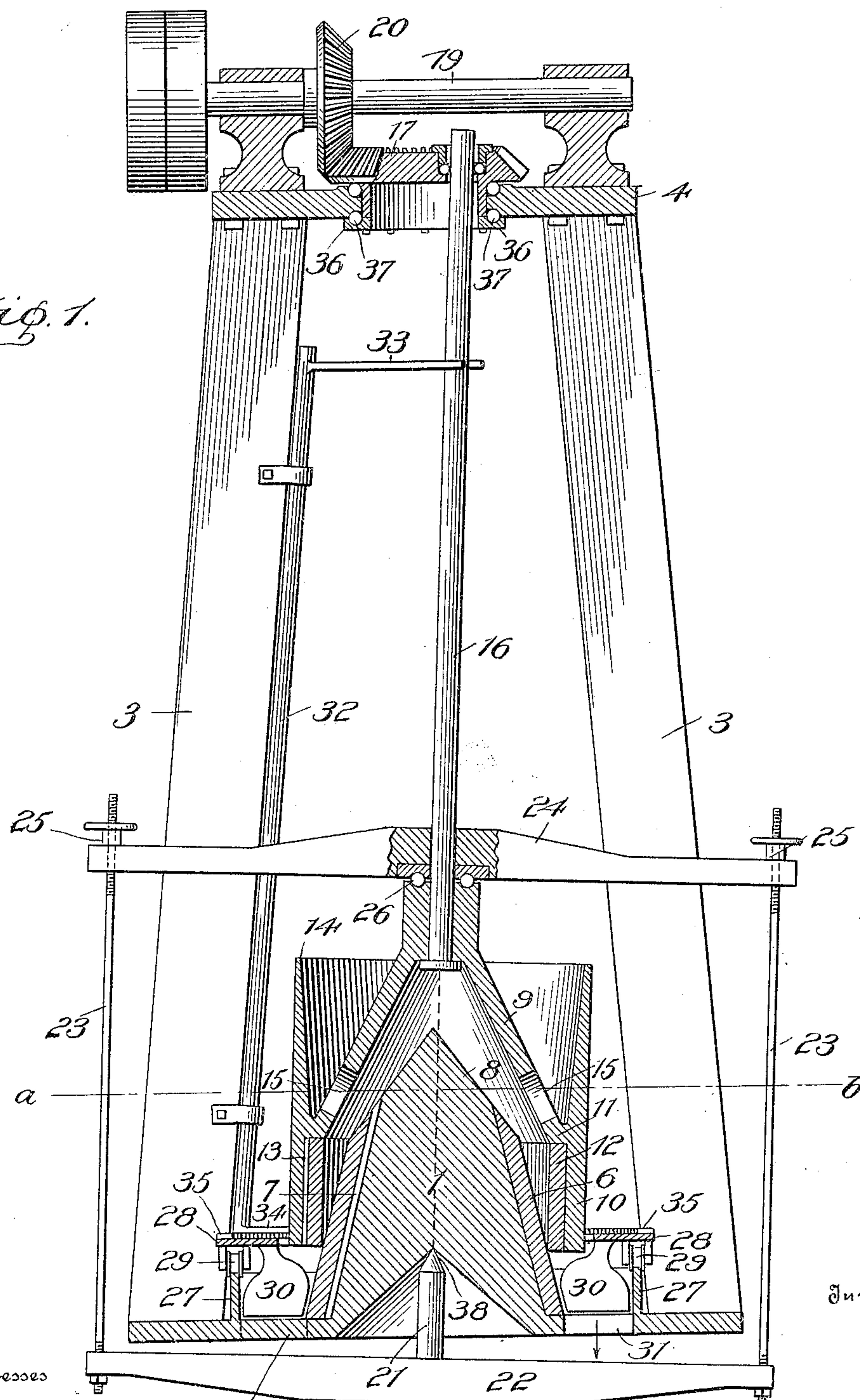


A. TETRAULT.  
ORE CRUSHER AND PULVERIZER MACHINE.

APPLICATION FILED DEC. 10, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



Inventor

Witnesses

Edwin L. Bradford  
Anne B. Johnson,

By

Alexis Tetrault  
Johnson & Johnson Attorneys

A. TETRAULT.  
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2 SHEETS—SHEET 2.

Fig. 2.

