

J. J. KNIGHT.
ORE PULVERIZER.
APPLICATION FILED FEB. 28, 1910.

983,067.

Patented Jan. 31, 1911.

2 SHEETS-SHEET 1.

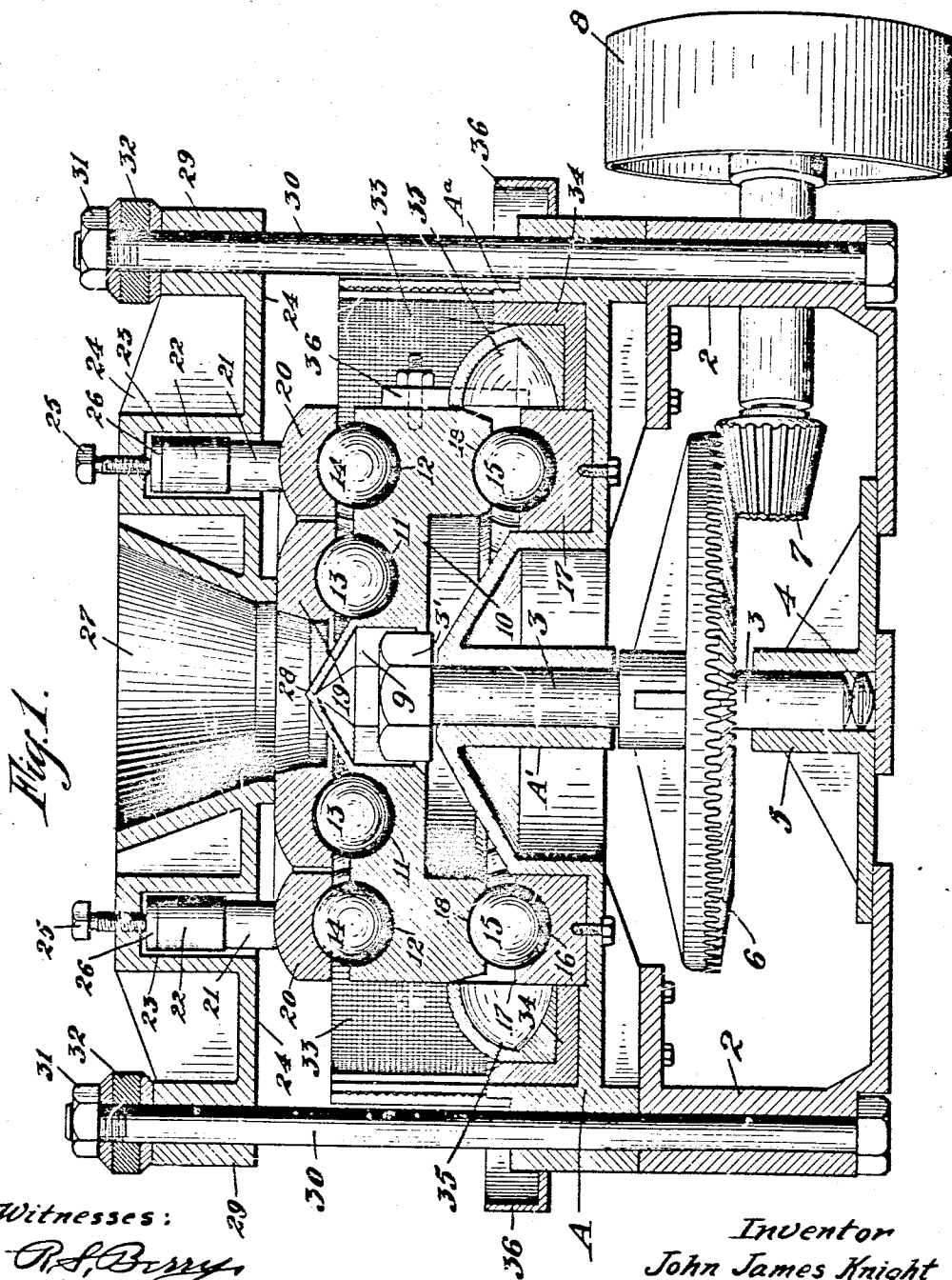


Fig. 1.

Witnesses:

R. S. Berry
Charles Pickles

Inventor
John James Knight
By *G. H. Strong*
His Attorney.

