B. C. BRADLEY.

PULVERIZING MILL.

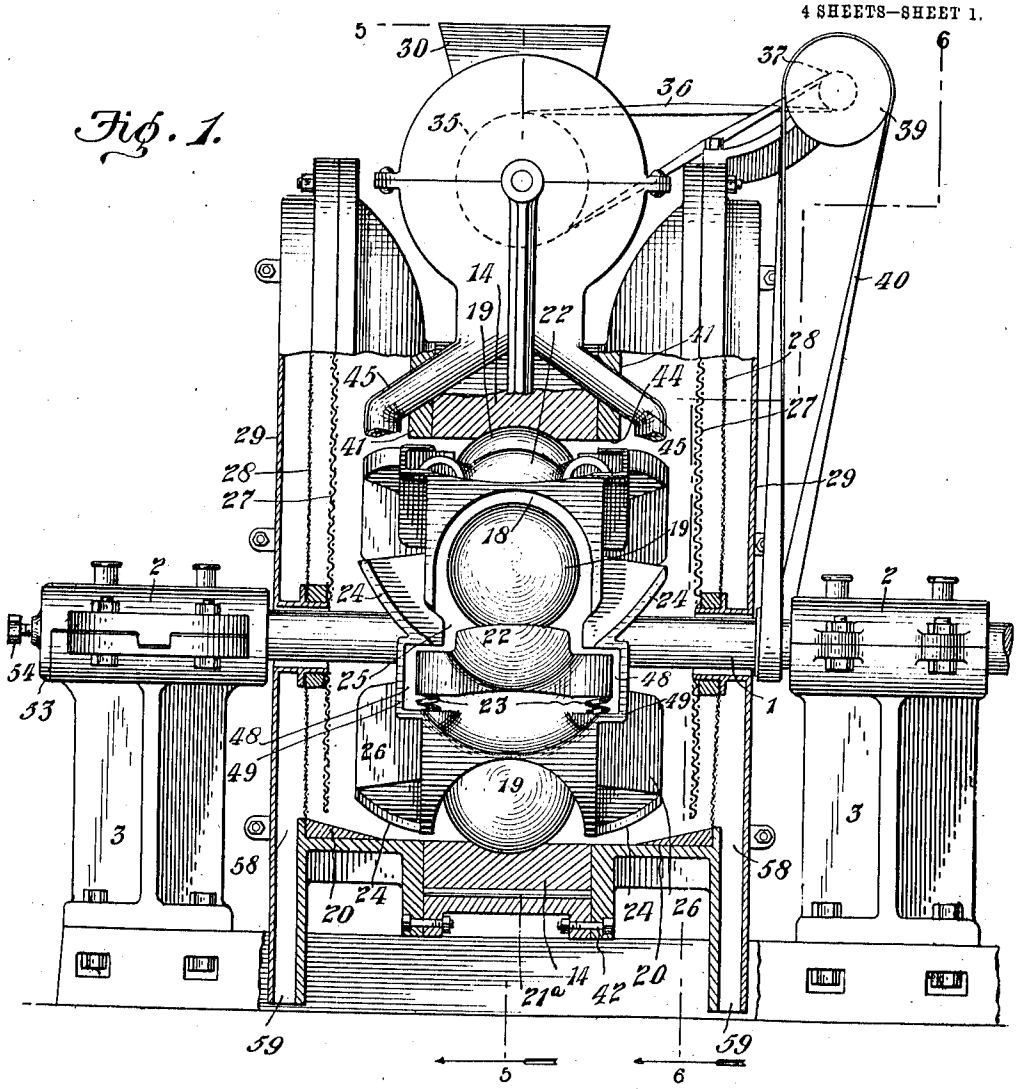
APPLICATION FILED DEC. 6, 1909.

1,020,398.

Patented Mar. 19, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



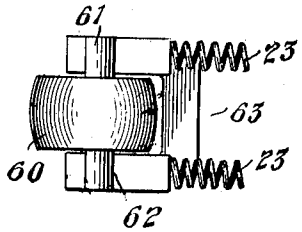


Fig. 2.