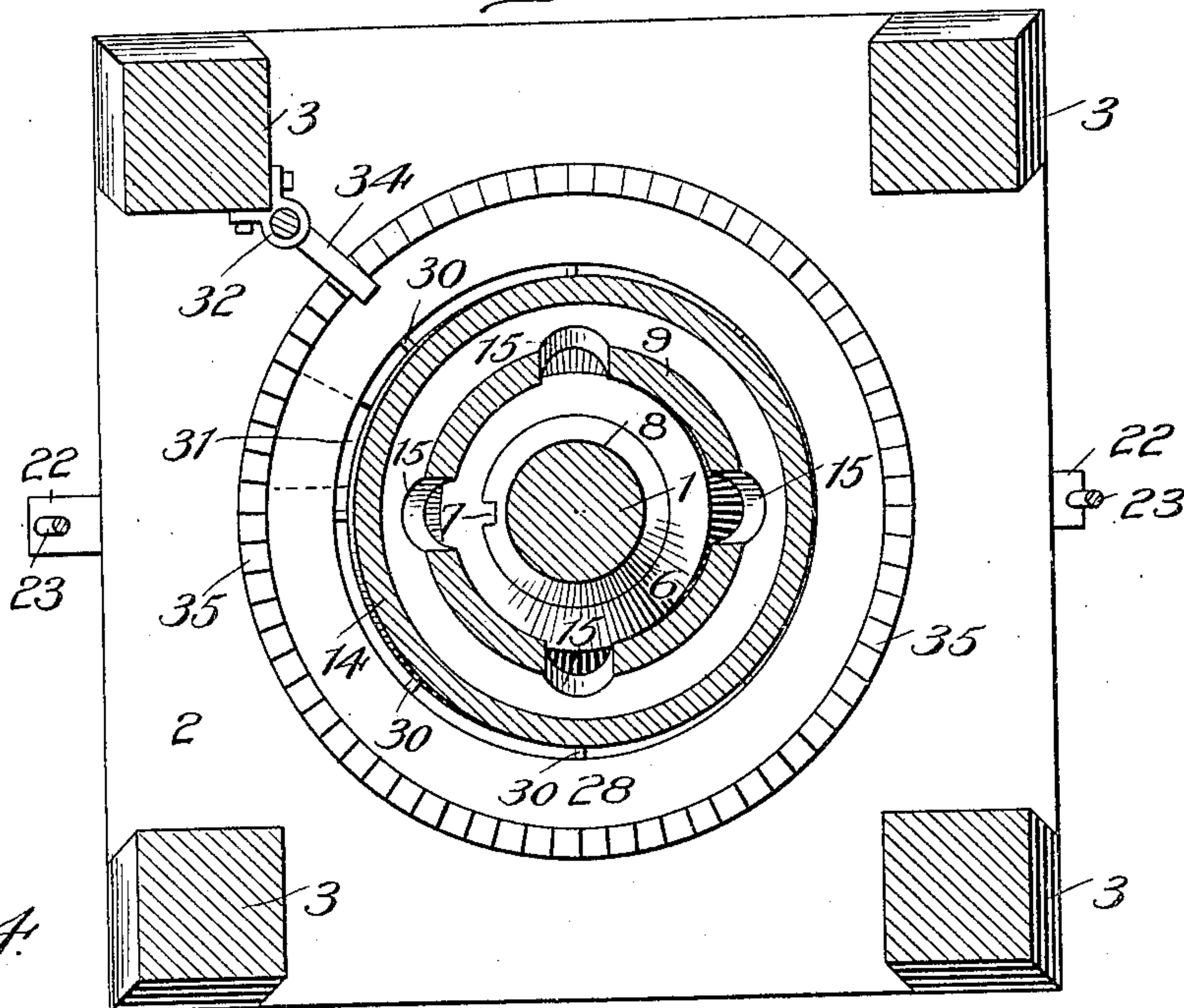


Fig. 4.

