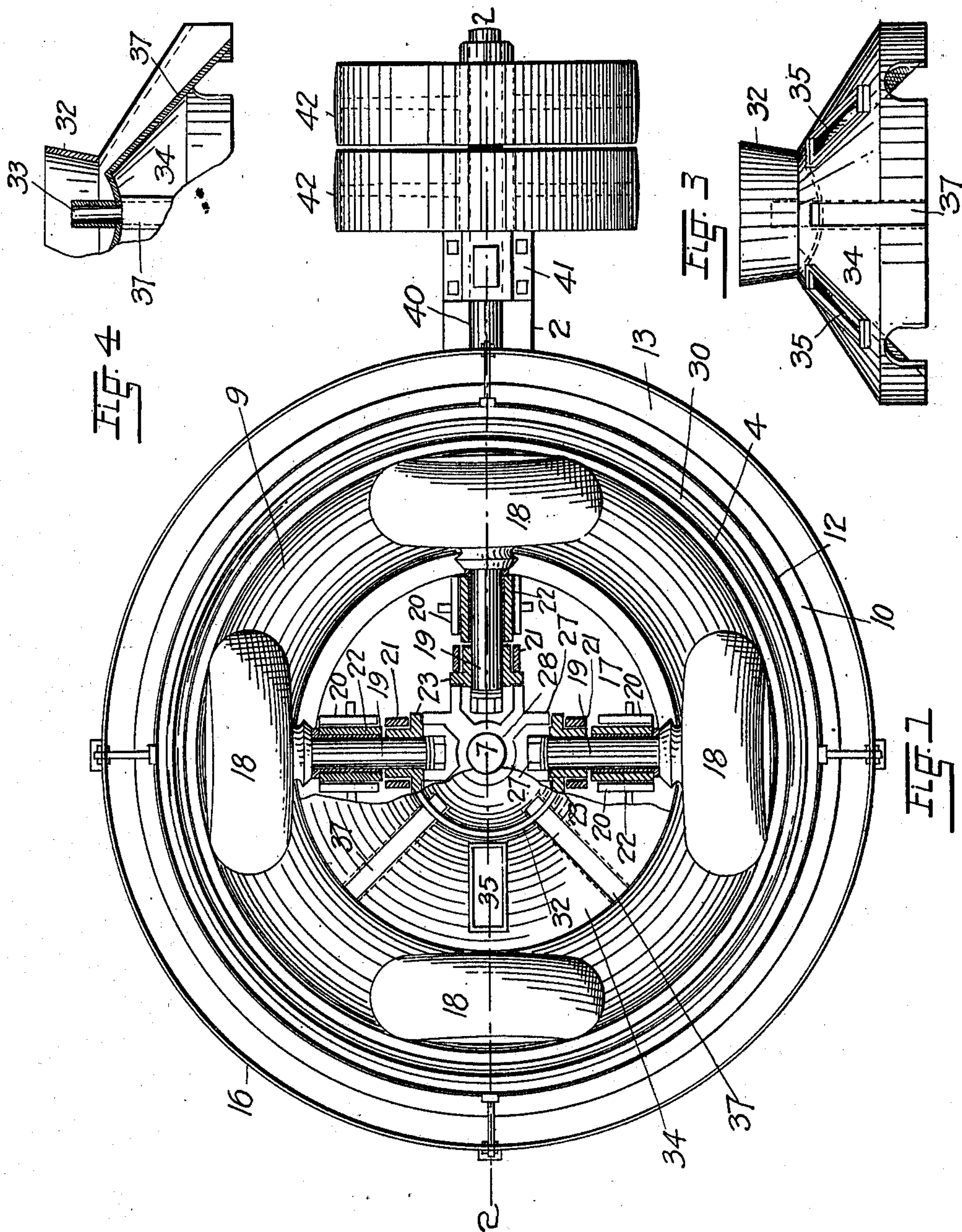


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S. C. ARNOLD.
QUARTZ MILL.
APPLICATION FILED MAR. 23, 1909.

Patented May 30, 1911.

3 SHEETS-SHEET 1.



WITNESSES:
F. H. Cuno
M. L. Geary.

INVENTOR.
S. C. Arnold
BY *G. J. Delaney*
ATTORNEY.

