No. 845,067. PATENTED FEB. 26, 1907.

A. L. ENGELBACH.

ORE CRUSHING AND GRINDING MILL.

APPLICATION FILED AUG. 21, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

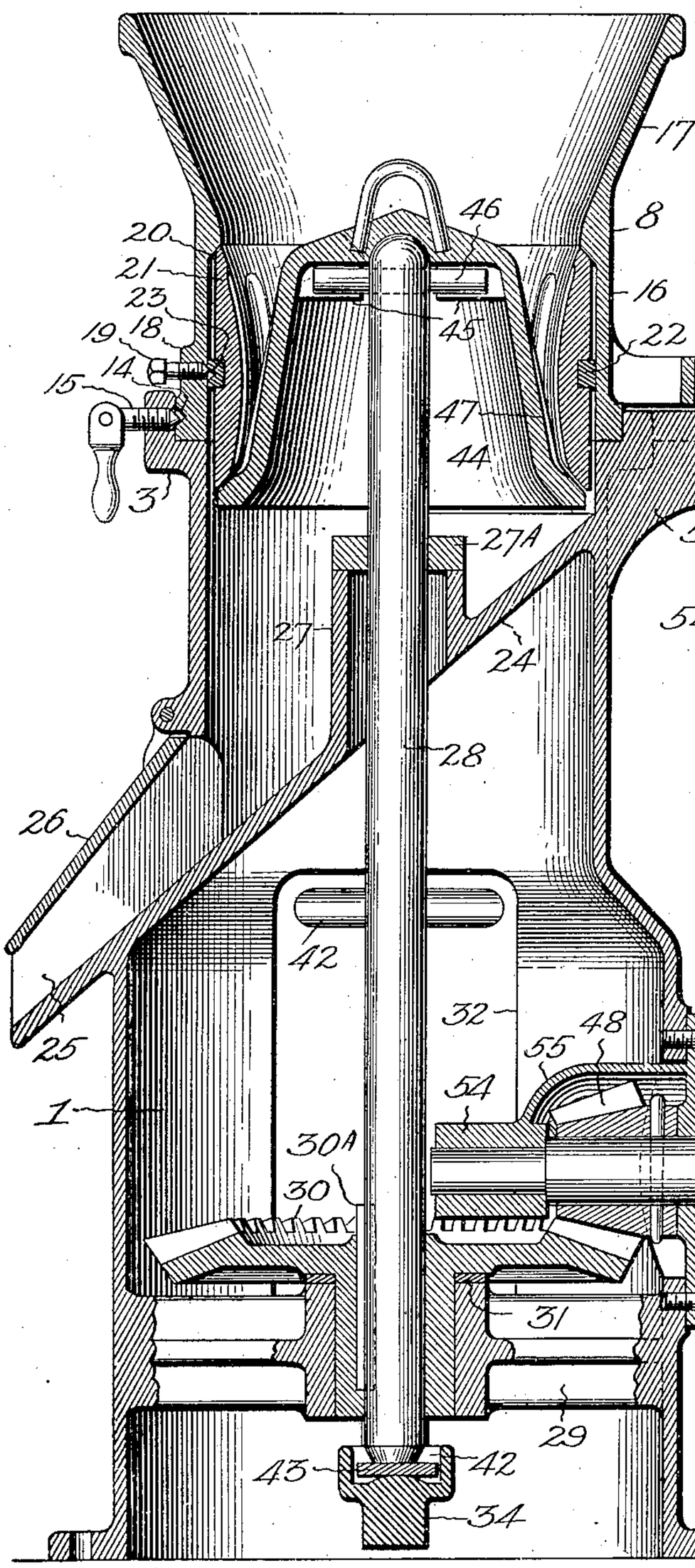


Fig. 6.