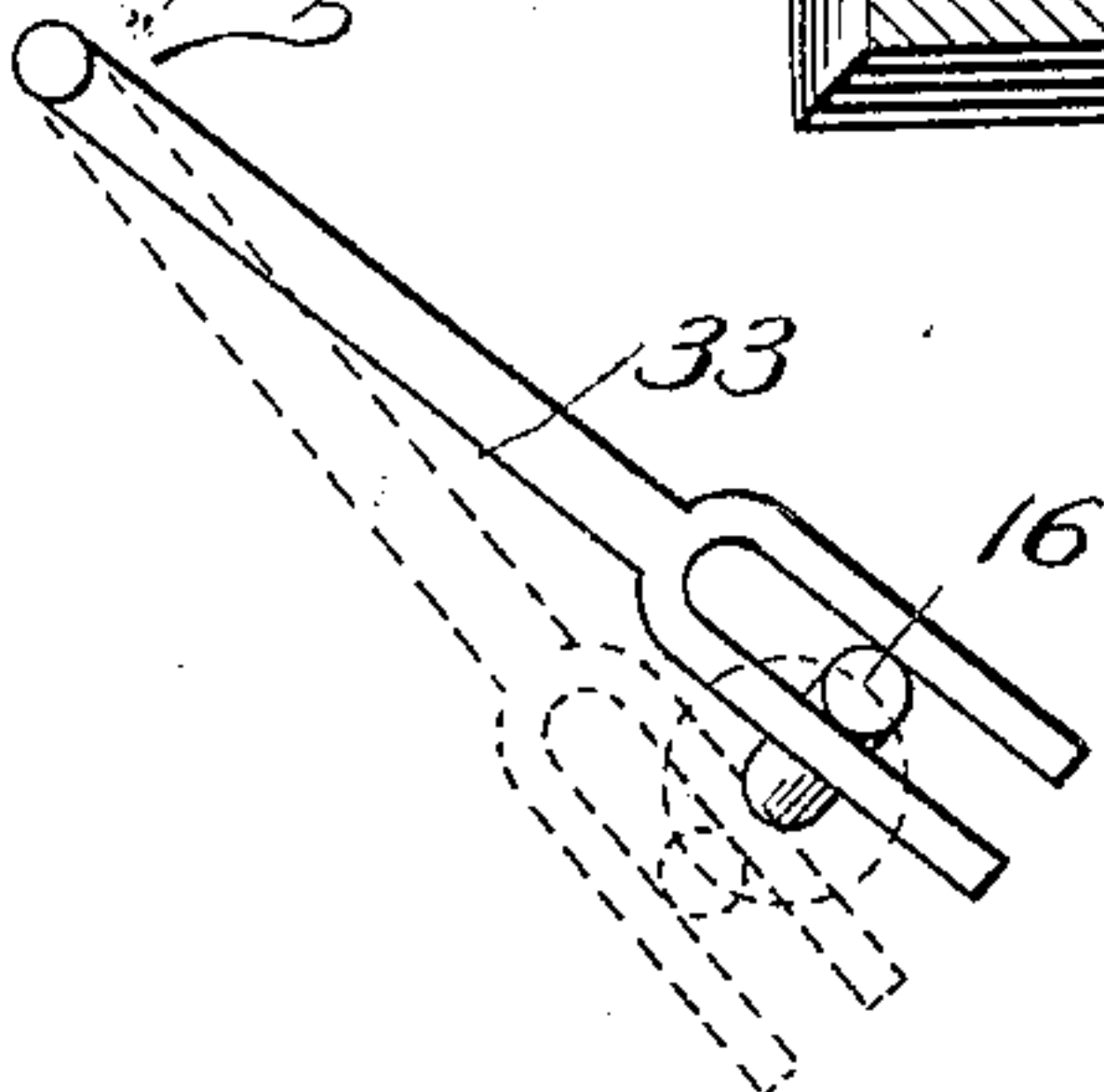


Fig. 3.