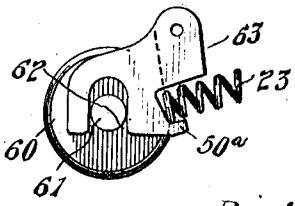


Fig. 3.

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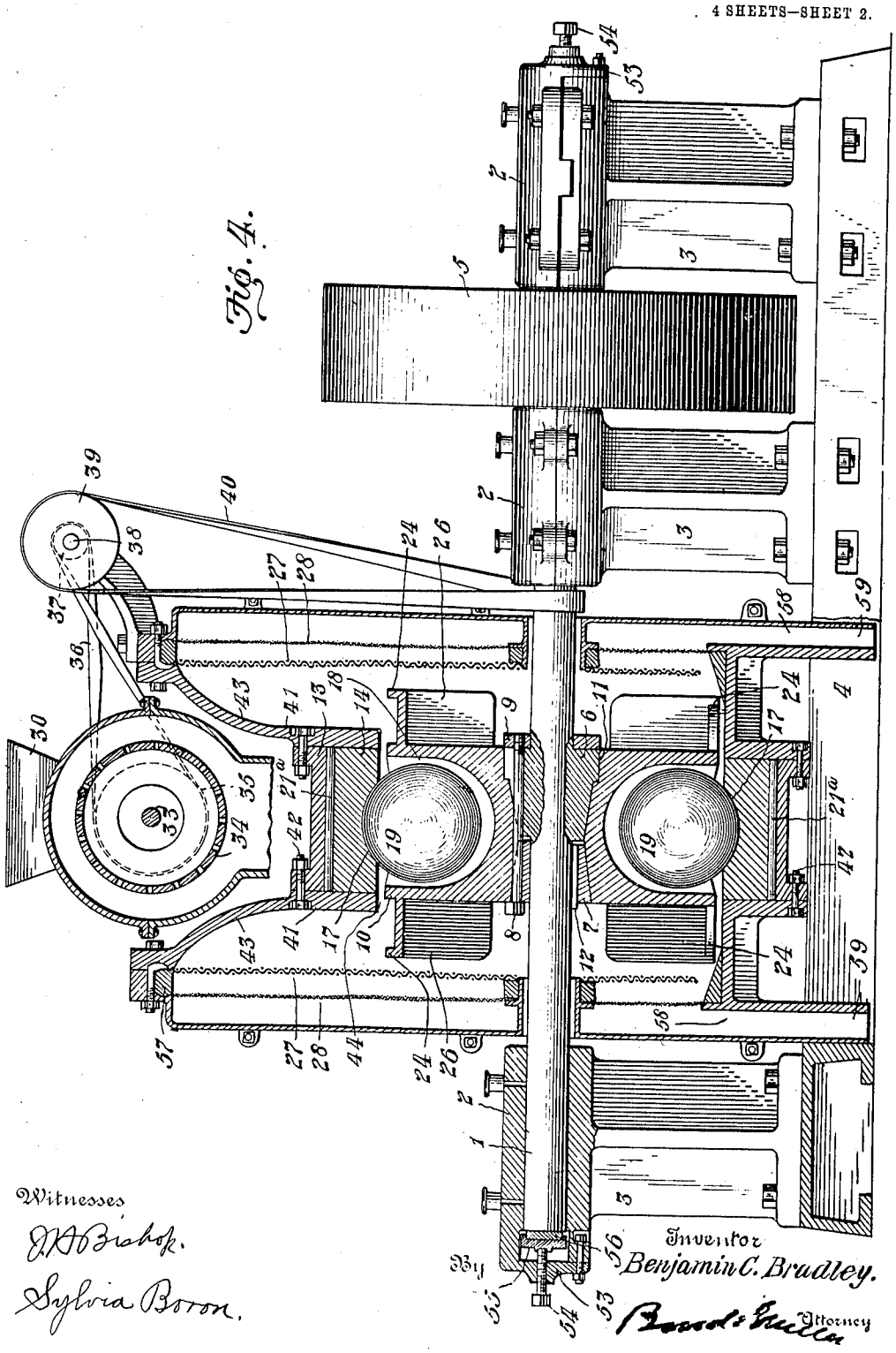
4 SHEETS—SHEET 2.

