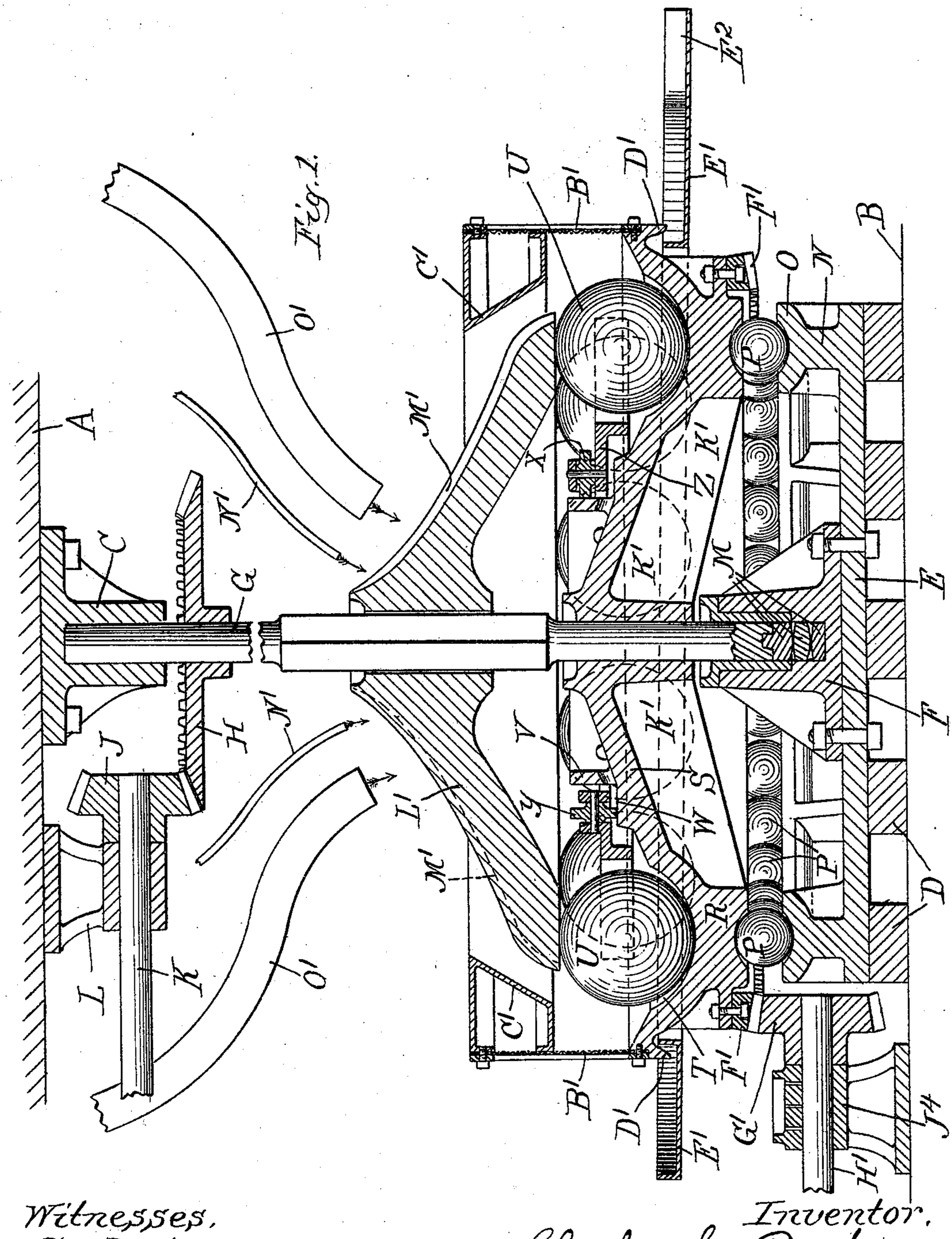
(No Model.) 2 Sheets—Sheet 1.

C. J. BEST.

TRITURATING AND REDUCING MILL.

No. 584,980. Patented June 22, 1897.

Fig. 1.



Witnesses.
E. T. Wray.
Lilley Johnstone.

Inventor.
Charles J. Best,
by Bakewell & Parker,
his Attys.

(No Model.) 2 Sheets—Sheet 2.

