No. 664,823. Patented Dec. 25, 1900.

H. M. PUTNAM.

MACHINE FOR GRINDING BALLS.

(Application filed Mar. 9, 1898.)

(No Model.) 2 Sheets—Sheet 1.

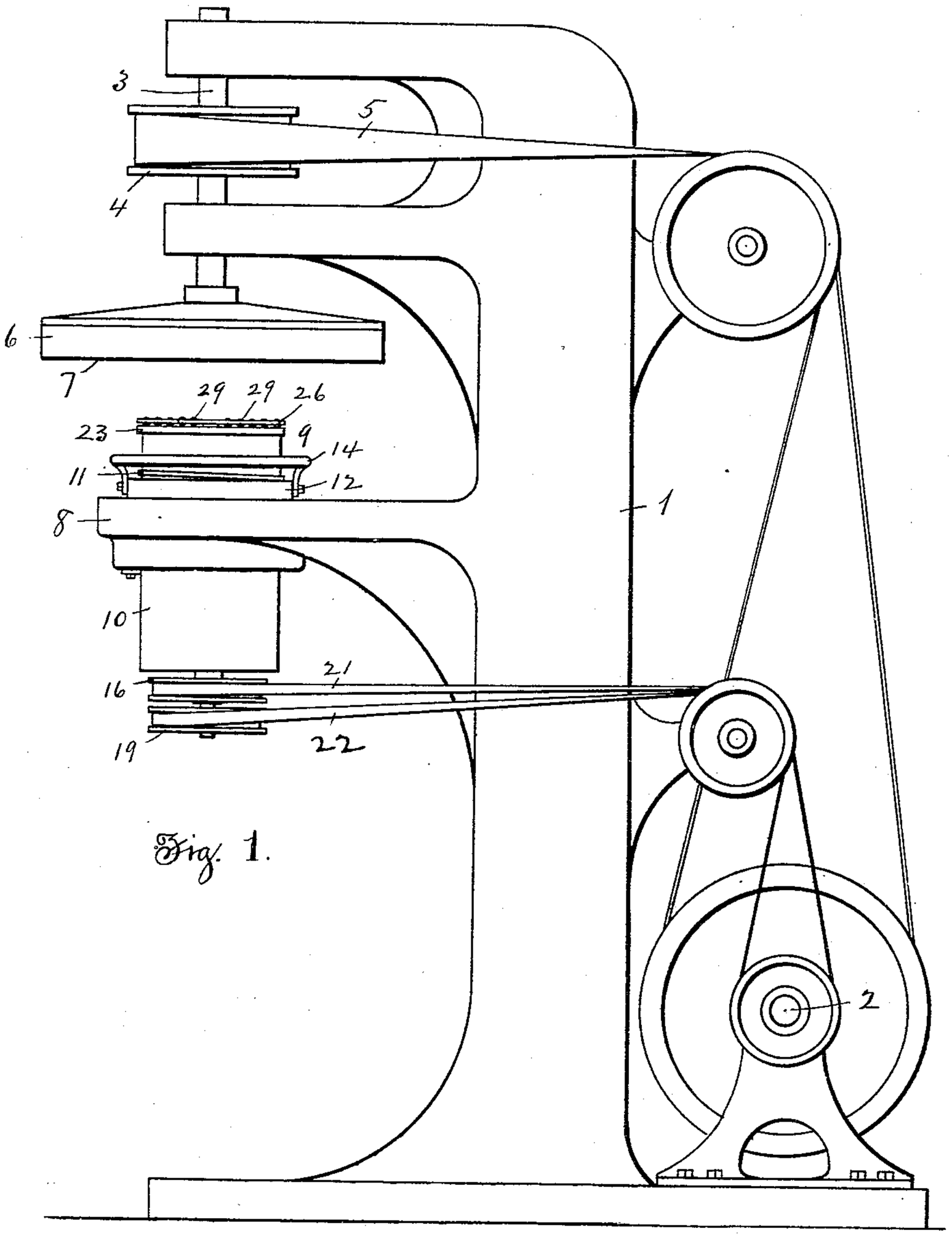

Fig. 1.

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Fig. 2.