Fig. 4.



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4 SHEETS—SHEET 3.

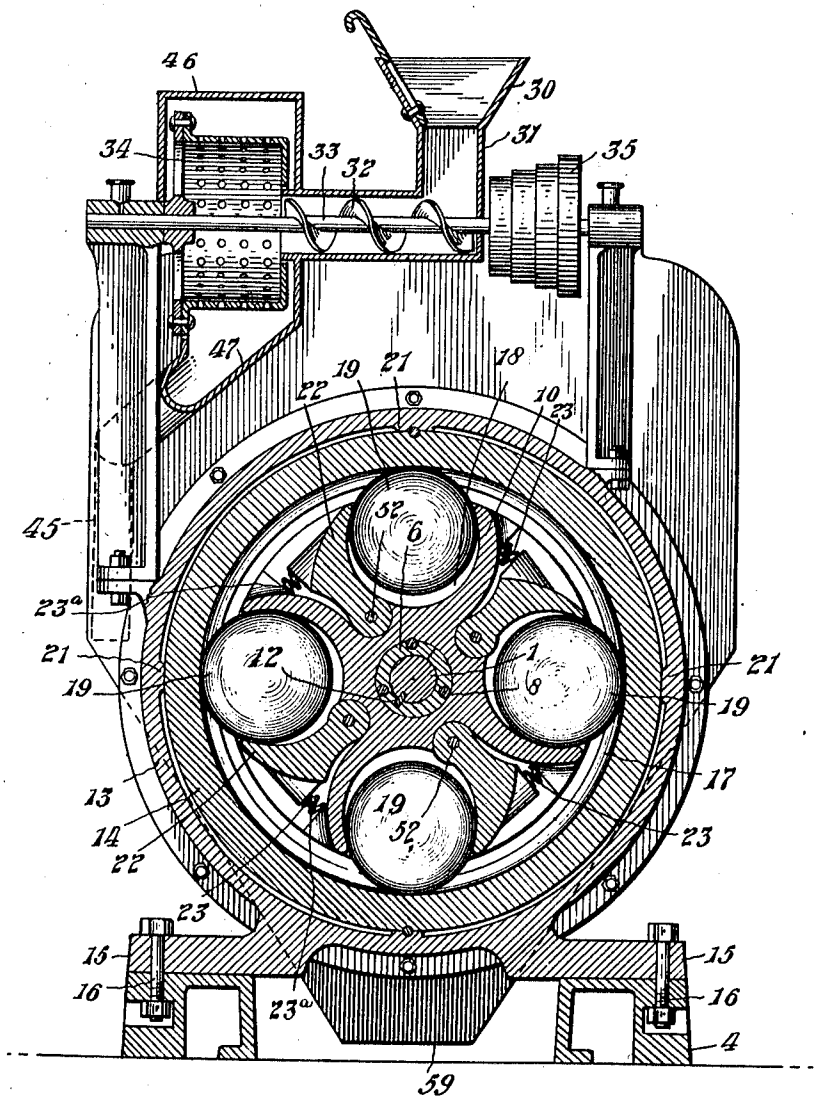

Fig. 5.

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4 SHEETS—SHEET 4.

Fig. 6.