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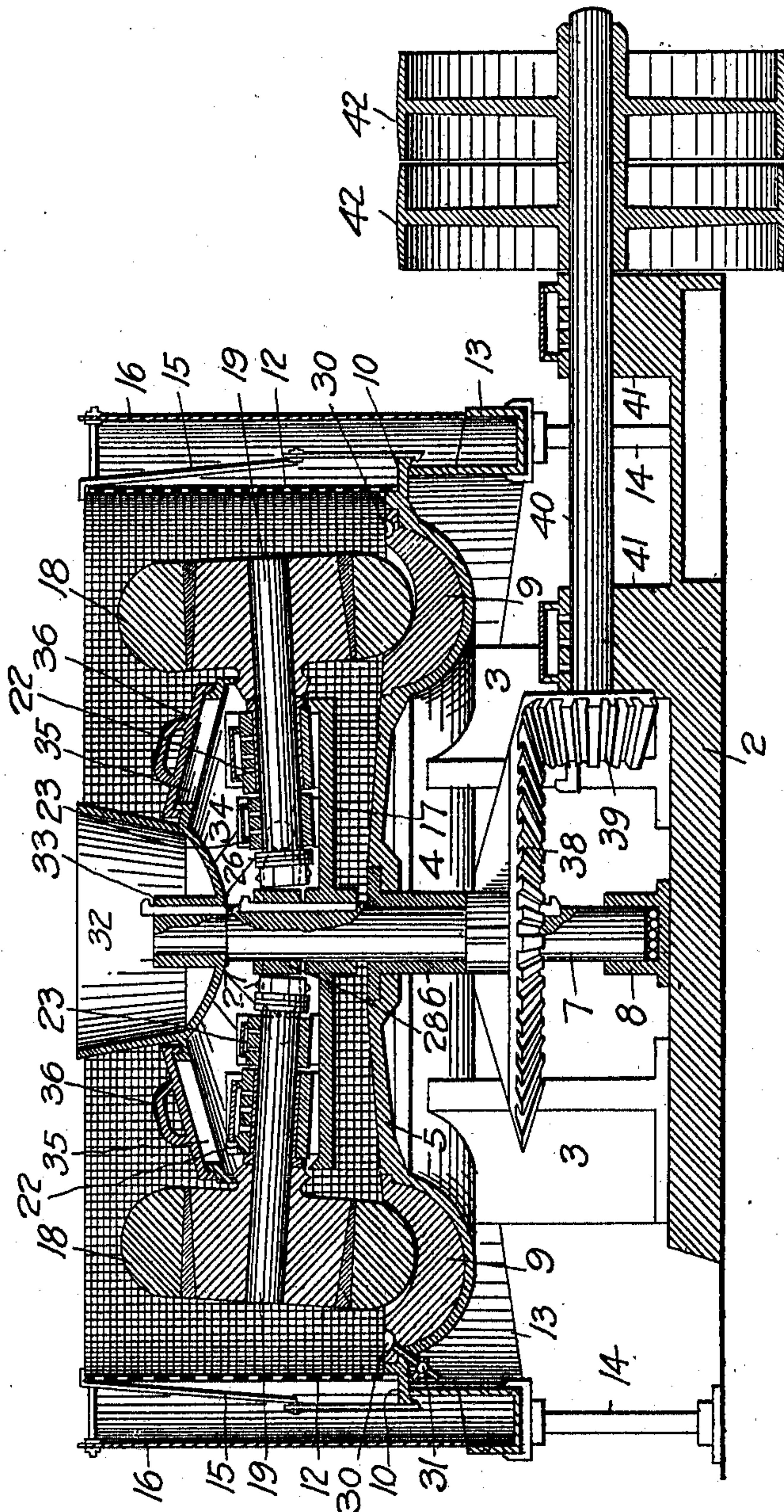


FIG. 2

WITNESSES:
F. H. Cuno.
M. S. Geary.

