

J. J. KNIGHT.
GRINDING AND PULVERIZING MILL.
APPLICATION FILED FEB. 14, 1908.

929,956.

Patented Aug. 3, 1909.

2 SHEETS—SHEET 1.

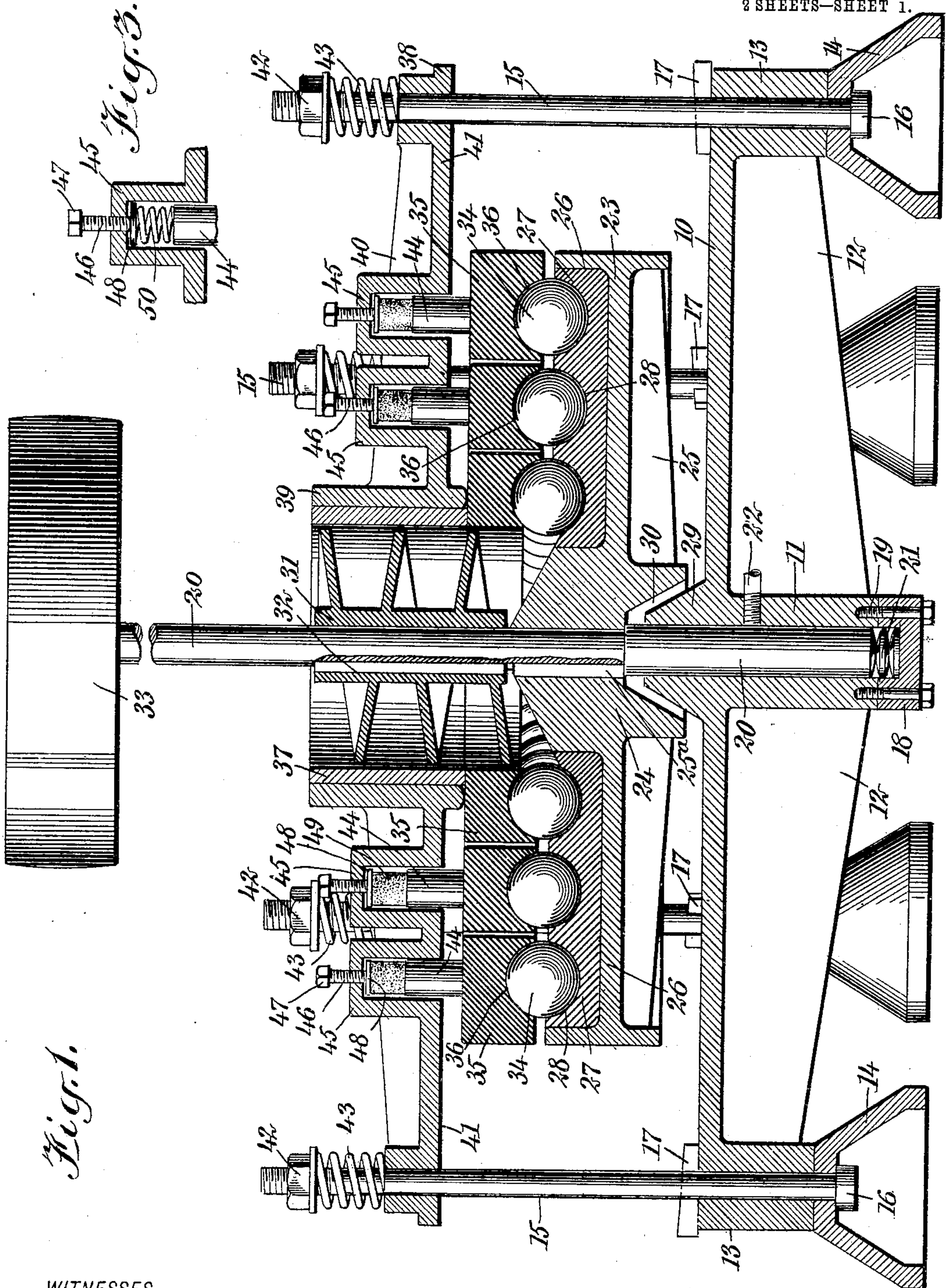


Fig. 1.

