

No. 636,469.

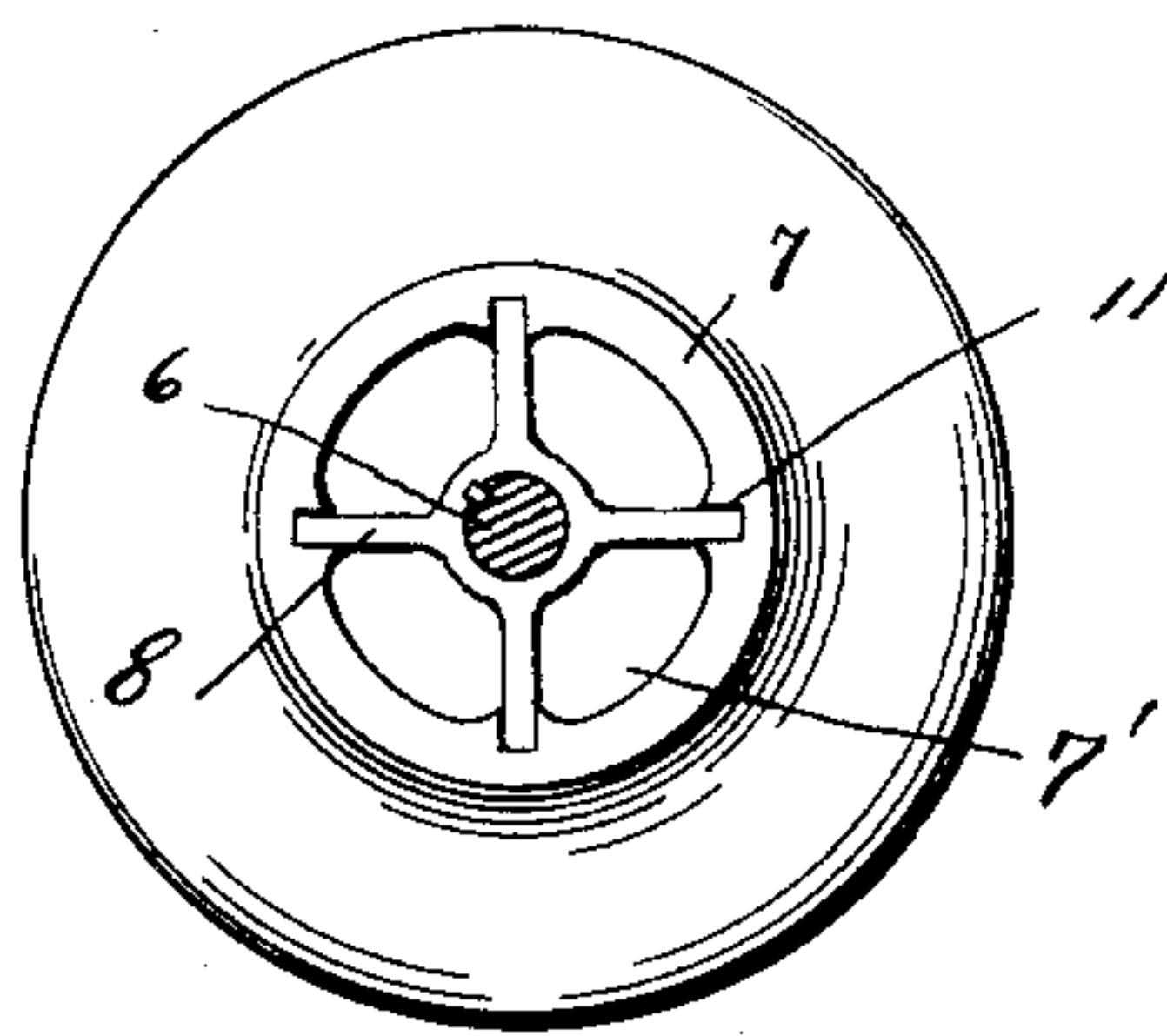