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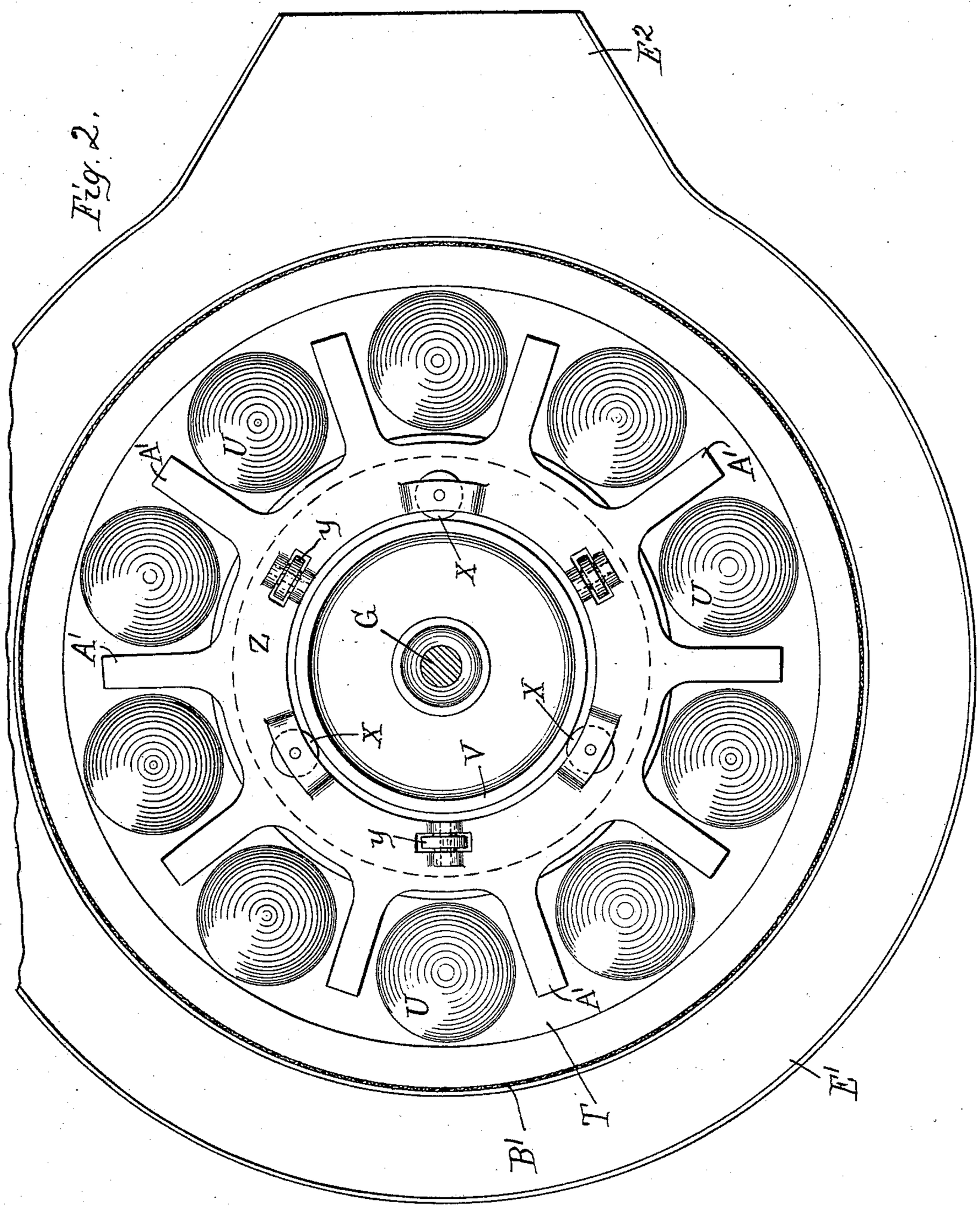
Fig. 2.



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Inventor
Charles J. Best.
by Francis W. Parker,
his Atty.

UNITED STATES PATENT OFFICE.

CHARLES J. BEST, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO JOHN H. VOGT, OF SAME PLACE.

TRITURATING AND REDUCING MILL.

SPECIFICATION forming part of Letters Patent No. 584,980, dated June 22, 1897.