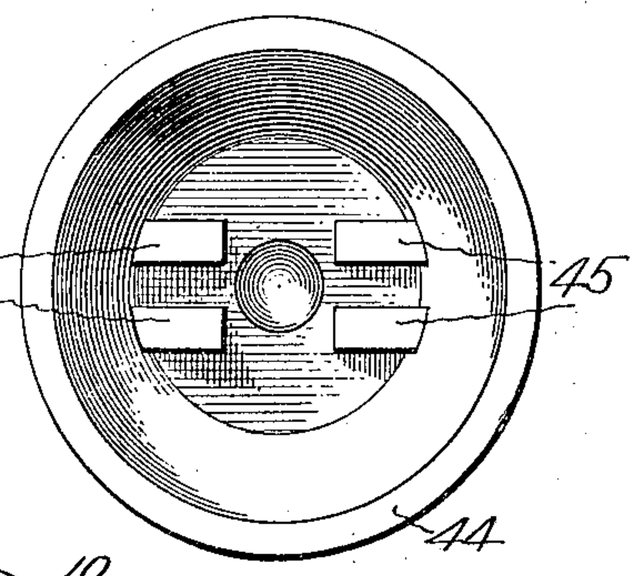
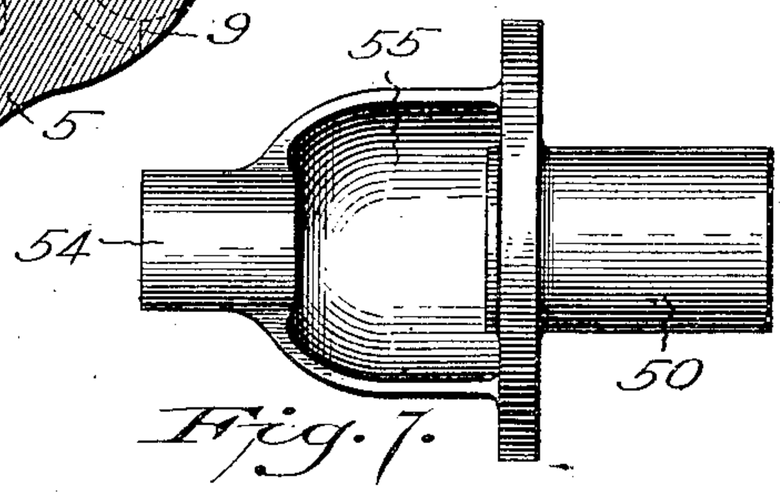


Fig. 7.



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2 SHEETS—SHEET 2.

Fig. 3.