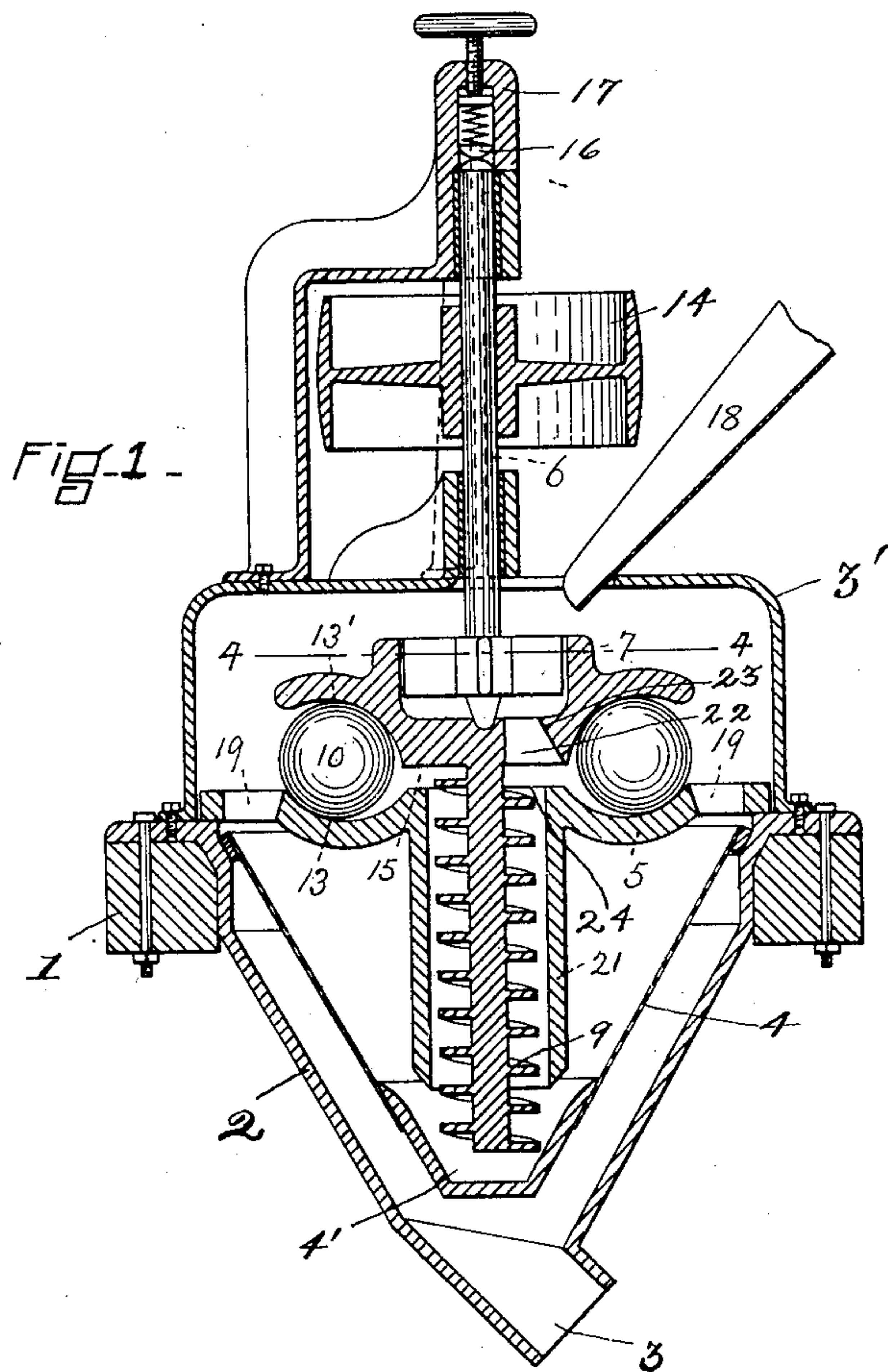
Patented Nov. 7, 1899.