Application filed November 18, 1895. Serial No. 569,318. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. BEST, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Triturating and Reducing Mills, of which the following is a specification.

My invention relates to triturating and reducing mills, and particularly such as are designed for the treatment of ores, though I do not desire to be limited in the matter of the use of my machine. It can be used in any place and for any purpose where a reducing process is desired. The particular thing I have in mind at this moment, however, is the reduction of ores.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a vertical section; Fig. 2, a plan view of part of the machine with the weight L′ removed.

We will assume that A is the ceiling, and B the floor, of a room in which my mill is to be set.

C is a head-block secured in the ceiling; D D, supporting-beams; E, a bed-plate, and F a foot-block supported on the bed-plate.

G is a shaft, round in cross-section at its upper end, provided with the beveled gear H, meshing with the gear J on the shaft K, which is journaled in the hanger L, and which shaft is driven to rotate the shaft G. The shaft G is round in cross-section at its lower end and provided with the antifriction-disks M M, upon which it rests.

N is an annular flange about the bed-plate, having the grooved trough at its upper edge. In this trough run the antifriction-balls P, upon which rests the lower outer rim R of the dish-shaped piece S. This piece is loose, so as to rotate on the shaft G, and has the trough-shaped piece T, circumferentially arranged and adapted to receive the reducing-balls U. The upper surface of the dish-shaped piece S is provided with the bearing-flange V and the bearing-surface W, against which bear, respectively, the antifriction-disks X and Y on shafts arranged at right angles to each other in the annulus Z, which annulus is provided with the projecting fingers A′ A′, between which lie the balls U. On the outer extremity of the dish-shaped piece S is arranged the annular screen B′, and above it the guard-plate C′, the whole being mounted and supported in any desired manner. The dish-shaped piece S is provided with the outer depending lip D′, and beneath this lip and inside of it is supported the pan E′, with an enlargement E^2 at one side. The pan is slightly inclined. On the outer edge of the rim R of the dish-shaped piece S is a sort of crown-gear F′, which is engaged by the pinion G′ on the shaft H′, which rotates in the bearing J^4 and which is driven from some source of power not here shown. The dish-shaped piece S may be strengthened by the webs K′.

L′ is a rotating weight, dish-shaped and on the shaft G at the square portion thereof, so that it rotates with the shaft G and is free to move vertically therealong. This weight L′ bears at its outer periphery on the balls U and has surface-channels M′ M′ to receive the water which may be discharged by the pipes N′ N′ and the crushed ore or other such substance which may be discharged from the pipes O′ O′ and carry the same down upon the outer surfaces.

Numerous details and devices for convenience and for facilitating the use of the apparatus, which may be apparent to any one, I have not gone into or set forth at length; but what I have above described and what is shown in the drawings will be sufficient to make clear the features of construction necessary to realize my invention.

The use and operation of the same are briefly as follows:

The power being properly applied will cause the shaft G and weight L′ to rotate in a given direction, said weight having all necessary freedom for vertical motion along the shaft. At the same time power applied to the shaft H′ will rotate the dish-shaped piece S in the opposite direction. The balls U being held between these two pieces and separated from each other by the arms A′ will of course begin to rotate under the action of the oppositely-rotating parts between which they lie. Now the speed or speeds may be regulated so that the balls will travel about in a circle, as well as rotate on their own axes, and they may

then be made to travel in either direction. In other words, I do not desire to be limited by the degree or character of motion imparted to any of the parts. The dish-shaped piece S is permitted to rotate by the bearing-balls P, upon which it rests. Now while this rotation is going on the substance to be treated—as, for example, pulverized ore—is discharged on the exterior of the weight L′ and runs down and along that exterior and is discharged upon the balls U and passing thence into the trough between them, whereupon it is ground and pulverized and further reduced by them. If desired, this action is facilitated by the use of water, which in suitable quantities may be supplied. When water is used, the liquid will gradually pass through the sieve or screen B′ and will carry with it such substance as may be fine enough to pass the meshes of that sieve, and this is carried out onto the table or trough E′ for further treatment, as the case may require. The grinding or pulverizing process continues until the work is completed. Any tendency of the substances to fly off from the surface of the weight L′ is resisted by the guard C′. It will be observed that by this means I bring to the work of reducing the ore a very considerable weight, and this weight may be increased to very great proportions, since there is no such thing as lifting of any dead-weight. The whole action proceeds on ball-bearings. The crushing-balls themselves are simply ball-bearings for the weight L′. Moreover, these balls have a twofold action. They roll over and thus crush the substance in the bottom of the trough in which they work, and they also have a twisting and turning action, which may be described as a rubbing action. This action not only crushes but also polishes the material which passes into the trough under the balls. The peculiar motion which I impart to these reduction-balls results in polishing the metal, so to speak—that is, it will result in removing from the surface of the metal to be recovered such coating as it may have—for example, the coating resulting from oxidation. The metal so polished is then carried over into the amalgamating-plates, where it becomes sensitive to the amalgamation and can be recovered.