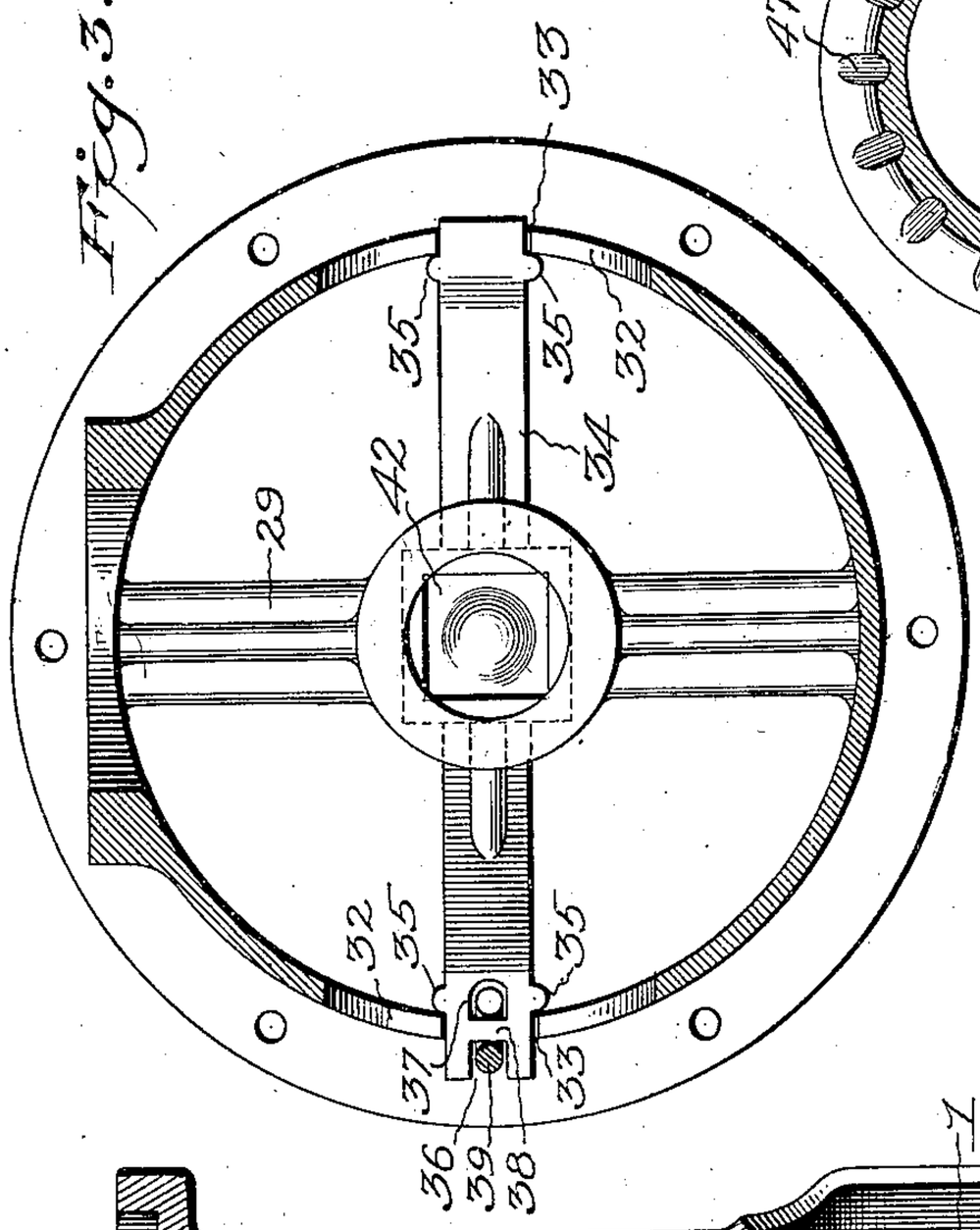


Fig. 5.

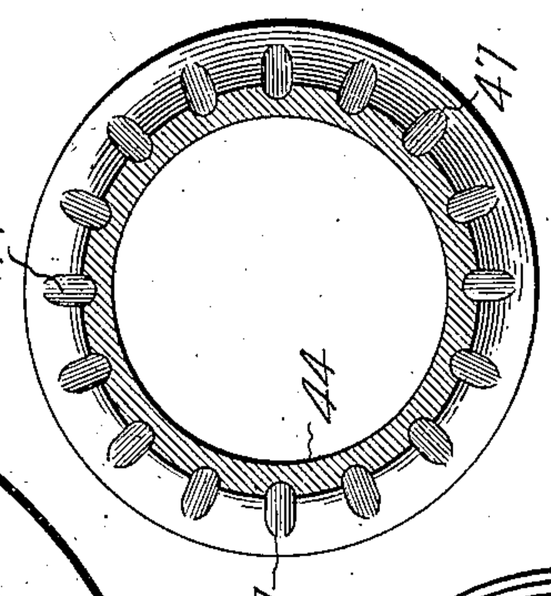


Fig. 4.