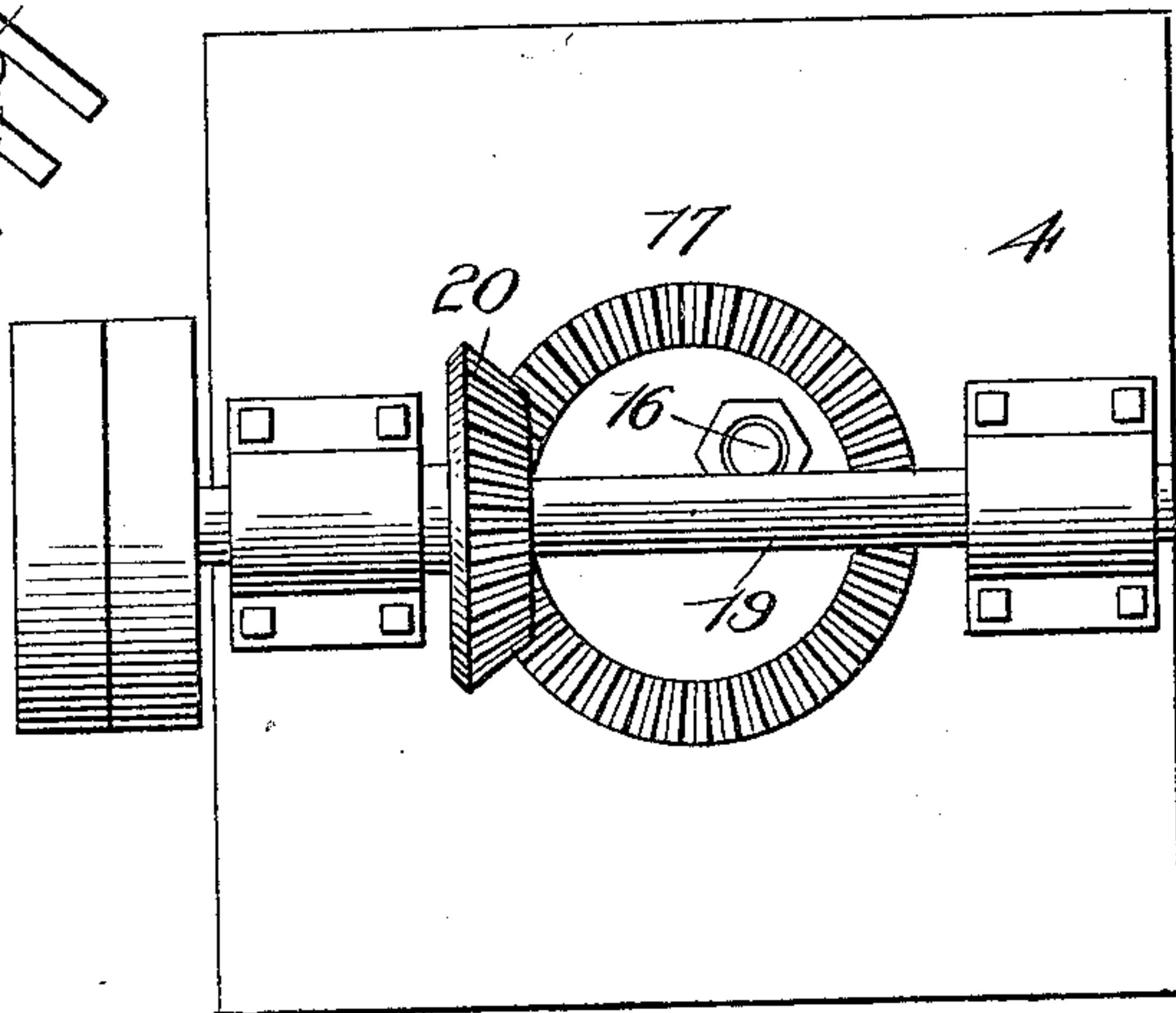
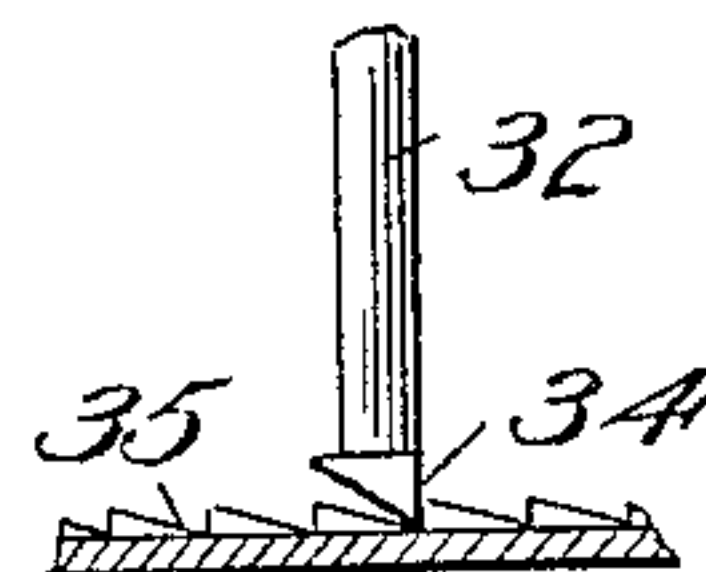