WITNESSES

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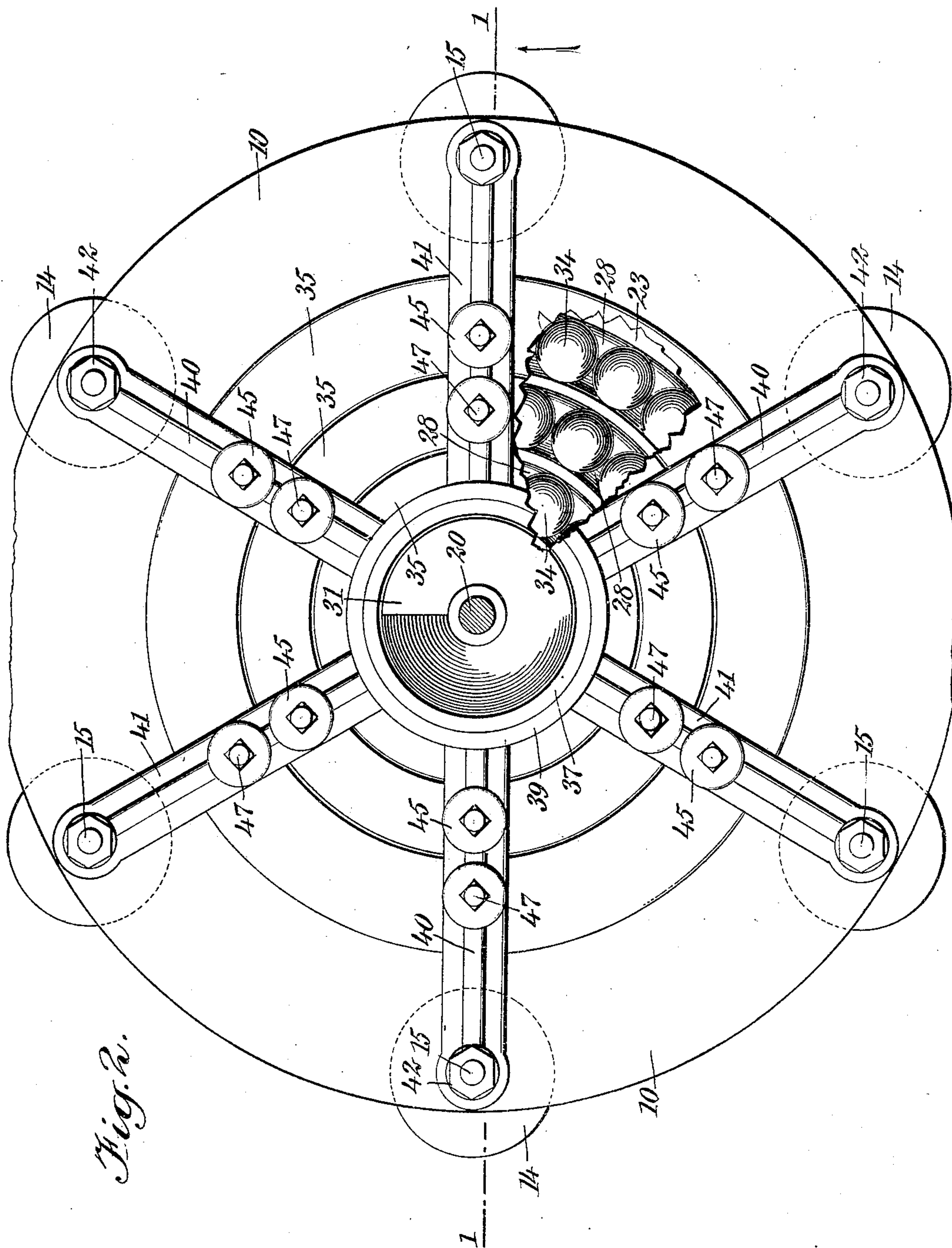


Fig. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN JAMES KNIGHT, OF ALAMEDA, CALIFORNIA.

GRINDING AND PULVERIZING MILL.

No. 929,956.

Specification of Letters Patent.

Patented Aug. 3, 1909.

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To all whom it may concern:

Be it known that I, JOHN J. KNIGHT, a citizen of the United States, and a resident of Alameda, in the county of Alameda and State of California, have invented a new and Improved Grinding and Pulverizing Mill, of which the following is a full, clear, and exact description.

This invention relates to grinding and pulverizing mills, and more particularly to machines of this character in which the comminuting elements are rollers arranged between suitable supporting members and pressure members, and in which the pressure members are adjustably and resiliently held in position upon the rollers.

More specifically, the invention relates to a ball or roller grinding and pulverizing mill in which comminuting rollers are arranged in concentric circles upon a supporting member, and have concentric pressure rings arranged upon each circle of rollers and held resiliently and adjustably in position thereupon to force the rollers firmly against the supporting member.

An object of the invention is to provide a simple, strong and efficient mill for grinding and pulverizing material, in which the bearing faces for the grinding and pulverizing balls or rollers, as well as the balls or rollers themselves, are removable to permit their being replaced when worn or injured, and in which the material is introduced by a force-feed and is discharged by centrifugal action or by a forced discharge due to the forced feed.