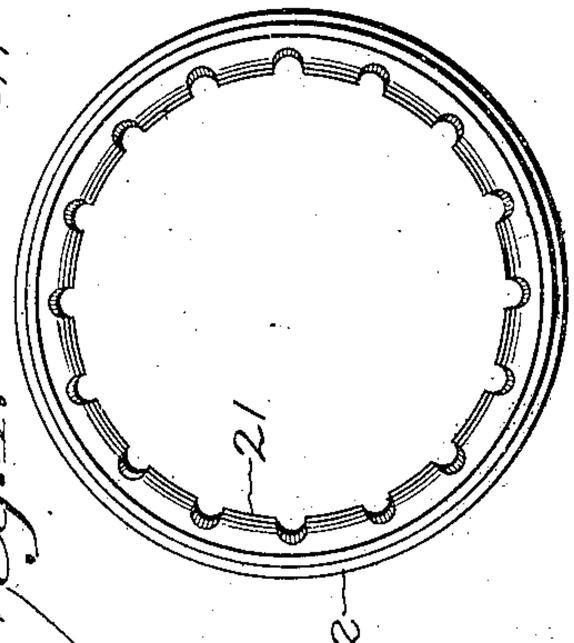
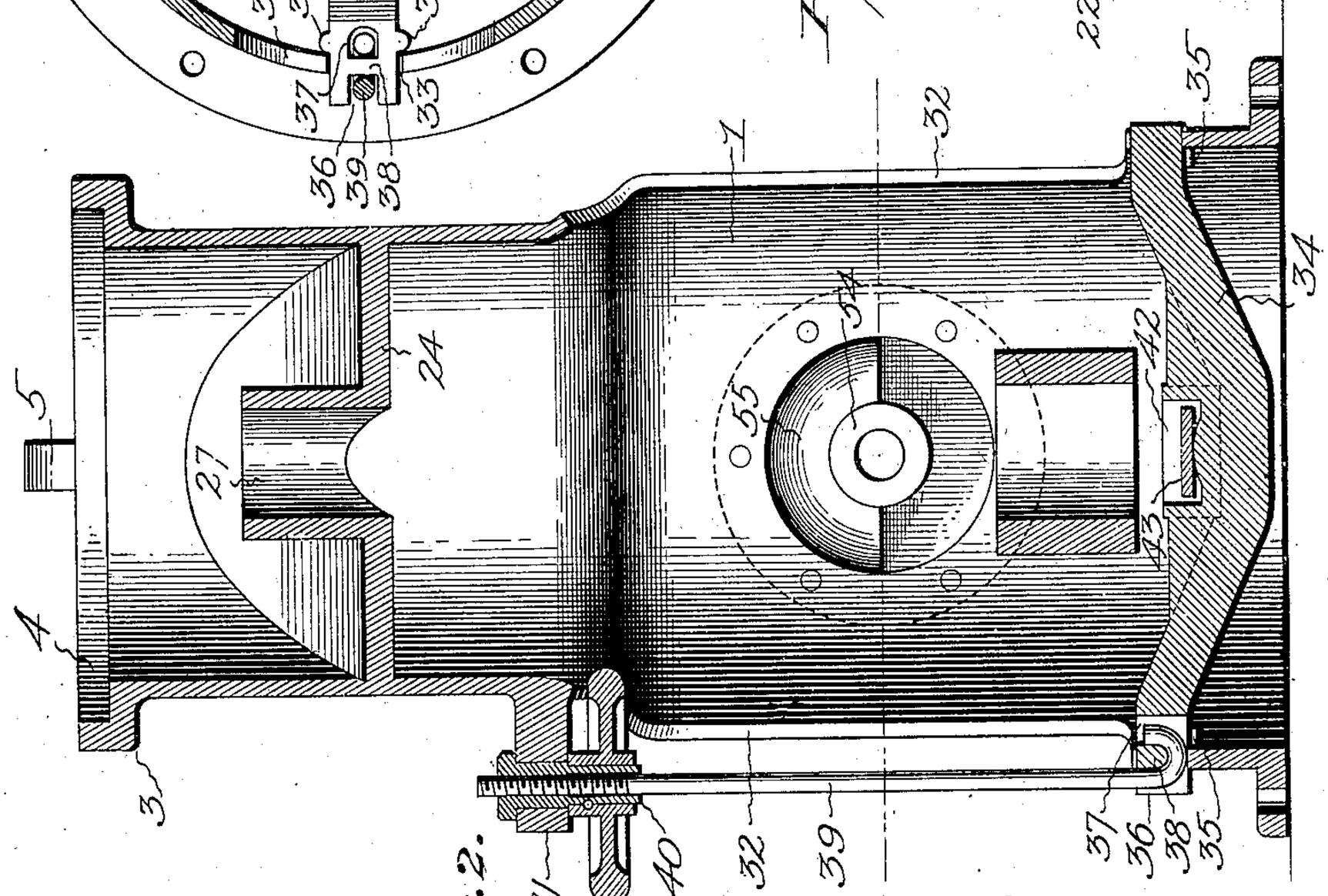


Fig. 2.



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UNITED STATES PATENT OFFICE.

AUGUSTUS L. ENGELBACH, OF DENVER, COLORADO.

ORE CRUSHING AND GRINDING MILL.