Fig. 5.



Inventor

Alexis Tetrault

Witnesses

Edwin L. Bradford  
Anne B. Johnson,

By

*Johnson Johnson*

Attorneys



# UNITED STATES PATENT OFFICE.

ALEXIS TETRAULT, OF BOULDER, COLORADO, ASSIGNOR OF ONE-HALF  
TO EDWIN C. POHLE, OF BOULDER, COLORADO.

## ORE CRUSHER AND PULVERIZER MACHINE.

No. 804,780.

Specification of Letters Patent.

Patented Nov. 14, 1905.

Application filed December 10, 1904. Serial No. 236,318.

*To all whom it may concern:*

Be it known that I, ALEXIS TETRAULT, a citizen of the United States, residing at Boulder, in the county of Boulder and State of Colorado, have invented certain new and useful Improvements in Ore Crusher and Pulverizer Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention herein is directed to the production of an improved ore-crusher and in which the crushing and pulverizing operation is effected by the gyrating movement and the weight and pressure of a shell directly upon the walls of a fixed cone; and my said invention consists of certain novel parts and combination of parts, which are particularly pointed out in the claims appended hereto.

The following description, read in connection with the accompanying drawings, will enable any one skilled in the art to which my invention relates to understand and to practice it in the form in which I prefer to employ it; but it will be understood that my invention is not limited to the precise form and construction herein illustrated and described, as various modifications may be made without exceeding the scope of the claims and the invention set out therein.

Referring to the drawings, Figure 1 represents a vertical section of an ore-crusher embodying my invention of a gyrating shell adapted to have a wobbling movement upon conical walls. Fig. 2 is a horizontal section taken on the line *a b* of Fig. 1. Fig. 3 is a top view of the same. Fig. 4 shows in detail the device for operating the scrapers for delivering the pulverized ore as it comes from the cones. Fig. 5 is a detail of the ratchet feed device for operating the scrapers.