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GRINDING MILL.

(Application filed Aug. 13, 1898.)

(No Model.)



WITNESSES.

A. D. Brown

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Fig-2.

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# UNITED STATES PATENT OFFICE.

THOMAS L. STURTEVANT, OF QUINCY, AND THOMAS J. STURTEVANT, OF FRAMINGHAM, MASSACHUSETTS.

## GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 636,469, dated November 7, 1899.

Application filed August 13, 1896. Serial No. 602,647. (No model.)

*To all whom it may concern:*

Be it known that we, THOMAS L. STURTEVANT, residing at Quincy, in the county of Norfolk, and THOMAS J. STURTEVANT, residing at Framingham, in the county of Middlesex, State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Grinding-Mills; and we 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, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to grinding-mills, particularly that class in which a runner and a stationary plate are employed.

Our invention is embodied in the arrangement and construction of the various cooperating parts, whereby the friction is diminished and less power is required to operate the mill, while the quality and quantity of the output are maintained.

Our invention is embodied in the combination, with two plates, one stationary and the other rotary, of a plurality of grinding or reducing instrumentalities in the shape of spheres or rolling bodies, which are confined between and compelled to move in grooves or tracks on the said plates and which constitute the grinding-surface or reducing-table of the mill.

In the accompanying drawings, Figure 1 is a central section of a mill embodying our invention. Fig. 2 is a detail view on line 4 4, looking downward, to show the connection between the runner-stone and driving-shaft.

Referring to the drawings by numerals, 1 denotes the frame of the mill, to which is bolted a casing 2, preferably of an inverted frusto-conoidal shape, as shown, and provided with a discharge-opening 3 at its bottom. Resting within the casing 2 and depending into the latter is a conoidally-shaped screen 4, the tip of said screen being an imperforate cup 4', the purpose of which will be hereinafter explained. A stationary bed-plate 5 is seated upon the said casing 2, so as to cover the bell-shaped mouth of the same, said bed-plate be-

ing grooved at 13 to form a circular track for a series of crushing or grinding balls 10. Near the outer edge of the bed-plate 5 are formed a series of discharge-openings 19, through which the material which is comminuted by the action of the balls 10 passes to the screen below. The bed-plate 5 is also provided with a central opening 24, and from the center of the plate 5 depends a sleeve 21, which extends downwardly into the conical screen 4 to a point near to or within the imperforate tip 4' of said screen. Resting upon the said grinding-balls 10 is the runner-plate 7, said plate being raised above the bed-plate 5 sufficiently to form a chamber 15 to receive the material to be reduced, from which chamber it passes to the grinding mechanism. The runner-plate 7 is grooved at 13' in a manner similar to the bed-plate 5, the arc on which these grooves are struck being slightly larger than that of the balls 10, as will be seen in Fig. 1, the object of this being twofold—first, in order that the frictional contact between the plates and balls will not be sufficient to cause the balls to slip instead of roll, as would be the case if the balls fitted the grooves closely, and, second, in order to allow room for the material in process of grinding and enable it to be acted on by the balls. Said runner-plate 7 carries an upwardly-feeding screw conveyer 9, which passes down through the central opening 24 and the sleeve 21 nearly to the bottom of the imperforate tip 4' of the screen 4, said screw conveyer terminating at its upper end in the chamber 15 between the bed and runner plates.

The driving mechanism for the runner-plate consists of a vertical shaft 6, mounted in suitable bearings and provided with a drive-pulley 14, said shaft being normally forced downward to give the proper thrust to the grinding agencies by a spring-pressed block 16, carried in the hollow shaft-support 17. To the lower end of the shaft 6 a spider 8 is keyed, the arms of said spider fitting into notches 11 in the sides of a cup-like depression 7' in the top of the runner-plate 7, so that as the shaft 6 revolves the spider 8 communicates motion to the runner-plate 7 and balls 10. A feeding-spout 18 empties the material to be pulverized into the cup 7' in the



top of the runner-plate 7, the spider forming no obstruction to the passage of the material. From the cup 7' in the runner-plate the material passes through an opening 22, having  
 5 an outwardly-flaring outer wall 23 at one side of the center of the cup 7', directly to the grinding agencies hereinbefore described. It will be seen that by placing the single feed-opening 22 at one side of the center and providing  
 10 it with an outwardly-flaring wall 23, as shown, the material will be fed from the receptacle or cup 7' in a comparatively thin outwardly-inclined stream to the grinding agencies without overloading them, even if the flow from the  
 15 feed-spout 18 is sufficient to fill the said cup 7', and, furthermore, by so locating the feed-opening 22 at one side of the center there is no danger of the material feeding down the return-feed conveyer-tube 21, since the in-  
 20 clined stream of material will clear the return-feed mechanism and pass to the grinding agencies without interference with said return feed. A casing 3' is secured to the frame of the mill, covers the grinding agencies,  
 25 and prevents the escape of dust from the mill or the entrance of foreign substances to the grinding agencies.

The operation of the mill is as follows: The runner-stone being set in motion, the material  
 30 to be ground is fed to the cup in the top of the runner-plate, from which it passes through the opening in the bottom of the runner-plate to the grinding agencies. It will be obvious that the centrifugal force imparted to the ma-  
 35 terial by the revolving runner-plate will as it discharges through the opening carry it outwardly into the grooves of the plates to be acted on by the balls. This action of the material under centrifugal force is, we find, mate-  
 40 rially aided by making the outer wall of the discharge-opening flaring, as shown, and locating said opening at one side of the center of the cup, this construction insuring the material under treatment passing to the grind-  
 45 ing agencies and not dropping through the central opening in the bed-plate and the depending sleeve. After the material has been acted on by the rapidly-revolving balls it is gradually worked out toward the outer edge  
 50 of the bed-plate by the ingress of fresh material and centrifugal action until it reaches the row of openings at the periphery of the bed-plate, through which it falls to the slanting walls of the screen below. The material  
 55 which is of the requisite degree of fineness passes through the screen and is guided by the casing to the discharge-opening at the bottom. The material, however, which has passed through the mill without being com-  
 60 pletely reduced, as is sometimes the case, slides down the sides of the screen and is caught in the imperforate tip or cup at the bottom. From said cup it is lifted by the screw conveyer carried by the runner-plate  
 65 through the depending sleeve on the bed-plate (it being understood that the term "screw conveyer" as used in this specifica-