No. 845,067. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed August 21, 1906. Serial No. 331,469.

To all whom it may concern:

Be it known that I, AUGUSTUS L. ENGELBACH, a citizen of the United States of America, residing at the city and county of Denver and State of Colorado, have invented a new and useful Ore Crushing and Grinding Mill, of which the following is a specification.

My invention relates to improvements in ore crushers and grinder mills; and the objects of my invention are, first, to provide a simple, compact, powerful ore-crushing mill provided with a vertical adjustment that has a pivotal step-bearing; second, to provide an ore-crushing mill having a hinged hopper and means for securing the hopper with a downward clamping pressure to the top of the ore-crusher's frame; third, to provide an ore-crusher provided with a driving shaft and pinion having a dust-proof bearing. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical sectional view through the improved mill. Fig. 2 is a vertical sectional view of the body of the mill, taken at right angles to the section shown in Fig. 1, the hopper, dies, shaft, and operating-gears being omitted, the adjustable shaft-support and means for adjusting the same being clearly illustrated. Fig. 3 is a horizontal sectional view on the line 3 3 of Fig. 2. Fig. 4 is a plan view of the die-ring. Fig. 5 is a horizontal sectional view through the bell-die. Fig. 6 is a bottom plan view of the bell-die, and Fig. 7 is a bottom plan view of the drive-shaft bearing.

Referring to the drawings, the numeral 1 designates the casing or frame of my improved ore-crushing mill, which is provided with a flange which is adapted to be secured to a floor or to a suitable foundation. This frame 1 is preferably made round, although it may be made of any other suitable form. The top portion of the upper part of the frame is preferably made a trifle smaller in diameter, and its top edge is surrounded by a cup-shaped flange 3. The frame or shell is hollow, and its top flange is provided with an axial bore 4, that terminates in a shoulder at the bottom of the counterbore. At one side of the cupped flange an ear or lug 5 is formed, to which is pivotally secured by a pin 6 a pair of ears 7, that are formed on the bottom of a hopper 8, the lower edge of which terminates in a bead, which is finished to fit within and against the side of the bore and bottom of the shoulder. Stop-shoulders 9 are formed on the lower side of the ear of the frame, and similar stops 10 are formed on the ear of the hopper, the faces of which are arranged to oppose and engage the faces of the stop 9 as the hopper is swung over and limit and stop the hopper in a tilted-over and swung-back position. The bead on the end of the hopper is provided at a point opposite the ears with a V-shaped hole 14, and a bevel-pointed screw 15 is threaded through the cup-shaped flange 3 of the frame in a position that will permit its bevel-point to bear against the lower side of the V-shaped hole. A yoke-handle is pivotally connected to the outer end of the screw and normally hangs downward at right angles to the screw; but when the screw is tightened by turning it its point presses against the lower side of the V-shaped hole and forces and holds the hopper with a constant downward clamping pressure against its seat in the top flange of the frame of the mill. This hopper comprises a substantially straight body portion 16 and a flaring hopper portion 17, that projects from the top of the body portion. The outside of the body portion of the hopper is provided at intervals with projecting lugs or bosses 18 above its lower beaded edge, each of which has a threaded hole in which is screwed a bevel-pointed screw 19.

The interior diameter of the body portion of the hopper is greater than the interior lower terminal edge of the hopper, and at the junction of these two diameters a beveled lip 20 is formed, and in the body portion of the hopper a cylindrical die-ring 21 is placed, the upper edge of which is beveled to fit snugly under and against the beveled lip 20. This cylindrical die-ring is preferably cast of chilled cast-iron or steel castings or of any metal for crushing purposes, and a soft-metal ring 22 is cast circumferentially around it at a point that will bring the ring opposite the points of the bevel-pointed set-screws when the die-ring is in position in the body of the hopper with its upper edge against the beveled lip. V-shaped holes 23 are formed in the periphery of this soft ring opposite the points of each set-screw, and these V-shaped or tapering holes are positioned in such a manner that the points of each set-screw will bear against their upper sides. Consequently when the set-screws are screwed up tight against the upper side of these tapering holes the die-ring is forced upward and its top edge is