A further object of the invention is to provide a machine of the class described which is so constructed that the grinding and pulverizing action is continuous, and in which the grinding parts are held resiliently in position to permit the mill to adjust itself automatically, to material of different grades.

A still further object of the invention is to provide a ball grinding mill in which the parts are simple in construction and are assembled so that they can be easily and rapidly removed, and in which the arrangement obviates as nearly as possible, all unnecessary friction.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specifica-

tion, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a longitudinal section of the mill on the line 1—1 of Fig. 2; Fig. 2 is a plan view of the machine showing a portion of the pressure rings broken away to disclose the balls or rollers under the same, and Fig. 3 is a transverse section showing a detail of a modified form.

Before proceeding to a more detailed explanation of my invention, it should be understood that the machine can be constructed from any suitable material such as cast-iron, steel or the like. I prefer to use white iron or chilled steel for the bearing face of the supporting member and for the pressure rings, as the balls or rollers travel between the bearing face of the supporting member and the rings, so that these parts are subjected to the greatest wear. If desired, however, any other suitable material adapted to the purpose may be substituted therefor. In the form of the machine shown, for example, in the accompanying drawings, I use rubber blocks or washers for resiliently holding the pressure rings in position. It may be found of advantage to substitute, as is illustrated in Fig. 3 showing the modified detail, helical springs or other resilient bodies, for the rubber blocks. The operation of my mill is based upon the principle of the grinding action due to the attrition of the bearing faces and the balls or rollers. The latter are arranged in concentric circles, and each circle has a pressure ring thereupon which can be adjusted to force the rollers more or less firmly against the bearing face of the supporting member. Consequently, the different circular series of rollers can be adjusted independently of one another. Furthermore, the rings may become unequally worn and consequently one or more can be removed and replaced, without necessitating the corresponding removal or replacing of the other rings. It will be understood that if a pressure plate is used instead of a plurality of pressure rings, when the plate becomes sufficiently worn at a series of points corresponding to one of the circular series of rollers, it is necessary to remove and replace the entire plate, regardless of whether or not it is also worn at other points. The pressure rings are held in position by a cap or spider which of itself is adjustably and resiliently mounted, so that the

machine is actually capable of a double adjustment. That is, the rings can be adjusted all together or separately.

My invention is embodied in the efficient form and arrangement of the parts and in the simplification of the construction. The invention also resides in the provision of a base member and a plurality of concentric pressure members having a revoluble member arranged therebetween, and in the location of the grinding rollers. Furthermore, the arrangement of the feeding mechanism operated by the means for driving the revoluble supporting member is of importance, in that it permits the material to be fed to the mill centrally, and to be discharged, by centrifugal action, or by the forced discharge due to the forced feed, at the sides of the machine.

Referring more particularly to the drawings, I provide a suitable base 10 having a central hub 11. The base is preferably circular in form, for reasons of simplicity of construction, and has radial strengthening ribs or flanges 12, the ends of which are formed into sockets 13 having substantially vertical openings therethrough. Hollow supports 14 are arranged under the sockets 13 and have openings which register with the openings of the sockets. Bolt posts 15 have the heads 16 arranged inside of the hollow supports and extend upwardly through the openings of the supports and the sockets. The posts 15 have transverse slots therethrough in which are arranged wedges 17, by means of which the posts can be firmly jammed in position with respect to the base, and which serve at the same time to secure the supports under the base by means of the posts. A thrust block 18 is arranged underneath the hub 11 and is secured in position by means of screws or bolts 19. A shaft 20 is mounted in the hub 11 and rests upon thrust bearings 21, arranged within the thrust block 18. An oil inlet 22 is provided in the hub to permit the lubrication of the shaft, which is, of course, revoluble, and which is substantially vertical.

A revoluble support 23, having a central hub 24 and radial ribs or flanges 25, is rigidly mounted upon the shaft 20 above the base 10, by means of a key 25^a or in any other suitable manner. The shaft has a shoulder formed to carry the supporting member, and receives the hub of the latter. Surrounding the hub and concentric therewith, the support has an annular recess 26 in which is mounted a bearing face 27 of white iron or other suitable material, and provided with concentric ball grooves or races 28. The hub 24 is tapered downwardly to the bearing face, for a purpose which will appear hereinafter. The hub 11 of the base has a tapered portion 29 arranged to extend into a correspondingly tapered recess 30 of the hub 24.

A screw or worm 31 is rigidly mounted by means of a key 32 or in any other suitable manner, upon the shaft 20 above the revoluble support 23. The shaft further, has means for driving it, for instance, a pulley 33.