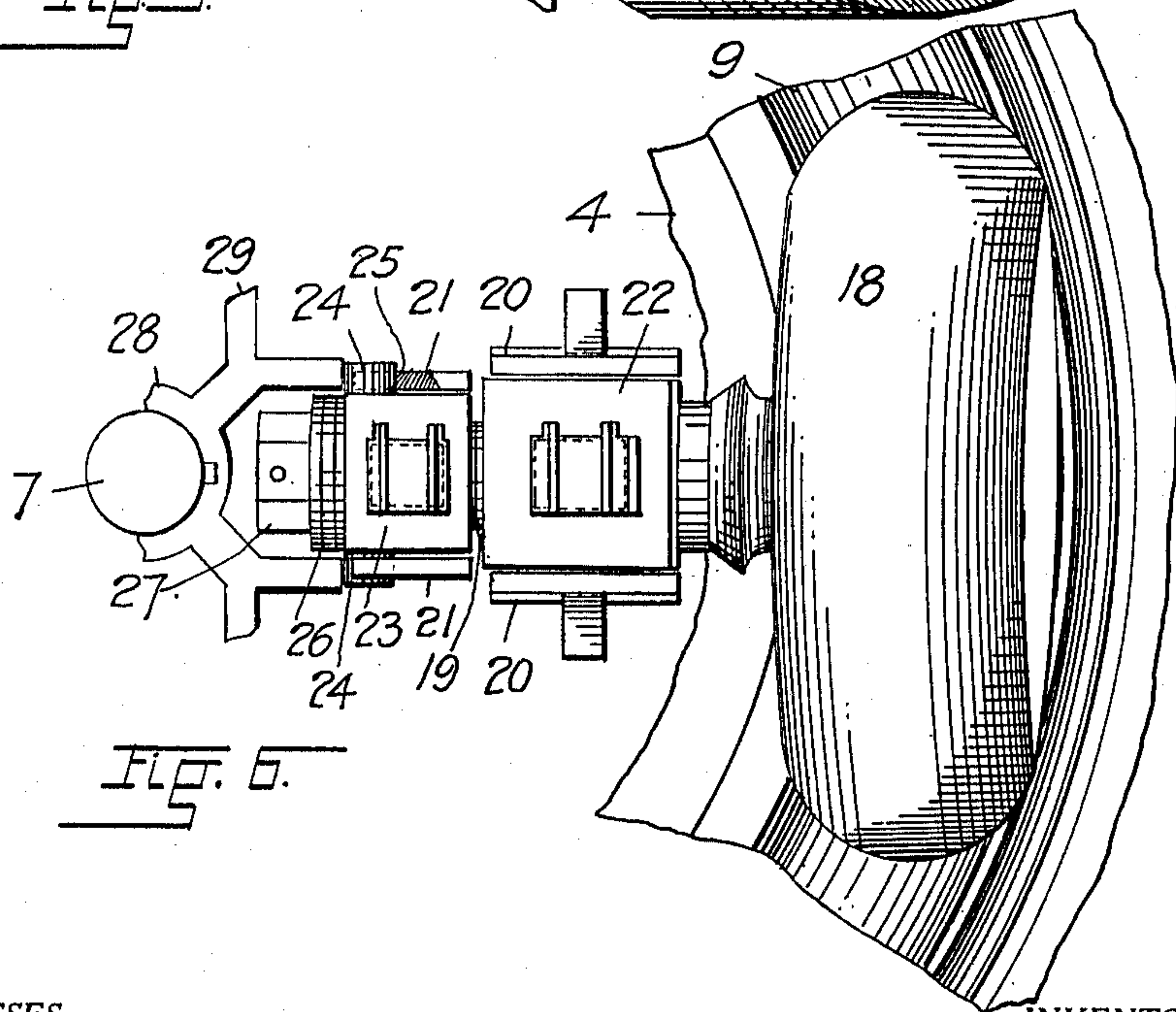
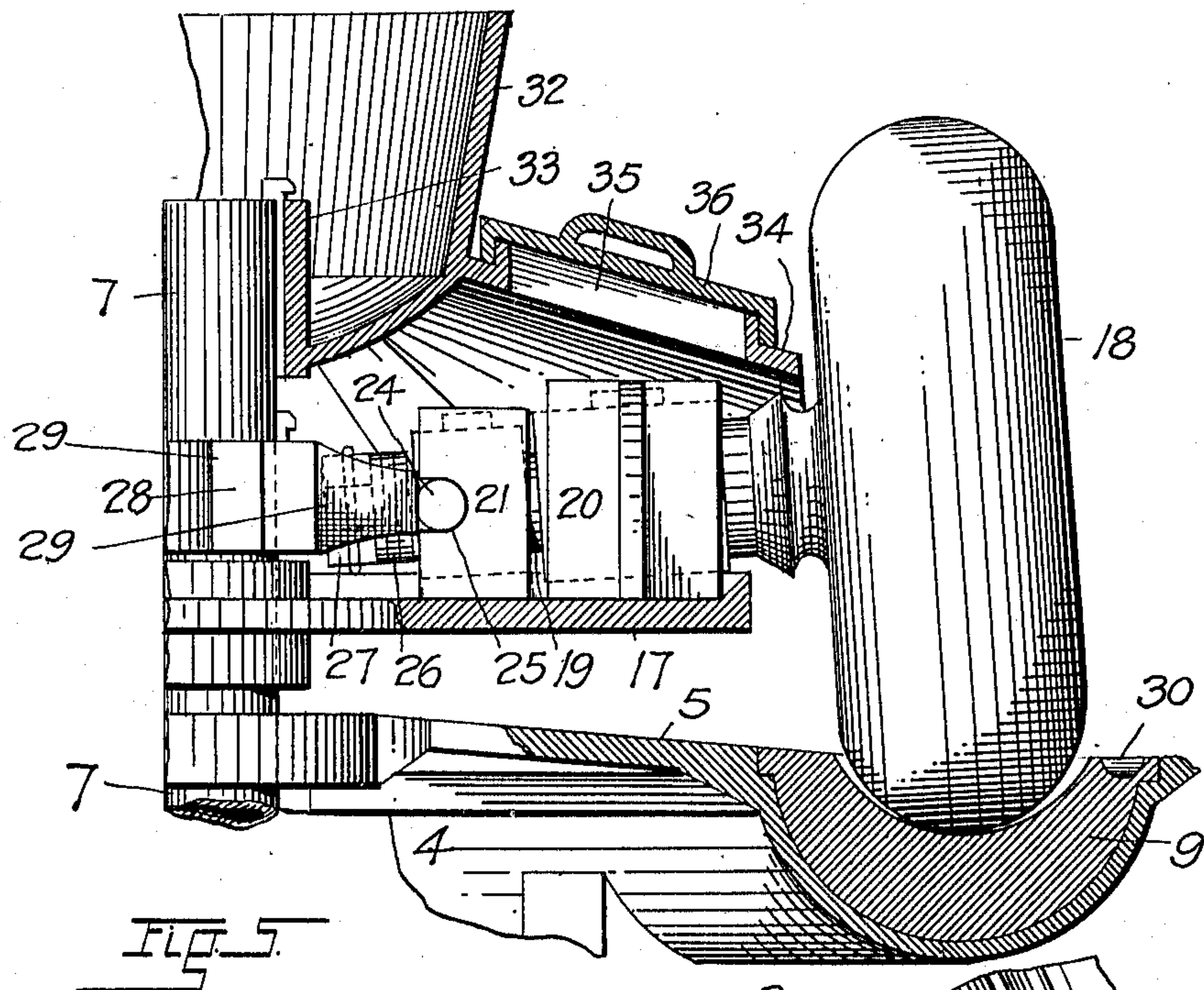
INVENTOR.
S. C. Arnold.
BY
G. J. [Signature]
ATTORNEY.