tion refers to the screw and its inclosing tube, which together coöperate to raise the material, although any equivalent construction adapt- 70 ed to accomplish the result aimed at might be used instead of the conveyer shown) and delivered to the grinding agencies for regrinding. The heavy imperforate tip serves also  
 75 as a wearing-plate for the end of the feed-screw, it being apparent that the attrition caused by the feed-screw working in the body of unpulverized substance caught at the end of the screen would soon result in wearing through and breaking the tip of the screen if 80 the solid tip were not provided.

It will be seen from the foregoing that the mill is automatic in its action, grinding and regrinding the material until it is reduced to the proper degree of fineness. It is also ap- 85 parent that the output of the mill can be varied in fineness at will by simply substituting screens of different mesh. It has been found that the type of mill which we have shown and described is well adapted to the class of 90 work for which it is designed by reason of its small number of parts, the compact manner in which it is assembled, the ease with which the parts may be removed for repair or change, and the effective work done by it with a mini- 95 mum expenditure of power.

What we claim is—

1. In a grinding-mill, the combination of the following instrumentalities, viz: a stationary bed-plate provided with a groove and 100 having discharge-openings for the ground products of the mill, a series of crushing-balls mounted upon said grooved plate, a runner-plate supported by said balls, means for rotating said runner-plate and the crushing- 105 balls which support it, central feed-openings for the material to be reduced, an inclined screen upon which the ground products fall, and means located centrally of and operated by the moving parts of said mill for return- 110 ing the unscreened material to the grinding agencies for regrinding.

2. In a grinding-mill, the combination of the following instrumentalities, viz: a stationary bed-plate provided with a groove and 115 having discharge-openings for the ground products of the mill, a series of crushing-balls mounted upon said grooved plate, a runner-plate supported by said balls, means for rotating said runner-plate and the crushing- 120 balls which support it, central feed-openings for the material to be reduced, a screen upon which the products of the mill fall and by which they are screened, and means located centrally of and operated by the moving parts 125 of said mill to return the unscreened material to the grinding agencies for regrinding.

3. In a grinding-mill, the combination with a horizontal, stationary bed-plate provided with a grooved upper surface and discharge- 130 openings near its outer edge, of a series of crushing-balls mounted on said grooved surface, a runner-plate resting on said balls and provided with a central feed-opening, means



for revolving said runner-plate, means for retaining the unground products of the mill, and a screw conveyer operated by said runner-plate and passing through the center of said bed-plate to return said unground products to the grinding agencies for further reduction.

4. In a grinding-mill, the combination with a stationary bed-plate having discharge-openings near its outer edge, of a series of grinding-balls carried thereby, a runner-plate revolving on said balls, a feed-hopper feeding into a central feed-opening in said runner-plate, an inclined screen beneath said bed-plate to receive the ground material, devices to catch and retain the unscreened material, and means operated by the runner-plate, to return said unscreened material to the grinding agencies.

5. In a grinding-mill, the combination with a fixed plate provided with a circular groove, a runner-plate having a similar groove, a series of balls supported and guided by said grooved plates, a screen beneath the above-described grinding mechanism, said screen having an imperforate portion to catch and retain the unground products, and a feed-screw to return the said products to said grinding mechanism for further reduction, substantially as described.

6. In a grinding-mill, the combination with a fixed grooved plate and a revoluble grooved runner-plate, of a series of balls mounted on and guided by said plates, a depending conical screen having an imperforate bottom, to catch and hold the unground material, and a feed-screw to return the unground products to the grinding mechanism for further reduction, substantially as described.

7. In a grinding-mill, the combination with a bed-plate provided with discharge-openings at its outer edge, of a series of crushing-balls mounted on said bed-plate, a runner-plate resting on said balls, means for driving said runner-plate, a screen of inverted conical form beneath said bed-plate to receive and screen the products of the grinding agencies, said screen having an imperforate tip to form a receptacle for the unscreened products, and means operated by said runner-plate to return the unscreened products from the said receptacle to the grinding agencies.