clamped under a constant upward clamping pressure against the beveled lip of the hopper. Consequently it is held rigidly in place. The lower end of this die-ring preferably extends a short distance below the lower edge of the hopper into the body of the frame of the mill. The interior peripheral surface of this die-ring is preferably convexed from its top to its lower edge. Below the die-ring the body of the machine is formed with an integral partition 24, which extends diagonally across the body from a point adjacent to the lower edge of the die-ring to a point about midway of the height of the body, where it extends far enough beyond the outer periphery of the body to form the bottom of a discharge-spout 25, the sides of which are integral with the spout and with the body. A cover 26 rests upon the top of the spout and is hinged to the body as shown. The partition 24 is provided centrally with an upwardly-projecting hub 27, through which loosely extends the upper end of a shaft 28, which operates a bell-shaped die that is positioned within the die-ring.

Near the lower end of the body of the mill is formed an integral bar or support 29, the central portion of which is formed into a bearing in which is journaled the hub of a horizontal beveled gear-wheel 30, a fiber washer 31 being interposed between the top of the bearing and the bearing portion of the gear-wheel. On the opposite sides of the lower half of the mill and at right angles to the bar 29 are formed large openngs 32, the lower edges of which are provided centrally with notches or recesses 33, in which rest the ends of a supporting-lever 34, the said ends of the lever adjacent to the inner periphery of the body of the mill being formed with lugs 35, which prevent any endwise movement or displacement of the lever. One end of this lever extends slightly beyond the opening and is formed with a vertical groove 36 and just beyond with a vertical aperture 37, the metal between them forming a bar 38, which is engaged by the hooked end of a vertical rod 39, the upper end of which is threaded to a flanged sleeve 40, that is journaled to a lug 41, which projects from the side of the mill. A hand-wheel 42 is rigidly secured to the sleeve below the lug, by turning which the threaded rod is raised or lowered, as well as the supporting-lever to which it is attached.

Upon the top of the supporting-lever and at the central portion thereof is formed a cup-bearing 42, the bottom of which is formed with a slight semispherical projection, upon which is placed a plate 43, which fits loosely within the cup 42, and upon this plate rests the lower end of the shaft 28, which end is preferably case-hardened to prevent excessive wear. This lower end of shaft 28 passes through the hub of the beveled gear 30 and is secured to it by a key 30^A, which insures the rotation of the gear, but at the same time allows the shaft to have a vertical sliding movement through the wheel. The cup is filled with a suitable lubricant, and the plate 43 will adjust itself when the lever is raised or lowered, so as always to rest squarely against the lower end of the shaft. Upon the top of the hub 27 of the diagonal partition is placed a collar 27^A, which fits the shaft 28 tight enough to prevent the dust arising from the finely-ground ore from getting into the lower half of the mill and settling upon the gear-wheel 30.

The upper end of the shaft is rounded, and a bell-shaped die 44 rests on top of it, a concaved recess being formed in the top of the die for that purpose. Two pairs of lugs 45 are formed on opposite sides of this recess, and a pin 46 extends through the end of the shaft in a position to lie between these lugs. This pin I term the "driving-pin," as when the shaft is rotated it engages the lugs and rotates the bell-die. This bell-die, as its name implies, is of bell shape, and it is positioned within the die-ring and is made so that its lower edge is as large as the lower diameter or the lower end of the die-ring, and the lower edge of the bell-die is made of the same curvature, so that it will fit closely the curvature of the lower edge of the die-ring; but the sides of the bell-die from its lower edge portion are preferably made a straight gradual taper that converges from its lower portion to close to the top, which is made large enough in diameter relative to the inner diameter of the die-ring to provide a tapering space between the two of any predetermined size required or desired for the size of the ore to be fed to the mill. This bell-die is made of chilled cast-iron or steel castings or of any other suitable metal for crushing ore or rock, and its apex is provided with a ring by which it may be lifted to be placed on or removed from its shaft. The exterior surface is provided with vertically-arranged narrow grooves 47, that are positioned at equal distances apart throughout its circumference. The die-ring is also provided with vertically-arranged narrow recesses or channels spaced equidistant apart around its interior diameter. It is necessary that the vertical bell-die shaft and the bell-die be made vertically adjustable relative to the die-ring in order to crush ore to different grades of fineness, and while there are a number of ways in which this bell-die and its shaft may be adjustably raised and lowered I preferably carry out this feature of my invention by means of the supporting-lever and rod and hand-wheel for adjusting the same, and in this way the bell-die may be brought as close as desired to the lower edge of the die-ring or moved away to leave any desired size of opening between the two, enabling rock or ore to be crushed to any degree of fineness required.

