W. H. LIEBER.

PULVERIZING MILL.

APPLICATION FILED DEC. 24, 1909.

966,843. Patented Aug. 9, 1910.

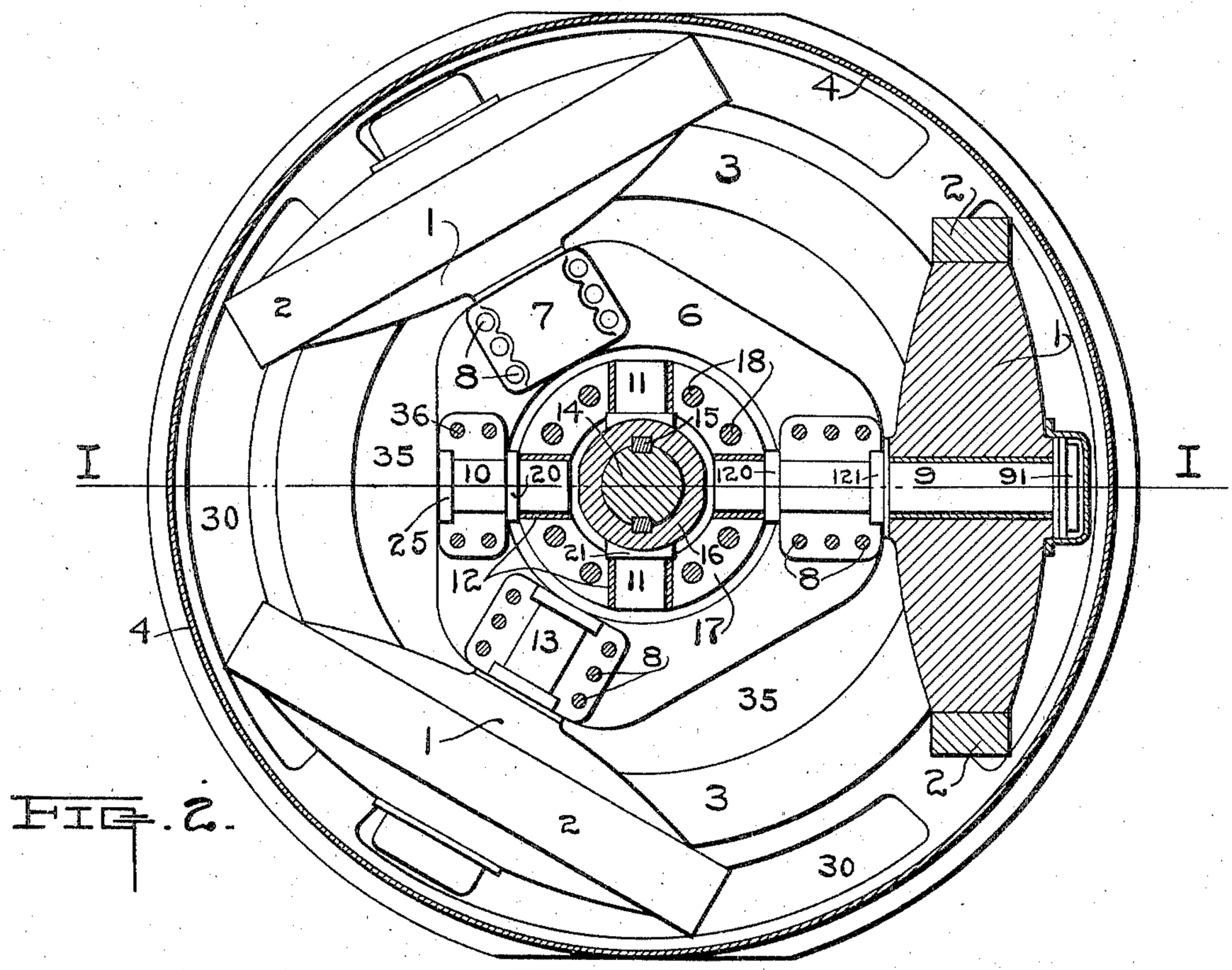

FIG. 2.