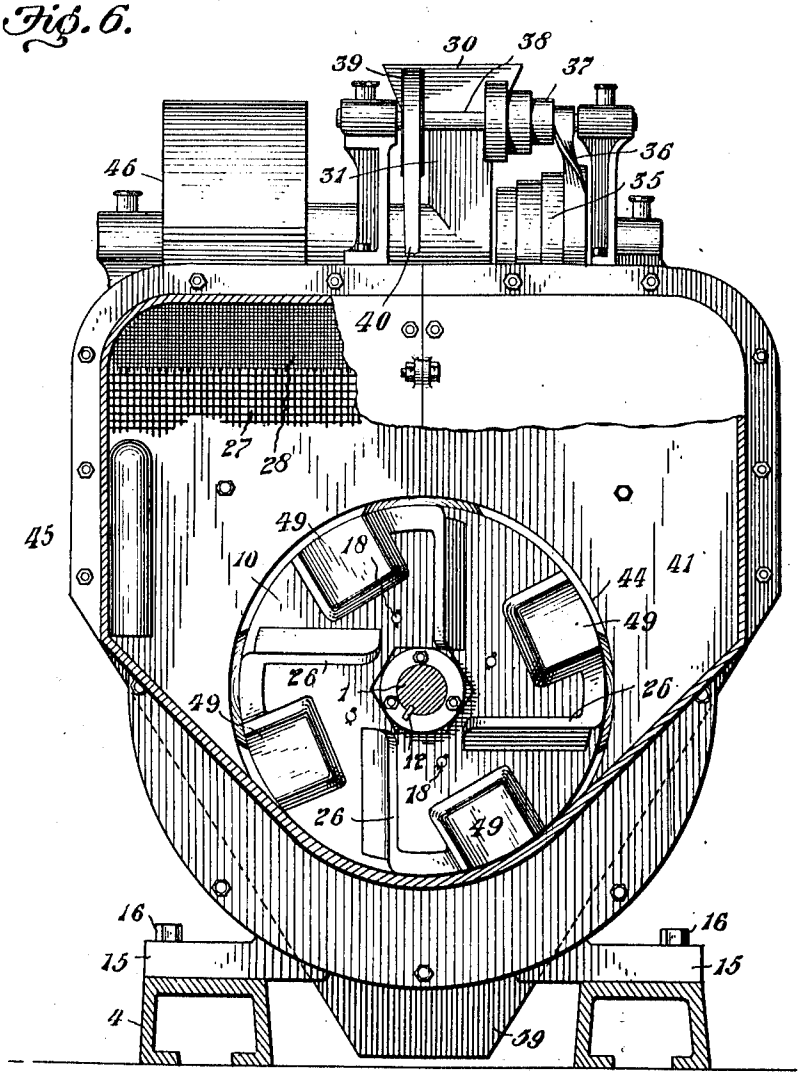
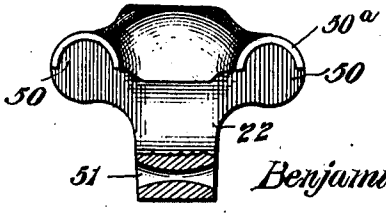


Fig. 7.



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UNITED STATES PATENT OFFICE.

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PULVERIZING-MILL.

1,020,398. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed December 6, 1909. Serial No. 531,637.

To all whom it may concern:

Be it known that I, BENJAMIN C. BRADLEY, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Pulverizing-Mills; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, and to the numerals and figures of reference marked thereon, in which—

Figure 1 is a side elevation showing parts in vertical section. Fig. 2 is a view showing a bottom plan view of a grinding roller to take the place of the grinding balls shown in Fig. 1. Fig. 3 is a side elevation of the modification. Fig. 4 is a vertical section of the mill. Fig. 5 is a vertical section taken on line 5—5, Fig. 1. Fig. 6 is a section taken on line 6—6, Fig. 1, showing a part of the upper portion of the casing broken away. Fig. 7 is a detached view of one of the grinding ball drivers or pushers.

The present invention has relation to pulverizing mills and it consists in the novel arrangement and construction hereinafter described and particularly pointed out in the claims.

Similar numerals of reference indicate corresponding parts in all the figures of the drawing.