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3 SHEETS-SHEET 3.



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F. H. Cuno.
M. L. Geary.

INVENTOR.
S. C. Arnold

BY
G. J. Delamater
ATTORNEY.

UNITED STATES PATENT OFFICE.

SAMUEL C. ARNOLD, OF DENVER, COLORADO, ASSIGNOR TO THE DENVER QUARTZ MILL AND CRUSHER COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

QUARTZ-MILL.

993,746.

Specification of Letters Patent.

Patented May 30, 1911.

Application filed March 23, 1909. Serial No. 485,249.

To all whom it may concern:

Be it known that I, SAMUEL C. ARNOLD, a citizen of the United States of America, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Quartz-Mills, of which the following is a specification.

This invention relates to certain new and useful improvements in quartz mills of the so-called roller type in which a plurality of crushing members have a rotatory movement in a circular crushing trough or mortar.

The objects of my invention reside in an improved method of mounting and driving the crushing rollers, in an improved method of feeding the ore to be crushed, in the provision of a mercury groove in the outer rim of the mortar to save a portion of the values discharged therefrom, and in other features of construction which will be fully brought out in the following specification in connection with the accompanying drawings in the various views of which like parts are similarly designated and in which—

Figure 1, represents a plan view of the machine, Fig. 2, a central, vertical section taken along the line 2—2 Fig. 1, Fig. 3, an elevation of the feeding device employed on the machine, Fig. 4, a fragmentary vertical section taken through one of the chutes which form part of the said device, Fig. 5, an enlarged fragmentary vertical section taken through the crushing trough and superposed parts and Fig. 6, a plan view of the crushing rollers, mortar and adjacent parts, as shown in Fig. 5.