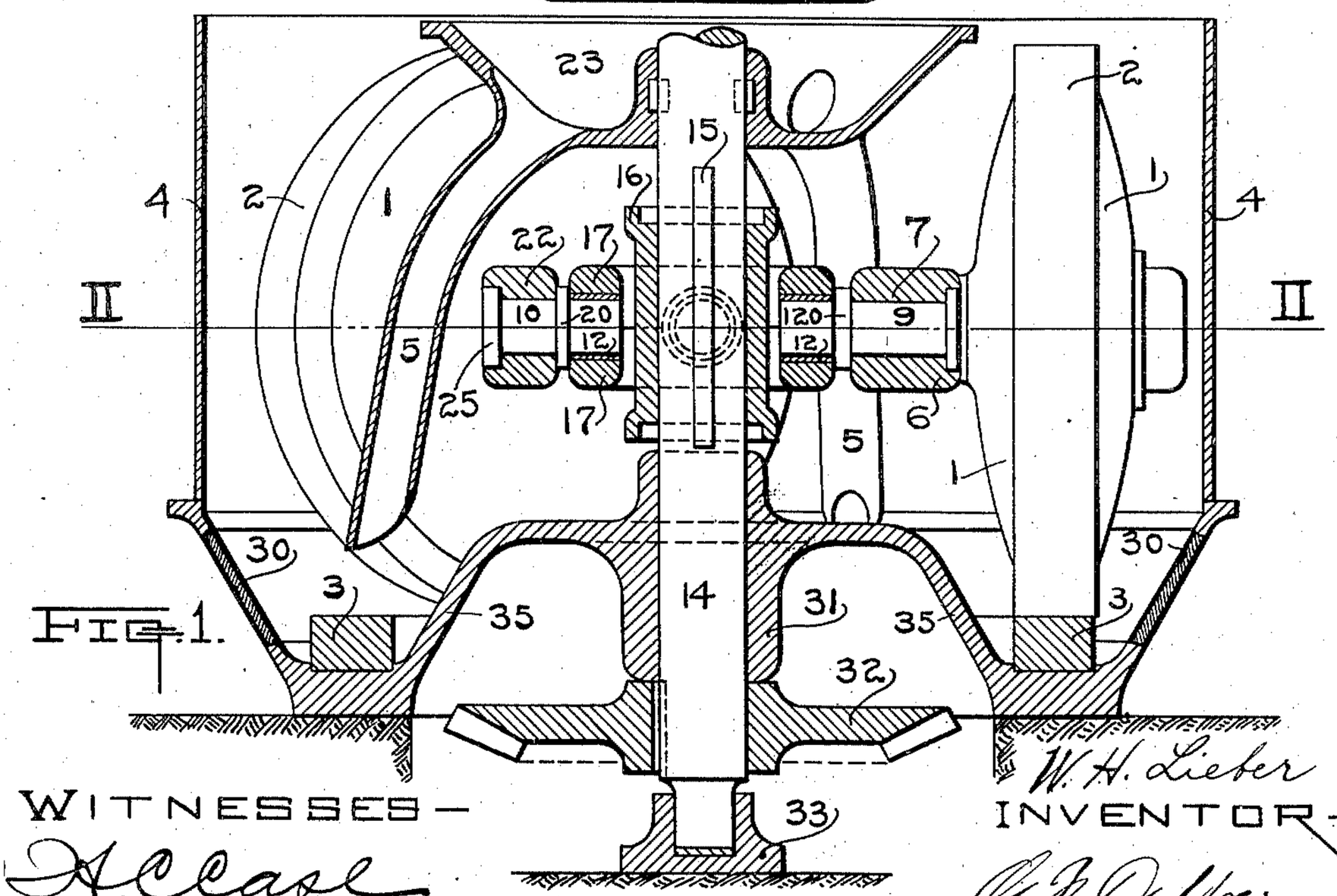

FIG. 1.