In the accompanying drawing, 1 represents the power shaft, which power shaft is journaled in suitable bearings 2, which bearings are held in proper elevation by the standards 3, which standards are securely bolted or otherwise attached to the bed-plate or base 4. Upon the power shaft 1 is located and securely fixed the power wheel 5, which power wheel is driven from any source of power. The power shaft 1 is provided with the fixed or integral cone 6, the outer portion of said cone is formed angular as best illustrated in Fig. 6. Upon the power shaft 1 is also mounted the cone 7, which cone is connected to the fixed cone 6, by means of the clamping bolts 8 and the ring or collar 9, which collar is also mounted upon the shaft 1. It will be understood that when the clamping bolts 8 are drawn the cone 7 will be moved upon the shaft 1 toward the fixed cone 6, and when the carrier 10 is properly placed upon the cones, said carrier will be securely connected to the shaft 1 and especially so by reason of a portion of the fixed cone being formed angular and the shaft aperture 11 in the carrier 10 being also formed angular for a portion of its length. For the purpose of better connecting the carrier 10 upon the shaft 1 the cone 7 is split as illustrated in Fig. 5 so that when the cone is drawn toward the fixed cone it will clamp upon the shaft and at the same time be snugly seated in the aperture formed in the carrier. A feather key such as 12 is also employed in connecting the cone 7 to the shaft 1.

Upon the base 4 is mounted the grinding ring casing 13, which is formed cylindrical, its inner diameter being somewhat greater than the extreme diameter of the grinding ring 14, which grinding ring is located concentrically with the casing 13. For the purpose of holding the casing 13 in fixed position with reference to the base 4 its lower portion is provided with the connecting flanges 15, which provide means for securely connecting the same to the base 4 by means of suitable clamping bolts 16.

The grinding ring 14 is provided with the annular groove or ball race 17. The carrier 10 is provided with the pockets 18, which pockets are formed of sufficient size to admit the major portion of the grinding balls 19 and at the same time provide room for properly locating the pushers 22, which pushers will be more specifically described hereafter. It is well understood that in mills of this kind more or less heat is generated, and of course, the grinding ring because of the friction incident to the grinding upon its periphery is subject to greater heat than the casing 13. In order to provide for such expansion I provide inward projecting pads or lugs 21 formed integral with the casing 13 and of such a size that their inner edges or faces come in close contact with the outer periphery of the grinding ring 14, thereby, producing chambers or spaces between the inner periphery of the casing 13 and the outer periphery of the grinding ring 14. It will be understood that by dividing the space thus formed between the members 13 and 14 with said contact points of the casing that the expanding grinding ring 14 will spring the casing outward at the points of contact and the curvature of that part of the casing ring between said contact points will be lessened and sprung inward in same proportion without danger of breaking said casing ring.

To the carrier 10 are pivotally attached the pushers 22 at a point spaced from the axis of said carrier, said pivotal point being on or near the radial line to the grinding balls 19 so that the pivotal movement or oscillatory movements will be in substantial unison with the slight backward movement of the grinding balls, the location of the pushers being best illustrated in Fig. 5. The pushers 22 are held in contact with the rear surfaces of the grinding balls by means of the springs 23, which springs are located in such a manner that they will normally hold the pivoted pushers 22 against the rear surfaces of the grinding balls 19; but when the balls are moved backward or jarred the springs are free to yield, thereby allowing the pushers to turn upon their pivotal points and permit the grinding balls to move backward with the backward movement of the pushers. By this arrangement all jarring of the grinding balls is absorbed, the jarring being incident to said balls coming in contact with the larger particles of material located in the path of the balls. By thus cushioning the balls and absorbing the sudden jarring action the cause of crystallization to adjacent parts is to a great extent removed, owing to the fact that there is a yielding movement as between the grinding balls and the carrier.