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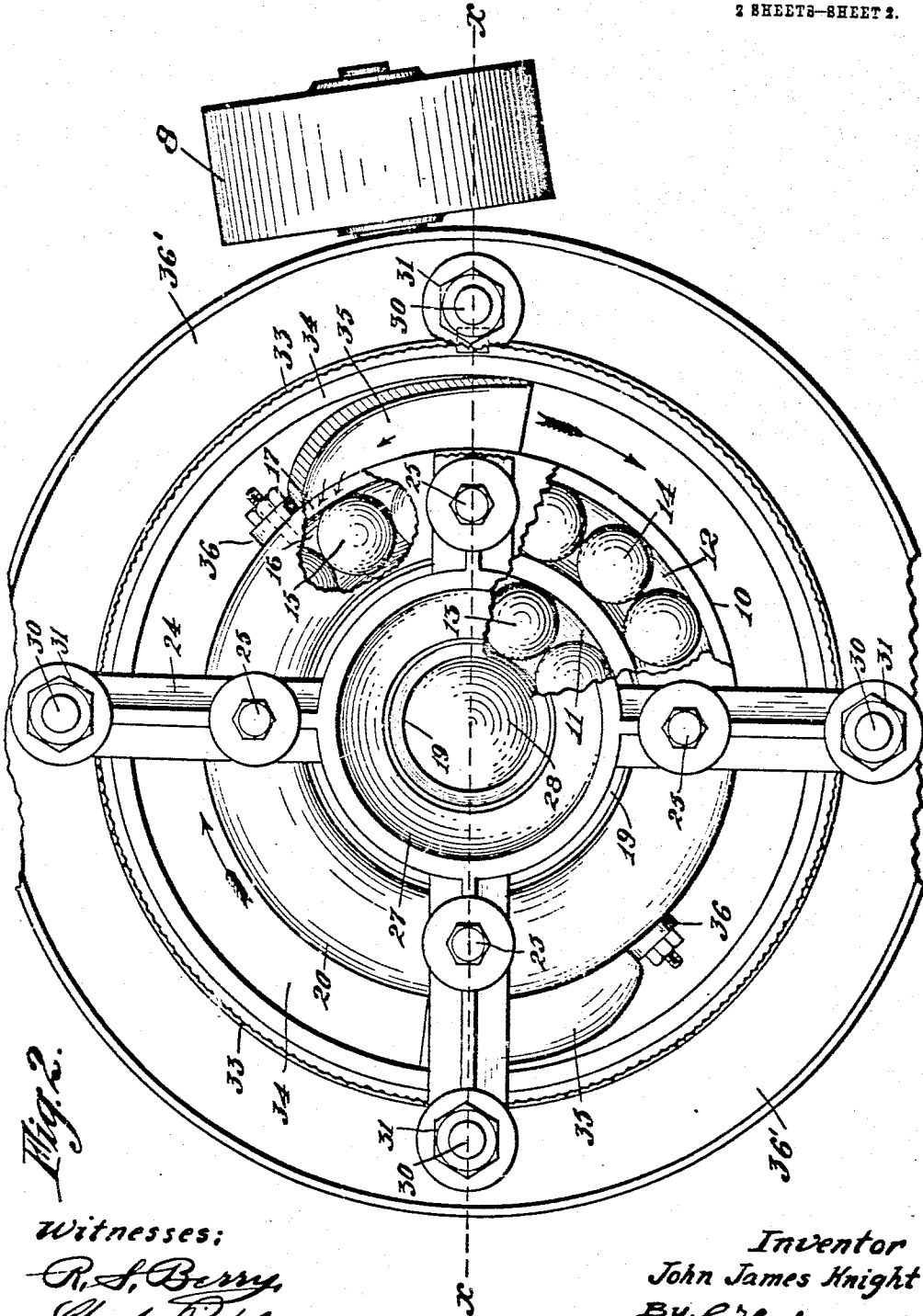


Fig. 2.

Witnesses:

R. S. Berry,
Charles Pickles

Inventor
John James Knight
By G. H. Strong,
His Attorney.

UNITED STATES PATENT OFFICE.

JOHN J. KNIGHT, OF ALAMEDA, CALIFORNIA, ASSIGNOR TO KNIGHT-CONLON PULVERIZING MILL CO., OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

ORE-PULVERIZER.

983,067.

Specification of Letters Patent.

Patented Jan. 31, 1911.

Application filed February 28, 1910. Serial No. 546,482.