While I have shown, for example, the bearing face 27 provided with three concentric grooves or ball races, it will be understood that I do not wish to limit myself to any particular number of ball races or rollers, but can employ any number adapted for the purpose. In each of the grooves or races 28 is arranged a series of grinding and pulverizing rollers 34, shown, for example, as substantially spherical in form. I wish to emphasize the fact that I do not restrict myself to rollers of this particular form, but can use other rollers, as well. Upon each of the concentric series of rollers is arranged an annular pressure member or ring 35, having the under face provided with a groove or race 36, corresponding to the opposite races in the bearing face 27. The pressure members are formed from white iron or any other suitable material. The pressure members are independent and can be replaced or removed singly or all together, as occasion necessitates.

The inner of the pressure members carries a substantially cylindrical chute 37, surrounding the feeding screw or worm 31. The latter, as the shaft 20 is rotated, forces the material to be ground, downward, to a point where it is directed by the beveled hub 24, to the inner series of rollers. It is then forced outwardly through the succeeding rollers, until it is discharged from the machine either by centrifugal action or by the following material which is forced in by the screw.

A retaining cap or spider 38, having a circular central portion 39 and radial strengthening ribs or flanges 40, is arranged above the pressure rings and has the central portion encompassing the cylindrical chute 37. The spider has radial arms 41 provided with openings through which the bolt posts extend. The latter have the upper extremities threaded and provided with adjusting nuts 42. Between the adjusting nuts and the spider arms, the posts carry resilient members such as helical springs 43, which tend to hold the spider firmly in position, and which can be adjusted by means of the nuts 42. The central portion 39 of the spider rests upon the inner pressure ring 35, and with the chute 37 serves to force the pressure ring downward upon the inner series of grinding rollers. The remaining or outer pressure rings have upwardly disposed projections 44, which extend into pockets 45, formed integrally with the arms 41 of the spider. The pockets have threaded openings in which are arranged adjusting screws 46, having heads 47 by means of which they can be manipu-

lated, and disks 48 within the pockets. Between the disks and the projections 44 are located resilient members such as blocks of rubber 49, or coiled springs 50. By regulating the adjusting screws 46, the outer pressure members can be forced more or less strongly against the outer series of rollers. Thus the various pressure members can be adjusted independently of one another, and they can furthermore, be adjusted all together by means of the nuts 42 which regulate the cap or spider 38.

By removing the cap 38, one or more of the pressure rings can be removed and replaced in case of necessity. The construction of the cap and the pressure rings, permits the separation of the parts without difficulty and with little loss of time. As the cap, as well as the pressure rings, are resiliently held in position upon the grinding rollers, the mill adjusts itself automatically to different grades of material. Also by adjusting the springs or other resilient members, the pressure rings can be held more or less firmly upon the grinding rollers, and consequently, the degree of comminution of the material will be automatically regulated by the pressure members, accordingly as they are more or less strongly held in position upon the grinding rollers.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:

1. In a machine of the class described, a movable supporting member, a plurality of series of rollers carried by said supporting member, independent pressure members arranged above said supporting member and each engaging one of said series of rollers, a cap above said pressure member and having radially extending arms, means for adjusting the pressure of said cap as a whole, and means on each of said arms for adjusting the pressure of each of said pressure members.

2. A machine of the class described, comprising a movable supporting member having a removable face provided with roller races, rollers in said races, independent concentric rings above said face and provided with roller races corresponding to the roller races of said removable face, said supporting member having a central hub extending above said face and tapered downwardly to

the same, a cap above said rings and having radial arms, adjustable means for holding said cap resiliently in position, adjustable means on said arms for resiliently holding each of said rings in position, and means rigid with said hub for forcing material between said face and said rings.

3. A machine of the class described, comprising a revoluble supporting member, a plurality of series of rollers carried by said supporting member, independent pressure members arranged above said supporting member and each engaging one of said series of rollers, and a resiliently held cap mounted above said pressure members, and having arms extending radially over said pressure members, said arms having upwardly disposed hollow pockets rigid therewith, said pressure members having rigid projections extending into said pockets, adjusting members projecting into said pockets from above said cap, and resilient members in said pockets between said adjusting members and said projections.

4. In a machine of the class described, a base, a revoluble supporting member over said base, a plurality of series of rollers carried by said supporting member, independent pressure members arranged above said supporting member, and each engaging one of said series of rollers, posts extending upwardly from said base, a cap above said pressure members and having radially extending arms each engaging one of said posts, and movable longitudinally of the same, means for resiliently resisting the movement of said arms upward on said posts, said cap having a central opening, means for introducing material to be ground through said cap to said rollers, and means on each of said arms for resiliently resisting the upward movement of each of said pressure members, said supporting member having a tapered hub under said opening of said cap.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN JAMES KNIGHT.

Witnesses:

JOHN T. CONLON,
H. G. MEHRTENS.