8. In a grinding-mill, the combination with the grinding mechanism, of a cone-shaped screen beneath said grinding mechanism to receive and sift the pulverized material, and a central feed-screw to return the unground material to the said grinding mechanism.

9. In a grinding-mill, the combination with the grinding mechanism, of a screen below said grinding mechanism to receive the pulverized material and sift the same, said screen having the imperforate portion to receive and retain the coarse unscreened products which pass through the grinding mechanism without being sufficiently pulverized, and a screw conveyer operated by the moving parts of the

mill to return the unground material to the grinding mechanism.

10. In a grinding-mill, the combination with the grinding mechanism, of a cone-shaped screen below said grinding mechanism to receive the pulverized material and sift the same, said screen having an imperforate portion to receive and retain the coarse unscreened products which pass through the grinding mechanism without being sufficiently pulverized, and a screw conveyer operated by the moving parts of the mill to return the unground material to the grinding mechanism.

11. In a grinding-mill, the combination with the grinding mechanism, of a cone-shaped screen below said grinding mechanism to receive the pulverized material and sift the same, said screen having an imperforate central portion to which the coarse, unpulverized material which passes the grinding agencies gravitates and by which it is held, and a screw conveyer operated by the moving parts of the mill to return the unground material to the grinding mechanism.

12. In a grinding-mill, the combination with the grinding mechanism, of a depending cone-shaped screen beneath said grinding mechanism to receive the pulverized material and sift the same, said screen having an imperforate cup-shaped tip which receives and retains the coarse, unpulverized material which passes through the grinding mechanism, and a feed-screw extending into said cup-shaped tip and operated by the moving parts of the mill to return the unground products to the grinding mechanism.

13. In a grinding-mill, the combination with the grinding mechanism, of a cone-shaped screen beneath the grinding mechanism to receive and sift the pulverized material, said screen having an imperforate central portion to receive the unscreened products, and feed mechanism operated by the moving parts of the mill to return such products to the grinding mechanism.

14. In a grinding-mill, the combination with a horizontal, grooved bed-plate having a central aperture and a series of openings near its outer edge, of a series of balls resting in said groove, a runner-plate having a central feed-opening mounted upon said balls, a screen beneath said bed-plate, a receptacle to receive the unscreened products, and a return-feed screw passing through said bed-plate centrally and delivering to the grinding mechanism.

15. In a grinding-mill, the combination with the grooved plate 5 having a central aperture and a depending sleeve 21 and the discharge-openings 19, of the balls 10 supported on said plate, the runner-plate 7 having the central feed-opening 22, the screen 20 having the imperforate tip 4', and the screw 9 to raise the unscreened material caught by the imperforate tip and deliver it to the grinding agencies.

16. In a grinding-mill, the combination with



a stationary bed-plate, of crushing-balls mounted thereon, a runner-plate supported by said balls, and provided with a receptacle for the material to be ground, said receptacle  
5 having a single feed-opening at one side of its center the outer wall of which feed-opening flares outwardly toward its bottom, means for rotating said runner-plate, means for retaining the unground material which passes  
10 through the mill, and a central screw conveyer carried by said runner-plate to return said unground material to the grinding agencies.

17. In a grinding-mill, the combination with  
15 a stationary bed-plate, of a series of balls mounted thereon, a runner-plate resting on said balls, said runner-plate being provided with a cup-like central depression in its top to receive the feed from a hopper, said runner-plate having a single feed-opening in the  
20 bottom of said depression at one side of the center of the runner-plate, said feed-opening having an outer wall which flares outwardly and downwardly, means for rotating said runner-plate, means for retaining the unground  
25 material which passes through the mill, and a central screw conveyer carried by said runner-

ner-plate to return the unground material to the grinding agencies.

18. In a grinding-mill, the combination with 30  
a grooved bed-plate, of a series of balls mounted thereon, a runner-plate resting on said balls and having a cup-like central depression in its top to receive the feed from the hopper, a  
central driving-shaft having its lower end 35  
mounted in a bearing in said cup-like depression, a spider keyed to said shaft and seated in said depression so as to impart motion thereto and yet not interfere with the feeding  
of the material, said runner-plate having a 40  
feed-opening in the bottom of said depression at one side of the shaft, the outer wall of said feed-opening flaring outwardly from its upper edge, a receptacle for the products of the  
mill, and a screw conveyer carried by said 45  
runner-plate to return the unground products from said receptacle to the grinding agencies.

In testimony whereof we affix our signatures in presence of two witnesses.

THOS. L. STURTEVANT.

THOMAS J. STURTEVANT.

Witnesses:

H. E. LODGE,

E. K. BOYNTON.