be seen, each sleeve on its shaft 11, with the upwardly-projecting arm 14, forms a species of bell-crank lever for the pivotal connection of a roll with the actuating-shaft and for transmitting to the roll the stress of a spring 15 against an arm of the bell-crank. The pivotal support of each roll is low down, nearly on a plane with the die 6, which permits the length of the lever-arm 14 to the point where the spring 15 engages it to be so great as to present to the outwardly-exerted force of the spring an extent of leverage which materially increases the power of the spring against the roll to augment accordingly its stress upon the die 6.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a pulverizing-machine, the combination with a grinding-bed, of a rotary actuating-shaft, a grinding-roll supported to extend over said bed and journaled on a spindle inclining downward toward said shaft, a bearing for the inner end of said spindle pivotally connected with the shaft and having an upwardly-projecting lever-arm, a hub on the shaft, means connecting said lever-arm with said hub and operative to turn said lever-arm on its pivotal support and thereby raise

the roll bodily with relation to the grinding-bed, and a spring confined between said hub and lever-arm, substantially as described.

2. In a pulverizing-machine, the combination with the grinding-bed, of a rotary actuating-shaft, a grinding-roll supported to extend over said bed and journaled on a spindle inclining downward toward said shaft, a bearing for the inner end of said spindle pivotally connected with the shaft near the plane of the grinding-bed and having an upwardly-projecting lever-arm, a hub on the shaft, a bolt secured to said hub and engaged with said lever-arm by a nut, turning of which turns said lever-arm on its pivotal support and thereby raises the roll bodily with relation to the grinding-bed, and a spring confined between said hub and lever-arm, substantially as described.

3. In a pulverizing-machine, the combination with a grinding-bed, of a rotary actuating-shaft, a head on said shaft provided with radiating ribs, each terminating in a pair of arms, shafts supported in said arms, sleeves on said shafts carrying inwardly and downwardly inclined spindle-bearings and upwardly-projecting lever-arms, grinding-rolls supported to extend over said bed and journaled on spindles inclining downward toward the shaft and confined at their inner ends in said spindle-bearings, a hub on the shaft, bolts secured to said hub, passing through said lever-arms and secured by nuts turning of which turns said lever-arms on their pivotal supports and thereby raises the rolls bodily with relation to the grinding-bed, and springs confined between said hub and lever-arms, substantially as described.

4. In a pulverizing-machine, the combination with the annular bed, of a bearing depending from the bed below its center and carrying a flanged journal-box, a base-plate removably fastened to the flange of said box, the rotary roll-carrying actuating-shaft journaled at its lower end in said box, and bolts screwed through said flange into the head of said bearing and carrying nuts below said base-plate and collars in the space between said flange and head, substantially as described.

5. In a pulverizing-machine, the combination with the annular bed, of a bearing depending from the bed below its center and carrying a flanged journal-box, a base-plate removably fastened to the flange of said box and carrying within the box a plate and a stud rising therefrom, a steel step removably supported on said stud, the rotary pivotal-roll-carrying actuating-shaft recessed at its lower portion at which it is journaled in said box and confined therein by a filling against more than slight rise, and bolts screwed through said flange into the head of said bearing and carrying nuts below said base-plate and collars in the space between said flange and head, substantially as described.

GEORGE RAYMOND.

In presence of—
M. S. MACKENZIE,
R. T. SPENCER.