To all whom it may concern:

Be it known that I, JOHN JAMES KNIGHT, a citizen of the United States, residing at Alameda, in the county of Alameda and State of California, have invented new and useful Improvements in Ore-Pulverizers, of which the following is a specification.

This invention relates to improvements in grinding and pulverizing mills, and particularly pertains to mills of this character in which the act of comminuting is performed by spherical rollers arranged between supporting and pressing members.

The object of this invention is to provide a grinding and pulverizing mill in which the materials to be comminuted are fed between concentrically arranged crushing dies and rollers or balls, and in which means are provided for screening the ground materials.

A further object is to provide means for directing and subjecting the coarse ground materials which cannot pass the screen, to further pulverizing action, so that the product of the mill will be of uniform fineness, and thoroughly ground.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical section of the invention on the line $x-x$ Fig. 2. Fig. 2 is a plan view, with portions broken away to disclose the crushing balls or rollers.

In the drawings, A represents a bed-plate, which is supported upon and secured to suitable legs 2. A vertical shaft 3 extends through a bearing A' formed on the bed-plate A, and is supported on a button 4 in a bearing 5 mounted on the feet of the legs 2. A gear 6 is keyed to the shaft 3 and meshes with a pinion 7 which is driven through the pulley 8 by any suitable power. The upper end of the shaft 3 is provided with a hexagonal or rectangular head 3', which is adapted to fit into a correspondingly shaped recess 9 in a revoluble disk 10. The upper surface of the disk 10 has concentric grooves 11—12 formed therein, in which a number of crushing balls 13—14 are loosely mounted. The disk 10 is supported upon grinding spheres 15 which are mounted in a circular groove or channel 16 formed in a supporting ring 17 secured to the bed-

plate A. A channel 18 is formed on the under side of the disk 10, directly beneath the outer groove 12, and above the spheres 15, the channels 16—18 forming a runway for the grinding spheres 15.

Pressing rings 19—20 bear upon the crushing balls 13—14 respectively, each ring having a groove on the under side at the point directly above the corresponding train of crushing balls. The outer ring 20 has upwardly projecting studs 21 formed thereon which are adapted to contact resilient cushions 22, mounted in recesses 23 formed on the head-plate 24. Set screws 25 threaded in the top of the recesses 23, bear against the cushions 22, a washer 26 being interposed between each set screw and cushion. The head-plate 24 rests upon the inner pressing ring 19, and has a hopper or opening 27 formed in the center thereof, through which ore or other material to be ground is fed to the grinding elements of the mill.

The portion of the revoluble disk 10 lying beneath the hopper 27 projects upward in conical form as at 28, forming a distributor, the object of which is to insure the materials to be ground, being evenly fed in a radial direction, to the circle of crushing rollers 13 beneath the pressing ring 19. Outwardly extending members on the head-plate 24, are cored at 29 to pass over the upper ends of vertically arranged bolts 30 which are mounted in the legs 2, and extend through the bed-plate A. The upper ends of the bolts 30 are threaded to receive nuts 31, and resilient cushions 32 are interposed between the nuts 31 and the extended members of the head-plate 24. A screen 33 is mounted on an upwardly projecting flange A* on the bed-plate A, and encircles the revoluble disk 10.

The annular trough formed between the flange A* and the supporting ring 17, is provided with an annular lining 34, preferably made of hardened steel or white iron, which is secured to the bed-plate A. Plow blades 35 are adapted to travel in the annular trough in contact with the lining 34, and are propelled around the trough by means of the revoluble disk 10, diametrically opposed projections 36 on the latter, extending rearwardly of, and contacting the blades 35 so as to move them forward as the disk 10 revolves. These blades are constructed with the forward end open, and rear-

ward end closed, with one edge contacting the trough lining 34, and the other contacting the periphery of the disk 10, the inclosed space beneath the blade gradually contracting rearwardly, so that as the blades travel around the trough, the materials therein will be directed between the grinding spheres 15.