The beveled gear 30 is driven by a pinion 48, which is secured by a pin to a driving-shaft 49, which is journaled in a bearing 50, provided with a flange that is bolted to the side of the frame. The shaft extends beyond the bearing, and a tight and a loose pulley 51 and 52, respectively, are secured to it, the hub of the tight pulley being placed against the end of the bearing, and a collar 53 is secured on the end of the shaft and secures the loose pulley on the shaft. The inner end of the shaft also extends beyond the pinion, and a bearing 54 is journaled to it. This bearing forms a part of the bearing 50 and is connected to it by a web-shaped hood 55, which projects from the flange of the bearing and preferably forms an integral part of it. This hood surrounds the pinion and makes a substantially dust-proof bearing for both pinion and shaft.

The operation is as follows: The driving-shaft and pinion are rotated by a belt from a suitable source of power, which imparts rotary motion to the gear and the vertical shaft and the bell-die within the die-ring. Ore or rock is then fed into the hopper and drops into the circumferential wedge-shaped space between the bell-die and the die-ring and into the channels of the die-ring. As the bell rotates its grooves and those of the die-ring catch the ore and break and crush it, and as the ore or rock works down between and through the die-bell and die-ring it is crushed finer and finer, and, if desired, the lower edge of the die-bell can be set so close to the lower edge of the die-ring as to grind the crushed ore or rock to a pulverized product of any desired fineness.

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

1. In an ore-crushing mill, the combination with the supporting-frame, of a hopper pivotally hinged to said frame, means for clamping said hopper to said frame, said hopper having a cylindrical aperture extending into its bottom a predetermined distance, said hopper being provided with an outward-flaring hopper-aperture in its top intersecting said cylindrical aperture, an inwardly-curved lip connecting the lower edge of said flaring hopper's bore and said cylindrical bore, a cylindrical die-ring of chilled or other suitable ore-crushing metal fitting said cylindrical bore and provided with an upper curved edge fitting the curved lip of said die-ring, a band of soft metal encircling said die-ring, provided with a plurality of tapering V-shaped holes spaced at equal distances apart, and pointed set-screws threaded through the shell of said hopper, and positioned to bear against the upper side of said V-shaped apertures in said soft band, and hold said die-ring up against the curved lip of said hopper, with an upward clamping pressure, as set forth.

2. In an ore-crushing mill, the combination of the vertical frame, and the hopper pivotally hinged to tilt backward thereon, an ore-crushing die-ring secured in said hopper, having a convexed circumferential row of vertically-arranged channels in its inner periphery extending from its top to near its bottom edge, and a smooth, angular circumferential band portion at its lower edge, with a bell-die rotatably mounted in operative rock-crushing relation to said die-ring and having a circumferential row of vertically-arranged channels in its peripheral surface extending from near its top to near its bottom edge, and a smooth angular band portion at its lower end adapted to fit closely against the lower edge of said die-ring, a shaft for rotating said bell-die, an adjustable bearing for the shaft, a hand-wheel and rod connected to said bearing for adjusting said shaft and bell-die relative to said hopper's die-ring, a journal bearing in the lower portion of the frame, a fiber washer on top of said bearing, the bevel-gear feathered to said shaft and resting on said fiber washer and having a hub portion which rotates in said journal, the driving-shaft journaled at right angles to said bell-die shaft, a pinion secured to said shaft and in mesh with it, and a double bearing having a flange member secured to said frame and two journal-bearings adapted to support said shaft on opposite sides of said pinion, a hood portion connecting said bearings and surrounding the upper portion of said pinion, and a power driving-pulley on the outer end of said shaft, as set forth.

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

AUGUSTUS L. ENGELBACH.

Witnesses:

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ADELLA M. FOWLE.