A stationary cone 1 rises from a base-plate 2, from which rise four standards 3, connected by a cap-plate 4, which supports the shell-operating mechanism. A hard-steel annulus 6 fits upon the fixed cone, rests upon its base-plate, and is prevented from turning upon the cone by being keyed to it, the annulus for this purpose having ribs 7, which engage grooves in the walls of the fixed cone. Preferably the cone terminates at the top in a more acute cone 8, with the sloping walls of

which the upper edge of the steel annulus coincides to make the surface pitch regular. The shell is of peculiar construction and partially incloses and has a gyrating movement directly upon the walls of the cone annulus. For this purpose the upper portion of the shell forms an inverted cone 9, which terminates in a bottom cylindrical offset part 10, forming an interior recess and an annular shoulder 11 at the junction of the cone with the cylindrical offset. Abutting this shoulder a steel annulus 12 is fitted to the inner recessed wall of the cylindrical part of the shell and secured to it by ribs 13 on the annulus-engaging grooves in the shell. The inner wall of this annulus forms an acute angle with the walls of the fixed cone, and the edge at the lower end of the annulus rests directly upon the walls of the annulus of the fixed cone at a level that will bring the top of the shell annulus about level with the top of the annulus of the fixed cone, forming thereby a V-shaped grinding-space between the two steel rings. The cylindrical part of the shell is extended upward to form a circular trough or hopper 14 around the conical part of the shell to form a supply-receptacle for the ore, and from it the ore is fed, through openings 15 at the base of the conical walls of the shell, into the pulverizing-space between the two rings, there being for this purpose a plurality of such openings, so as to provide a regular and uniform feed to the crushing-rings. This means of providing an annular supply-hopper on a gyrating shell forms an automatic feed for the machine and is filled either by hand or otherwise.

An important feature of my invention is a cylindrical shell resting with its full weight and pressure in all its movements by its edge on the fixed cone, hugging the cone-walls with a close-fitting edge, and holding the pulp in the grinding-recess, letting it pass down only as dust. A guide-shaft 16, firmly connected to the apex of the shell, rises and freely pierces an opening eccentrically formed in a bevel-gear 17, mounted in the top plate 4 on the frame-posts, so that the rotation of the gear will give and control a gyrating movement to said shaft and a corresponding movement to the shell upon the fixed cone, and thus give the pulverizing action upon the ore. A power-driven shaft 19, mounted on the frame, carries a bevel-gear 20, which engages the bevel-



gear 17 in the opening in which the shell-shaft freely engages and is driven by a fixed and loose pulley. It is important that the shell while resting freely upon the steel ring of the fixed cone in its pulverizing function should have provision for vertical adjustment for increasing its pressure on the fixed cone, and this is effected as follows: The fixed cone is preferably hollow and is adapted to receive and center a stud 21, fixed to and rising from a tension-beam 22, which is suspended at each end by a vertical rod 23, to the upper ends of which a pressure-beam 24 is connected and through an opening in which the shell-operating shaft passes. The suspending-rods pass freely through the ends of the pressure-beam and have hand-wheel nuts 25, by which the suspended beam can be adjusted to maintain the pressure-beam under more or less tension and to resist the tendency of the shell to rise under the resistance offered by the ore against the shell-ring, as the connections for effecting the pressure are exerted from the fixed cone upon the shell. By this construction the fixed cone is made an abutment, from which pressure is put upon the shell to regulate the fineness of the pulverizing operation. At its point of suspension the shell is provided with ball-bearings 26, on which the pressure-beam is seated to reduce the friction, and it is important to note that the gyrating movements of the shell-shaft are communicated to the pressure-beam and through its suspension-rods to the suspended tension-beam, so that in every position of the shell it will be under the same tension in its pulverizing contact with the walls of the fixed cone.

A ring 27 surrounds the base of the cone and forms a pulp-trough into which the pulverized ore drops in the gyrating movements of the shell around its edge contact with the walls of the fixed cone, and from this trough the pulp is conveyed by any suitable means.