Upon the carrier 10 are located a series of flanges 24, which flanges flare outward and are inclined in the direction of rotation of the carrier, said flanges are for the purpose of gathering and conveying the material to the grinding groove or ball race 17 said material passing through the openings 25, which openings are located in the sides of the carrier 10 as best illustrated in Fig. 1. It will be understood that the gathering action of the flanges 24 takes place at the time when they come into their lowermost position during the rotation of the carrier, owing to the fact that the material to be acted upon falls by gravity on to the inclined bottom 20. Upon the faces of the carrier 10 are located the blades 26, which blades are located substantially as shown in Fig. 6. The tops of the blades are inclined backward and are so inclined for the purpose of deflecting the pulverized material or moving the material away from the vertical faces of the carrier and toward the screens 27 and 28 which screens are spaced from each other, and also spaced from the carrier and from the outer casing 29 of the feed chambers. It will be understood that the carrier 10 must necessarily be rotated rapidly and by the rapid rotation of the carrier, the pulverized material is driven by the force of said rotation of the carrier toward the screens 27 and 28. The screens 27 and 28 are formed of different mesh, the inner screens being the coarser ones and the outer screens being the finer ones and of such a mesh that the material when properly pulverized will pass through said outer screens and be conveyed as hereinafter described. The material acted upon by the blades 26 not being reduced to the proper degree of fineness will be returned by gravity to the inclined bottoms 20 and re-acted upon by the scrapers and reducing elements. It will be understood that the feeding chambers should be formed of such size to provide sufficient room for the scrapers, deflecting blades and screens.

For the purpose of conveying material designed to be pulverized to the mill a hopper 30 is provided, from which hopper leads the spout 31, which spout communicates with the conveyer 32. The conveyer 32 is mounted upon the shaft 33 and is of the usual construction. To the shaft 33 is rotatably mounted the perforated drum 34, which drum is substantially of the form shown in Fig. 5 and rotates with the shaft 33. The perforations of the drum 34 are of a size to permit only the passage of material not exceeding a size proper to be fed into the mill and to keep out material of a size greater than the mill is designed to grind, also to keep out all foreign substance. It will be understood that the material designed to be pulverized should be first reduced to the proper degree of fineness.

For the purpose of regulating the amount of material designed to be fed into the mill at any given time the stepped pulley 35 is securely mounted upon the shaft 33, said stepped pulley being driven by the belt 36 leading from the stepped pulley 37, said stepped pulley being mounted upon the counter shaft 38 to which counter shaft is connected the driving pulley 39, to which driving pulley leads the belt 40 from the shaft 1 or its equivalent. It will be understood by the belt 36 upon the different steps or faces of said stepped pulleys different speeds of rotation will be imparted to the shaft 35 and also to the conveyer 32.

For the purpose of holding the grinding ring 14 in proper lateral position the plates 41 are securely attached to the casing 13 by means of the bolts 42 or their equivalents, which casing 13 is securely attached to the base 4. For the purpose of providing means for connecting the different parts pertaining to the feeding mechanism and deflecting the pulverized material against the screens, the tops or upper portions 43 of the plates 41 are curved outward and may be formed integral with the plates 41 or made separate and attached in any convenient and well known manner. For the purpose of preventing rotation of the grinding ring 14 the pins 21^a are provided and are located substantially as shown in Fig. 5.

The plates 41 are provided with suitable openings 44, which openings are for the pur-

pose of exposing the vertical faces of the carrier 10 and are of a diameter somewhat greater than the diameter of the carrier 10. For the purpose of distributing the material to both feed chambers which feed chambers are located upon opposite sides of the carrier as best illustrated in Fig. 1, the branch pipes 45 are provided, which branch pipes lead into the feeding chambers and communicate at their upper ends with the chamber the bottom of said chamber being bounded by the inclined plate 47, which plate guides the material to the branch pipes 45.

The carrier 10 is provided with the chambers or recesses 48 which are formed by the integral casings 49 which casings provide room for the lateral flanges 50 formed upon the pushers 22 and also room for the springs 23 and also for limiting forward movement of the pushers. For the purpose of permitting the pushers to oscillate or rock the apertures 51 formed in the connecting shank of the pushers are formed flaring or tapered as illustrated in Fig. 7 so as to permit said movement of the pushers upon the connecting pin 52. The smaller diameters of the flaring apertures being substantially of a diameter corresponding with the diameter of the pins 52 and the apertures tapered in opposite directions from the smaller portions of the apertures. It is well understood that in mills of this kind the power shaft should be held in such a manner that there can be no end thrust and in order to prevent any end thrust the outer bearings 2 are provided with the caps 53 through which caps the set screws 54 are passed which set screws abut against the thrust plates 55 against which are located the anti-friction disks 56. It will be understood that by adjusting the set screws 54 so that the thrust plates 55 will hold the disks 56 in close contact with the ends of the shaft 1 there can be no end thrust of the shaft. The thrust plates 55 can be adjusted from time to time in case it becomes necessary by reason of the wear of the said parts.