The balls need not and in fact it is preferable that they should not precisely fit the groove in which they run. When the crushed ores or other substances are passed in, it will be noted that the arrangement is such that the bulk of the material will pass in on one side of the balls, in the illustration on the outer side, though I might also with a somewhat similar result throw the greater quantity of the ore on the inner side of the balls—that is, nearer the center. In the device as shown the greater portion of the material is discharged on the outer side of the ball, or at its side farthest from the center of rotation. Now the result of this is to form an irregular and varying cushion on the outer side of the groove, against which the ball bears, and thus the ball is caused to travel a somewhat serpentine path along its groove and about the center of rotation. A similar result might be accomplished by balls traveling in a straight groove, as will be readily seen, but the importance of this action is very considerable, since it gives the grinding or polishing effect as distinguished from the crushing effect of the ball, and, as above explained, this grinding and polishing effect is highly desirable.

The trough or groove in which the balls U are placed may be of any desirable shape. For example, it may be a serpentine groove, and I therefore do not wish to be limited to any definite shape or form of groove.

I claim—

1. In a reduction-mill the combination of a rotatable table supported on ball-bearings, with mechanism for rotating the same in one direction, a series of reduction-balls on such table, a weight resting on said balls, mechanism for rotating said weight in a direction opposite to the direction of rotation of said table, and an intermediate framework independent of said table and weight, said framework provided with projecting parts which extend outwardly between the balls and keep them properly distanced from each other, said framework provided with antifriction-disks adapted to engage said table, and annular bearing-surfaces on said table, substantially as described.

2. In a reduction-mill the combination of a rotatable pan with a groove therein, a series of balls within said groove, said balls and groove so proportioned that the balls are free to move radially within said groove, a pan-like weight resting upon the top of said balls, means for rotating said weight, said pan operatively connected with a rotating shaft so as to be rotated in a direction opposite to the direction of rotation of the weight, an intermediate framework independent of said table and weight and provided with projecting parts which extend outwardly between the balls and keep them properly distanced from each other, an exterior stationary pan or trough supported independently of the said first pan, the whole so arranged that the material ground can be mixed with water which then passes through the sieve and is received on the exterior pan.

3. In a reduction-mill the combination of a pan or dish shaped piece S provided with a gear F′, adapted to operatively engage the pinion G′ on the driving-shaft H′, and having an annular groove therein, a series of balls U in said groove, a pan-shaped weight L′ resting upon said balls and connected with a shaft G so as to be rotated thereby and so as to be free to move longitudinally, an intermediate framework Z interposed between the piece S and the weight L′, and provided with the arms A′ extending between the balls, the antifriction-disks Y connected with said framework, all substantially as described.

4. In a reduction-mill the combination of a pan provided with a gear on its under surface adapted to operatively connect with a pinion on a driving-shaft, said pan provided with an annular groove with a series of balls therein, said groove so formed that the balls are free to move radially, an inverted pan-like weight resting upon the top of said balls, a shaft projecting through said weight and provided with a pinion above the weight by which it is rotated, the parts so constructed that the weight and pan may be rotated in opposite directions, an intermediate framework independent of said table and weight, said framework provided with projecting parts which extend outwardly between the balls and keep them properly distanced from each other, said framework provided with antifriction-disks adapted to engage said table, an annular bearing-surface on said table, a screen or sieve which surrounds said pan at a slight distance above the bottom of the groove, and an exterior stationary trough supported independently of said pan, substantially as described.

November 7, 1895.

CHARLES J. BEST.

Witnesses:
FRANCIS W. PARKER,
LILLEY JOHNSTONE.