The means I have shown consists of a ring-plate 28, mounted to rotate on suitable roller-bearings 29 upon the edge of the trough-forming ring 27 and carries on its under side a plurality of scrapers 30, traversing the trough and delivering the pulverized ore therefrom through a bottom opening 31. The ring-plate is rotated by the gyrating movements of the shell-shaft by means of a vertical rod 32, secured to one of the standards and connected by a forked arm 33 to the shell-shaft, while at the lower end said rod has a ratchet-arm 34, adapted to engage a ratchet-ring 35 on the scraper-carrying plate, and thereby cause the rotation of the scrapers within the trough. For this purpose the ratchet-rod receives a rocking movement from the gyrating movements of the shell-shaft, as shown by dotted lines in Fig. 4, and imparts such rocking movements to the ratchet-arm, the free mount-

ing of the rod allowing it to rise and fall to cause the ratchet-arm to move over the ratchet-teeth in its backward movements.

The shell-actuating gear may be mounted in any suitable way, and I have shown said gear provided with a ring 36 on its under side, fitted to rotate on ball-bearings 37, housed in the top plate, while the shell-shaft may have ball-bearings seated within the opening in the gear through which said shaft passes.

In whatever position the shell assumes in its gyrating movements it must rest at every point under the same pressure upon the walls of the fixed cone, and for this purpose the points 38 of the bearing of the center stud 21 on the fixed cone is at a point about on a level with the bottom of the shell or at such point as will cause the axis of the center stud and the axis of the shell-actuating shaft to be coincident in all positions of the shell, as seen by dotted lines in Fig. 1.

While the weight of the shell upon the fixed-cone ring will cause a pulverizing of the ore, yet the degree of fineness results from the degree of pressure put upon the shell by its connection with the tension-beam. The shell-operating shaft passes freely through the opening in the gear about three inches from its center and by the rotating of which the shaft has the gyrating movements imparted to it, and the friction on the shaft produced by the turning of the gear will cause said shaft to have a continuous but slow rotation, and thereby give the shell a compound movement upon the walls of the cone-ring, and thereby cause the wearing at the contact of the edge of the shell-ring and the walls of the cone-ring to be true and even at all points.

The apex of the fixed cone has a greater pitch than its annulus, while the conical body of the shell has a less pitch, thereby forming an annular chute of the apex of the fixed cone, into which the openings in the shell-walls communicate to cause the material to be fed into the crushing-space.

The seating of the annulus in a recess and against an overhanging shoulder in the shell and anchoring it to the shell to prevent the rotation of the annulus renders it easy to remove and replace said annulus, and in like manner the steel annulus of the fixed cone may be renewed.

So far as I know and can find I am the first to support a gyrating grinding-shell by an unbroken circular edge bearing under pressure directly upon the side walls of a fixed cone, whereby a line-contact of pulverizing-surfaces is obtained to effect a fine reduction of the ore-pulp, and to maintain such line-contact at every point of such edge in the circle of the shell under unyielding pressure applied to the shell from the under side of the fixed cone as an abutment from which to apply a downward pressure upon the shell.



I claim—

1. In an ore crusher and pulverizer, a frame, a cone fixed on the base thereof, and a ring shell freely resting by its lower edge on the walls of said cone, means for imparting gyrating movements to said shell, means for applying pressure upon said shell centrally at its top from a point centrally at the bottom of said fixed cone, and means for feeding the material to the crushing-surfaces.

2. In an ore crusher and pulverizer, a frame, a cone fixed on the base thereof and a ring shell mounted relatively to said cone to cause it to rest with an unbroken annular grinding-edge contact upon the side walls of the cone, means for imparting gyrating movements to said shell, means for applying pressure upon said shell, whereby in its gyrating movements the grinding edge of the shell has uniform pressure at every part of its grinding edge upon the conical walls, and means for feeding the material to the crushing-surfaces.

3. In a crusher and pulverizer, a fixed cone, a ring shell having an edge contact with the side walls of said cone, a shaft fixed to and extending from said shell, a stud centrally engaging the bottom of said fixed cone, means for imparting gyrating movements to said shell-shaft, the bearing-point of said stud against said cone and the circular edge contact of said shell with the side walls of said cone being substantially on the same horizontal plane, and means connecting said stud and shell-shaft for maintaining the continuity of the pressure of the shell edge upon the cone-walls at every point of the shell edge.