For the purpose of spacing the screens 27 and 28 and also holding said screens in proper position bars 57 are provided, which bars are clamped between the flanges on plates 41 and the flange of the outer casing 29. For the purpose of conveying the sufficiently pulverized material which has passed through the outer screens the delivery passages 58 are provided, which passages lead to the delivery spout 59 from which spout the material may be conveyed to any desired place.

In Figs. 2 and 3 I have illustrated a slight modification which consists in providing rollers 60 in place of the balls 19, which rollers are mounted upon the short shafts 61 which shafts are located in the slots 62, said slots being formed in the pushers 63, which pushers are secured to the carrier in substantially the same manner as the pushers 22.

For the purpose of holding the springs 23 in proper position the flanges 50^a are formed on the pushers, and the pins 23^a are provided which pins are located in the chambers 48 and attached to the carrier 10 in any convenient and well known manner. It will be understood that when the carrier is rotated at a rapid rate the grinding elements will be moved outward by centrifugal force from their common center and in contact with the grinding surface of the race formed in the grinding ring.

Having fully described my invention what I claim as new and desire to secure by Letters Patent, is—

1. In a pulverizing mill, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided with grinding balls, pushers located behind the grinding balls and adapted for contact with the rear surfaces of said grinding balls, said pushers pivoted at a point between the axes of the carrier and the points of contact with the grinding balls, a fixed grinding ring provided with a ball race upon its inner periphery and means for holding the grinding ring in fixed position.

2. In a pulverizing mill, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided with grinding balls, pushers located behind the grinding balls and adapted for contact with the rear surface of said grinding balls, said pushers pivoted at a point between the axes of the carrier and the points of contact with the grinding balls, a fixed grinding ring provided with a ball race upon its inner periphery, means for cushioning the pushers, and means for holding the grinding ring in fixed position.

3. In a pulverizing mill of the class described, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided with grinding elements, pushers pivoted at a point between the axes of the carrier and the points of contact with the grinding elements, said grinding elements adapted to yield opposite to the line of travel and said pushers adapted to yield in substantial unison with the yielding movement of the grinding elements and the pushers adapted for contact with the rear surfaces of the grinding elements, springs adapted to normally hold the pushers in contact with the rear surfaces of the grinding element and a fixed grinding ring.

4. In a pulverizing mill, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided upon its periphery with grinding elements, deflecting blades extended from the vertical faces of the carrier, said blades flared outward and back-

ward from the faces of the carrier and flanges located at the rear of the deflecting blades and inclined in opposite directions from the blades, the carrier provided with openings, said openings located at the bases of the flanges, and a fixed grinding ring, substantially as and for the purpose specified.

5. In a pulverizing mill, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided upon its periphery with grinding balls, pushers adapted for contact with the grinding balls, flanges located upon the faces of the carrier, said carrier provided with openings located at the bases of the flanges, and a fixed grinding ring and means for cushioning the pushers, said pushers located at the rear of the grinding balls, substantially as and for the purpose specified.

6. In a pulverizing mill, the combination of a shaft, a carrier mounted upon said shaft, said carrier provided upon its periphery with grinding balls, pushers adapted for contact with the grinding balls, flanges located upon the faces of the carrier, said carrier provided with openings located at the bases of the flanges and a fixed grinding ring, means for cushioning the pushers and the pushers adapted to oscillate with the backward movement of the balls, independent of the rotary movement of the carrier, substantially as and for the purpose specified.

In testimony that I claim the above, I have hereunto subscribed my name in the presence of two witnesses.

BENJAMIN C. BRADLEY.

Witnesses:
F. W. BOND,
SYLVIA BORON.