WITNESSES—

A. C. Case

Ella Brickell

W. H. Lieber

INVENTOR—

BY G. J. DeWein

ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM H. LIEBER, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

PULVERIZING-MILL.

966,843. Specification of Letters Patent. **Patented Aug. 9, 1910.**

Application filed December 24, 1909. Serial No. 534,835.

To all whom it may concern:

Be it known that I, WILLIAM H. LIEBER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Pulverizing-Mills, of which the following is a specification.

This invention relates to improvements in the construction of crushing or pulverizing mills in which material is crushed by the impact of several rolls traveling upon an annular track or ring die.

The object of the invention is to produce a pulverizing mill having a series of rolls traveling upon an annular die, which will be simple in construction and efficient in its operation.

In mills of the above described type it is an essential feature to have the connections between the rolls and their driving shaft as flexible as possible so that any one roll of the series is free to adjust itself relative to the ring die without greatly disturbing the position of the other rolls. This flexibility between driving and driven members prevents undue stresses from falling upon the driving parts of the mill, and is a feature of the present invention.

A clear conception of the invention can be obtained by referring to the accompanying drawing in which like reference characters designate the same or similar parts in different views.

Figure 1 is a vertical section of a pulverizing mill built according to the invention, the section being taken along the line I—I of Fig. 2. Fig. 2 is a horizontal section through the driving members, the pan and one of the rolls, of the mill shown in Fig. 1, the section being taken along the line II—II of Fig. 1.

The mortar 35 of the pulverizing mill is circular in form and supports the concentric, annular die 3. The discharge screens 30 are fastened to the outer wall of the mortar 35 and form nearly a complete circle surrounding the annular die 3. The casing 4 is cylindrical in form and is supported by the mortar 35 above the screens 30. The main driving shaft 14 is supported concentric with the mortar 35 and casing 4 by a boss 31 formed in one with the mortar 35, and a thrust bearing 33, at the lower end of the shaft 14. The driving shaft 14 is thus mounted to rotate about a fixed axis. The driving gear 32 is keyed to the main shaft 14 between the boss 31 and the bearing 33, and is drivingly connected to a suitable source of power, not shown.

The main shaft 14 extends upwardly within the casing 4, and has the splines 15 fastened to it, the splines 15 extending upwardly from the top of the boss 31. The sleeve 16 is slidably mounted upon the shaft 14 and splines 15. Pins 11 are formed coaxial with each other and in one piece with the sleeve 16, the pins 11 being radial to the shaft 14 and having sections of different diameters. The sections of the pins 11, having the larger diameters, are formed nearest the sleeve 16. Bushings 12, which surround the sections of the pins 11 of smaller diameter, shoulder against the sections of the pins 11 of larger diameter.

The bushings 12 surrounding the pins 11, are clamped between the upper and lower halves of the connecting piece or ring 17, by clamping bolts 18 passing through the ring 17. Bushings 12, surrounding the pin 10 and shaft 9, are similarly clamped between the halves of the ring 17, by bolts 18. The pin 10 and shaft 9 are coaxial, their axes intersecting the common axis of the pins 11 at any angle, preferably at right angles as shown.

The pin 10 has an enlarged section 20 which shoulders against the bushing 12 and the ring 17 on one side, and against the main driving head 6 on the opposite side of the section 20. The portion of the pin 10 beyond the enlarged section 20 is clamped between the driving head 6 and the cap 22 by clamping bolts 36, a second enlarged section 25 at the outer end of the pin 10 preventing the pin 10 from sliding endwise.