In the drawings, let the reference numeral 2 designate the base or foundation structure of the mill upon which are mounted a plurality of chairs 3, which support the circular mortar 4. The latter consists of a disk 5 whose central hub 6, loosely surrounds a vertical shaft 7 which is revolubly mounted in a step box 8, secured upon the base. The disk 5 is formed, near its circumferential edge, with a circular, transversely arcuate depression for the reception of a correspondingly shaped annular die or crushing trough 9 in whose upper, concave surface, the ore is reduced. The disk 5 is furthermore provided with a surrounding horizontal flange 10 which supports a cylindrical screen 12 through which, in the operation of

the machine, the reduced ore, when fine enough, escapes from the mortar into a subjacent inclined annular trough 13 which is supported upon the base by means of a plurality of standards 14.

The screen is secured upon the flange 10, by means of a number of longitudinally adjustable clamps 15 and it is surrounded by a cylindrical concentrically disposed fender 16 which, being supported upon the outer edge of the trough 13, deflects into the latter the pulverized matter which is forcibly emitted through the meshes of the screen.

Rigidly secured upon the shaft 7 above the mortar 4, is the driving plate 17 which is formed with a circumferential, upwardly projecting rim and serves to transmit the rotary movement of the shaft to a plurality of circumferentially convex crushing rollers 18, whose shafts 19 are revolubly mounted upon the plate 17 in radial relation thereto. The driving plate is to this end, provided with two radially alined sets of upwardly projecting parallel cheek-plates for each of the rollers supported thereby, and these sets which, in the drawings are respectively designated by the numerals 20 and 21, constitute chairs in which the two journal boxes 22 and 23, which carry each roller-shaft 19, are movably disposed.

The outer box 22, against which the roller 18 bears, is free to move vertically in between the cheeks 22, while the inner box 23 is provided with laterally projecting trunnions 24 which are revolubly supported in correspondingly shaped seats 25 which are formed by indentations in the innermost vertical edges of the plates which constitute the chair 21 in which the box is disposed.

Washers 26 upon the shaft 19 engage the surface of the box 23 and are held in place by means of a nut 27 which is screwed upon the threaded extremity of the said shaft.

The above described arrangement permits a vertical displacement of the roller about a fulcrum which is provided by the trunnions 24 on the box 23; outward movement of the roller is prevented by the contact of the said trunnions with the seats 25 in which they are supported, and its displacement in opposite direction is averted by means of a spider 28 which is keyed upon the shaft 19 and whose outwardly projecting arms 29 engage the peripheral surface

of the trunnions by means of which the various crushing rollers comprised in the machine, are pivotally supported.

The crushing trough 13 is formed in its upper surface, surrounding the concavity in which the rollers 18 travel, with a circular groove or channel 30 whose bottom surface inclines to a point of discharge where a valve-controlled outlet 31 is located, and this groove is, in practice, filled with quicksilver with which values discharge over the edge of the mortar and too large to escape through the surrounding screen, amalgamate.

The feeding device employed in the improved mill consists of a circular hopper 32 whose bottom is provided with an upwardly extending hub 33 by means of which the device is secured upon the upper extremity of the upright shaft 19.

A circular apron 34 inclines downwardly from the lower portion of the hopper and extending over the driving plate 17 and the thereon supported journal boxes, effectually excludes dirt and particles of ore from the moving parts and thus aids in the effective operation of the mill.

To reach the various boxes for the purpose of lubrication or renewal, the apron 34 is provided with hand holes 35 which are normally closed by means of covers 36. The apron is furthermore formed with a plurality of downwardly inclined radially extending depressions 37 which communicate at their upper ends, with the interior of the hopper by means of openings in the bottom of the latter and these depressions, which when the parts are assembled are disposed in between each two rolls, constitute chutes through which the ore is fed from the hopper 32, into the crushing trough 9.

The shaft 7 which is preferably supported upon a nest of anti-friction rollers placed in the bottom of the step 8, carries, at a point below the mortar 4, a bevel gear wheel 38 which meshes with a pinion 39 at the end of a driving shaft 40 which is revolvably mounted in bearings 41 upon the base 2 and which carries, at its outer extremity, loose and tight pulleys 42 by means of which the shaft is operatively connected with a convenient source of energy.