In operation the ore or other materials to be ground, and water, are delivered into the hopper 27 in any suitable manner. The disk 10 being rotated by means of the gears 6—7 and driving pulley 8, the crushing rollers 13—14 are caused to revolve in their respective runways, in such a manner as to pass the ore between the rollers and subject it to a crushing action. The ore is first acted on by the rollers 13, then passes on to the rollers 14, whereafter it is dropped over the edge of the disk 10 into the trough or lining 34. The pressing disk 19 is allowed to give or move upward to a certain extent by reason of the cushions 32, and cushions 22 permit of an upward movement of the pressing ring 20. By this arrangement either ring 19 or 20 may move upward more or less independently of each other, and thus allow refractory particles of the materials to pass between the rollers 13 or 14, and thus prevent clogging of the machine at this point. The crushed material after being subjected to the action of the rollers 13—14, passes into the space between the rotatable disk 10 and the screen 33, the finer particles being carried through the screen 33 by the flow of water, and delivered to an exterior trough 36 from whence it is removed in any suitable manner for further treatment. The coarser materials, such as are too large to pass through the screen 33, settle to the bottom of the trough 34, and are deflected by the plow blades 35 between the crushing spheres 15 as before described, and are here thoroughly ground so as to pass with the other fine materials through the screen 33. The plow blades 35 are loosely mounted in the trough 34, so that if metallic or other refractory materials which resist the action of the crushing spheres 15 are encountered, the blades will rise and pass over same, and thus prevent injury of the blades. The disk 10 is free to be moved upward, when refractory particles of material pass between it and the rollers 15, but as its upward movement is opposed by its own weight, and that of the grinding rollers 13—14, pressing rings 19—20, and the head-plate 24, and also by the opposition of the cushions 32, the ordinary materials that may resist the action of the upper grinding rollers 13—14, will be pulverized by the more powerful action of the lower grinding spheres 15. The pressure of the pressing ring 20 on the crushing rollers 14 may be regulated by means of the set screws 25, and the pressure on the rollers 13

is adjusted by means of the nuts 31 on the bolts 30. This adjustment of pressure on the grinding rollers permits of the adaptation of the mill to handling different grades of material. By removing the bolts 31, the head-plate 24 may be lifted so as to give access to the pressure rings 19—20, and rollers 13—14, and the head-plate being removed permits of the disk 10 being lifted clear of the grinding spheres 15, and thus allows of ready access to the grinding parts for examination or repairs.

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

1. The combination in a pulverizing mill, of a horizontally revoluble disk having annular ball races upon its upper and lower surfaces respectively, a channeled bed-plate, a die located in the inner portion of the channel having a ball race corresponding with the one in the bottom of the superposed disk, a loose or detached plow adapted to travel with the disk and in the outer portion of the bed-plate channel to deliver material into the above named ball race, said revoluble disk having a projection to engage behind the loose plow and thereby move the same forwardly, means for applying pressure upon the balls in the upper ball race, means for feeding the material to be crushed into the innermost ball race to be carried centrifugally outward through the second race and discharged into the bed-plate channel.

2. The combination in a pulverizing mill, of a horizontally revoluble disk having annular ball races upon its upper and lower surfaces respectively, a channeled bed-plate, a die located in the inner portion of the channel having a ball race corresponding with the one in the bottom of the superposed disk, a loose or detached plow adapted to travel with the disk and in the outer portion of the bed-plate channel to deliver material into the above named ball race, said revoluble disk having a projection to engage behind the loose plow and thereby move the same forwardly, other means for applying pressure upon the balls in the upper ball race, means for feeding the material to be crushed into the innermost ball race to be carried centrifugally outward through the second race and discharged into the bed-plate channel, and a screen inclosure therefor.

3. The combination in a pulverizing mill, of a horizontally revoluble disk and driver having concentric ball races in the upper surface and another ball race in the lower surface, an annular channeled bed-plate having a ball race coincident with that of the disk, independent pressure rings having ball races corresponding with those in the upper surface of the disk, a main cap with adjust-

able pressure devices acting upon the inner
of said pressure rings, studs projecting up-
wardly from the outer pressure ring, and in-
dependently adjustable cushioned members
5 carried in the head and acting upon said
ring, a central feed device whereby material
is delivered to the inner and uppermost of
the crushing members and carried outwardly
therefrom by centrifugal action through the
10 outermost crusher, and thence delivered into
the annular trough of the bed-plate, a de-
tached plow by which the crushed material
is returned into the lowermost crushing

channel, said disk having a projection to en-
gage behind the detached plow and thereby 15
move the same forwardly, and a surround-
ing screen through which the crushed ma-
terial is delivered outwardly.

In testimony whereof I have hereunto set
my hand in the presence of two subscribing 20
witnesses.

JOHN J. KNIGHT.

Witnesses:

W. B. STRAUB,
E. S. PAGE.