The shaft 9 has an enlarged section 120 which coacts with the bushing 12, ring 17, and driving head 6, in a manner similar to the coaction of the enlarged section 20 of the pin 10 with these members. A second enlarged section 121 on the shaft 9 prevents the shaft 9 from sliding endwise under the cap 7, which cap 7 clamps the shaft 9 to the driving head 6 by means of clamping bolts 8. The end of the shaft 9 projects beyond the driving head 6, and has a crushing roll 1 mounted thereon concentrically therewith. The roll 1 is prevented from sliding longitudinally on the shaft 9 by an enlarged sec-

tion 91 at the outer end of the shaft 9, but is free to rotate about the shaft 9. The roll 1 is surrounded by a wearing ring 2 which is fastened to the roll 1 by shrinking or other suitable means, and which ring 2 rests upon the upper surface of the annular die 3 in the mortar 35. The shafts 13 are also clamped between caps 7 and the head 6 by means of bolts 8, but do not project beyond the head 6 on the inner side thereof. The portions of the shafts 13 which project beyond the outer limits of the head 6, are exactly the same as the outward projecting portion of the shaft 9. Rolls 1, having wearing rings 2, are mounted on the projecting ends of the shafts 13 and rest upon the annular die 3 within the mortar 35. There may be any number of rolls 1 mounted on shafts clamped to the head 6, three rolls, as shown, being the preferred form of mill.

The feed hopper 23 is fixed to the upper portion of the shaft 14 above the splines 15, by means of dowels, short keys or in any other suitable manner. Discharge spouts 5 project from the hopper 23 to points above the annular die 3, so that any material leaving the hopper 23 through a spout 5, will fall upon the annular die 3 between two adjacent rolls 1 resting on the die 3.

The mechanisms for controlling the feed to the hopper 23, and for lubricating the various bearings of the mill, may be of any suitable type, and have been omitted from the drawings, since they form no part of the present invention.

In the operation of the mill, the main driving shaft 14 is given a rotary motion by means of the power, not shown, connected to the gear 32. This rotary motion of the shaft 14 is transmitted to the rolls 1 through the splines 15, sleeve 16, pins 11, ring 17, pins 10 and shaft 9, head 6 and shafts 9, 13, causing them to roll upon the annular die 3. The material to be pulverized is admitted to the hopper 23, which hopper 23 being fastened to the shaft 14 is also rotating with said shaft 14. From the hopper 23 the uncrushed material is passed to the annular die 3, through the discharge spouts 5, falling in the path of the crushing rolls 1. After the rolls 1 have, by their repeated rolling over the material, reduced same so that it may pass through the screens 30, the pulverized material is discharged through the screens 30, and fresh material is supplied from the hopper 23 through the spouts 5.

It will be seen that if the rolls 1 were connected with the shaft 14 by rigid driving connections, it would be necessary to maintain an equal amount of material above the annular die 3 at each of the contact points of the rolls 1 therewith. If this were not done, the accumulation of material under one roll 1, above the amount under another roll 1, would produce an upward twist in the driving connection between the first roll and the shaft 14, thus producing an intense stress in the connection. With the present construction such stresses cannot occur. If the material is unevenly distributed over the annular die 3, the rolls 1 will adjust themselves to any such unevenness, due to the universal driving connection between the head 6 and the sleeve 16. If material enough is placed upon the die 3 to raise all of the rolls an equal amount, the entire driving mechanism of the rolls will move up with the sleeve 16 on the shaft 14.

A universally flexible connection is formed between the head 6 and the sleeve 16, as the four pins 9, 10, 11, will allow the head 6 to be shifted to any angular position, relative to the sleeve 16, within certain limits determined by the sizes of the head 6, ring 17 and sleeve 16. The flexibility of the driving connections as shown in the present invention is, moreover, a compact construction since all of the bearing boxes of the driving pins are confined to the ring 17, the shafts 9, 13, and the pin 10 being rigidly connected to the head 6 and the pins 11, being rigidly connected to the sleeve 16. A single series of means for transmitting power from the shaft 14 to the driving head 6 and for permitting wabbling of the head about the shaft 14 is established by having the elements which serve as the driving means also serve as the means for permitting wabbling. The connecting piece or ring 17 can be easily removed by withdrawing the bolts 18 therefrom, thus leaving the shaft 14 and sleeve 16 disconnected from the driving head 6. This feature also gives easy access to the bearings for inspection and repairs. The head 6 can have no parallel side movement in the mill, since the shoulders on the pins 10, 11, and the shaft 9, coacting against the ring 17 and bushings 12, keep the head 6 concentric with the shaft 14.