Having thus described the mechanical construction of the improved quartz mill, its operation and the advantages derived from the improvements hereinabove set forth, will be readily understood.

The ore or other material to be crushed is fed into the hopper 32 at the upper extremity of the shaft, whence it is discharged through the inclined chutes 37 in the apron 34, into the annular crushing trough 9, in between each two successive rollers. The arrangement of the chutes and the rotary movement of the hopper with the shaft, as-

sure an even distribution of the ore in the concave runway of the die 9, and the shape of the open chutes positively averts clogging and consequent obstruction of the feeding process, which often occurs in machines of this class in which the ore is fed through circumferentially closed conduits. The ore being thus deposited in the trough, is at once, acted upon by the grinding rollers 18, which by their rotary movement about their respective axes and their simultaneous circular motion about the common vertical axis, will reduce it to a size suitable for concentration or, if so required, to a fineness adapted for amalgamation. By reason of the upward motion of the rollers about the fulcrums provided by the respective trunnions 24 on the bearing boxes 23, they will assume different levels to pass over the uneven strata of ore in the mortar and the gravitational force of the said rollers will thus cooperate with their grinding movement in the speedy and uniform reduction of the ore. The comminuted ore, together with the water supplied through the feed hopper, is by the action of the rollers, constantly thrown against the inner surface of the continuous screen 12, through whose meshes the smaller particles escape into the subjacent trough 13, while the larger parts fall back into the mortar or upon the mercury in the groove 30, with which the values contained in the deflected matter, amalgamate to be discharged through the outlet 31.

I am aware that crushing mills operating on the broad principle of that hereinabove described, are old and the improvements set forth in the preceding description relate more particularly to the construction shown and described in the application for patent of Charles Wallace, Serial No. 328,037, and were made with the express purpose of rendering a machine of proven impracticability, effective, reliable and of great practical value.

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

1. In a quartz mill, an annular mortar, a vertical shaft concentric therewith, crushing members within the mortar, mounted to rotate with the shaft and about their respective axes, and a feeding device comprising a hopper fixed concentrically upon the upper portion of the shaft, and having discharge openings in its lower portion, and an inclined apron surrounding said hopper and having radial depressions in communication with said openings, the circumferential edge of said apron extending above the mortar whereby matter moving downwardly along the upper surface of the apron, will fall in the mortar.

2. In a quartz mill, an annular mortar, a vertical rotatory shaft concentric therewith,

a driving plate fixed upon the shaft, boxes upon said plate, shafts mounted in said boxes, grinding members connected with the shafts, within the mortar, and a feeding device, comprising a hopper fixed concentrically upon the upper portion of the shaft and having discharge openings in its lower portion, and an inclined apron surrounding said hopper and having radial depressions in communication with said openings, the circumferential edge of said apron extending beyond that of the driving plate, whereby the latter is protected against matter falling beyond the edge of the hopper.

3. In a quartz mill, an annular mortar, a vertical rotatory shaft concentric therewith, a driving plate fixed upon the shaft, boxes upon said plate, shafts mounted in said boxes, grinding members connected with the shafts, within the mortar, and a feeding device comprising a hopper fixed concentrically upon the upper portion of the shaft and having discharge openings in its lower portion, and an inclined apron surrounding said hopper and having radial depressions in communication with said openings, the circumferential edge of said apron extend-

ing beyond that of the driving plate, whereby the latter is protected against matter falling beyond the edge of the hopper and the said apron having normally covered openings arranged to afford access to the boxes on said plate.

4. In a quartz mill an annular mortar, a vertical rotatory shaft concentric therewith, a driving plate fixed upon the said shaft, and having cheek plates arranged in pairs radially in relation thereto, bearing boxes movable between the cheek plates of each pair and having trunnions occupying corresponding grooves in the inner edges thereof, a movable spider upon the vertical shaft in engagement with the trunnions of the various boxes so as to prevent displacement thereof, shafts rotatable in the boxes and grinding members on the shafts, within the mortar.

In testimony whereof I have affixed my signature in presence of two witnesses.

SAMUEL C. ARNOLD.

Witnesses:

G. J. ROLLANDET,
O. H. BROWN.