4. In a crusher and pulverizer, a frame, a fixed cone having a steel annulus conforming to said cone, a shell having at its base a cylindrical steel annulus, supported by its lower edge upon the walls of said cone, a shaft fixed to and extending from the top of said shell, a base tension-beam having a stud centrally engaging said fixed cone, a rod rising from each end of said tension-beam, a pressure-beam engaging said shaft, supported upon said shell, and having its ends connected to said rods, means for adjusting the pressure of said beam upon the shell, and means for imparting to said shaft a gyrating movement.

5. In a crusher and pulverizer, a fixed cone, a shell having an annulus supported at its lower edge only upon the walls of said cone, means for imparting a gyrating movement to said shell, and means acting against the fixed cone for imparting pressure to said shell under its gyrating movement, and a feed-hopper carried by said shell.

6. In an ore crusher and pulverizer, a fixed cone, a pulverizing-shell freely supported upon the walls of the cone, means for imparting to said shell a gyrating movement, a stud having a central bearing upon the under side of said cone, a guide and controlling shaft for

said shell and means for imparting to said shaft a gyrating movement, the said center stud being so disposed and related to said shaft as to cause the lower edge of said shell to have an unbroken supporting contact at every point of its annular edge upon the walls of said cone, and means connecting the fixed cone and the top of the shell for maintaining pressure of said shell at its edge contact upon said cone.

7. In an ore crusher and pulverizer, a fixed cone, a shell, a guide-shaft fixed to and rising centrally from said shell, means for imparting to said shell-shaft gyrating movements upon the side walls of said shell, and means for imparting pressure of the shell upon the walls of the cone, consisting of a suspended base-beam having a stud bearing centrally against said fixed cone, a tension-beam movable laterally with the shell-shaft and resting upon the top of the shell, and nutted rods connecting the movable top beam and the base-beam and adapted to conform to the gyrating movements of the shell-shaft.

8. In an ore crusher and pulverizer, a fixed cone, a shell, a guide-shaft fixed to and rising centrally from said shell, means for imparting to said shell-shaft gyrating movements, a trough surrounding the base of said cone, and means rotatable upon and within said trough operated intermittently by the gyrating movements of said shaft whereby the pulverized pulp is discharged from said trough.

9. In an ore crusher and pulverizer, a fixed cone, a shell supported by its lower edge upon the walls of the cone, a guide-shaft fixed to and rising centrally from said shell, means for imparting to said shaft a gyrating movement, a trough surrounding the base of the cone, an annular ring having a plurality of scrapers and mounted upon the wall of said trough, a ratchet carried by said ring, a rod having an arm engaging said ratchet-ring and also having an arm engaging said shell-guide shaft, whereby the gyrating movements of said shaft cause the scrapers to traverse said trough.

10. In an ore crusher and pulverizer, a fixed cone, a shell supported at its lower edge upon the walls of the cone, a guide-shaft fixed to and extending centrally from said shell, a gear mounted at the top of said frame and having an eccentric opening within which said shaft terminates, means for rotating said gear, a trough surrounding the base of the cone, a plurality of scrapers mounted on the outer wall of and within said trough, and means for rotating said scrapers engaging and operated by the gyrating movements of said shell-shaft.

11. In an ore crusher and pulverizer, a fixed cone, a shell supported at its lower edge upon the walls of said cone, a guide-shaft fixed to and rising centrally from said shell, means for imparting to said shaft a gyrating move-

ment, a trough surrounding the base of the  
cone, a plurality of scrapers mounted on the  
outer wall of and within said trough, and  
means for rotating said scrapers operated in-  
5 termittently by the gyrating movements of  
said shell-shaft.

In testimony whereof I have signed my name

to this specification in the presence of two sub-  
scribing witnesses.

ALEXIS TETRAULT.

Witnesses:

J. H. LITTLE,  
F. S. BURR.