It should be understood that it is not desired to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent,—

1. In a pulverizing mill, a plurality of rolls, a driving head, a driving shaft, a spline coacting with said shaft, a shaft fixed to said driving head for mounting each of said rolls, and a single series of means connecting said spline and said driving head, said series of means being adapted to transmit power and to permit wabbling of said head, and said series of means being longitudinally movable relative to said driving shaft.

2. In a pulverizing mill, a plurality of rolls, a driving head for said rolls, a driving

shaft for said head, a sleeve, a driving connection between said sleeve and shaft permitting sliding of said sleeve on said shaft, and a single series of means connecting said sleeve and said driving head, said series of means being adapted to transmit power and permitting wabbling of said head.

3. In a pulverizing mill, a driving shaft, a spline coacting with said shaft, a driving head, a plurality of rolls associated with and rotatable relative to said head, and a single series of means connecting said spline and said driving head, said series of means being adapted to transmit power and to permit wabbling of said head, and said series of means being adapted to move longitudinally relative to said shaft.

4. In a pulverizing mill, a driving shaft, a ring, a driving head, a plurality of rolls associated with and rotatable relative to said head, means interposed between said driving shaft and said ring for allowing relative motion between said shaft and said ring, and a second means interposed between said ring and said driving head for allowing relative motion between said ring and said head.

5. In a pulverizing mill, a driving shaft, a sleeve slidably mounted on said shaft, a ring surrounding and swiveled on said sleeve, a head swiveled on said ring at an angle to the swivel between said ring and sleeve, and a plurality of rolls mounted on said head.

6. In a pulverizing mill, a driving shaft, a sleeve slidably mounted on said shaft, a driving head concentric with said shaft and said sleeve, a driving connection between said sleeve and said head, said connection being adapted to allow wabbling of said head, and a plurality of rolls rotatably mounted on said head.

7. In a pulverizing mill, a driving shaft and a driving head, a pin for driving said head, said pin being fixed to said head and projecting toward said shaft, a second pin projecting toward said head and driven from said shaft, means connecting the projecting ends of said pins, and a plurality of rolls rotatably mounted on said head.

8. In a pulverizing mill, a driving shaft, a sleeve slidably mounted on said shaft, and a driving head, a pin projecting toward said shaft for driving said head, a second pin projecting toward said head and driven from said shaft, a ring connecting said pins and providing bearings therefor, and a plurality of rolls rotatably mounted on said head.

9. In a pulverizing mill, a driving shaft, a spline coacting with said shaft, a driving head, rolls rotatably mounted on said head, and a positive driving connection between said spline and said head, including means for maintaining said head concentric with said shaft and for permitting wabbling of said head, said connection being longitudinally movable relative to said shaft.

10. In a pulverizing mill, a rotatable driving means, a driving head, a plurality of rolls rotatably mounted on said head, a connecting piece, a pivotal connection between said connecting piece and said driving means, and a pivotal connection between said connecting piece and said driving head.

11. In a pulverizing mill, a rotatable driving means, a driving head, a plurality of rolls rotatably mounted on said head, a connecting piece, a pivotal connection between said connecting piece and said driving means, and a pivotal connection between said connecting piece and said driving head, said pivotal connections being formed in said connecting piece.

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

WILLIAM H. LIEBER.

Witnesses:
G. F. De Wein,
John Day, Jr.