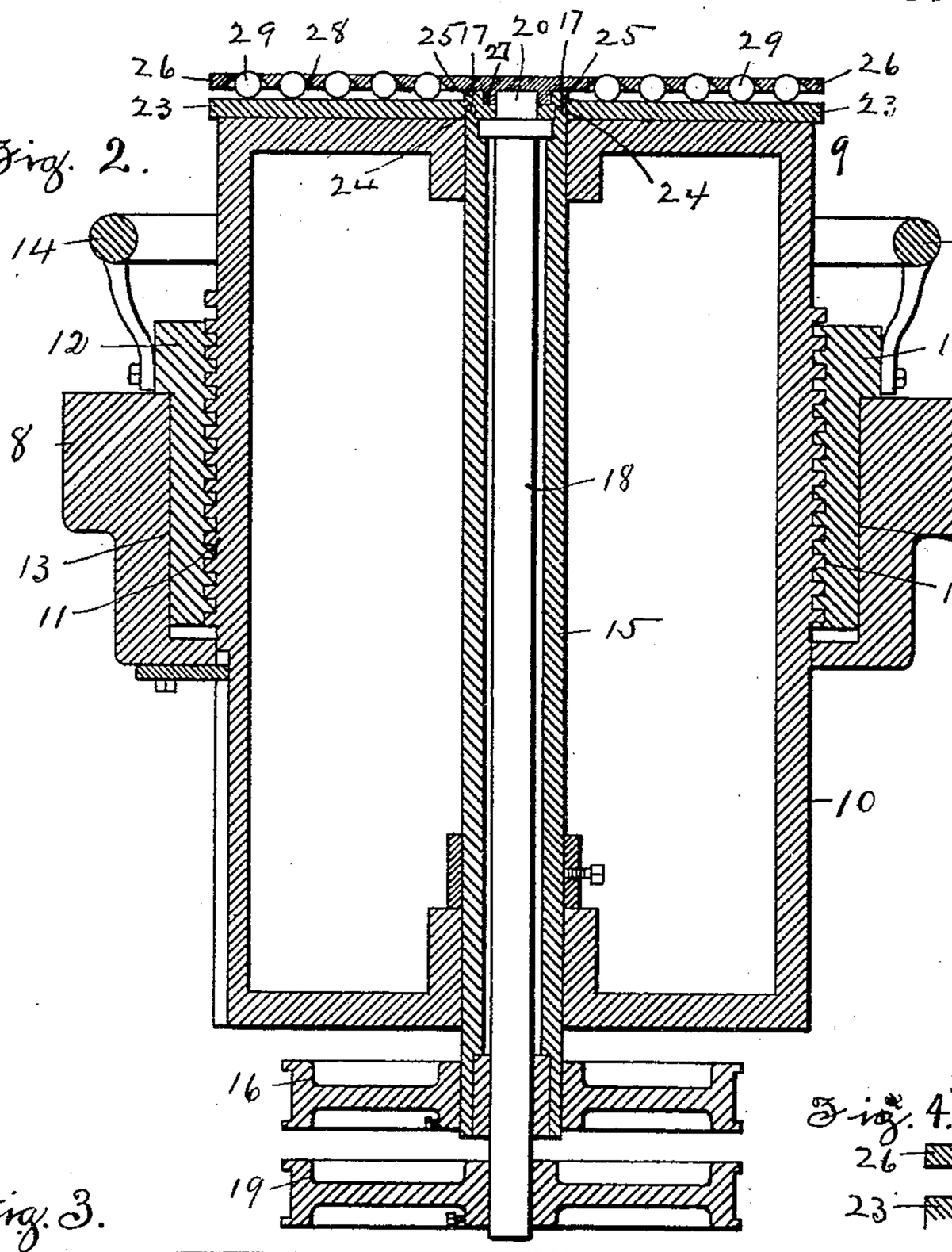
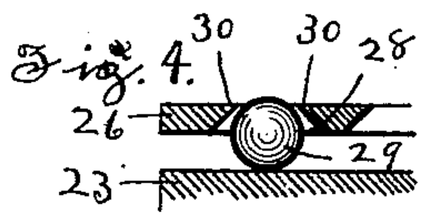
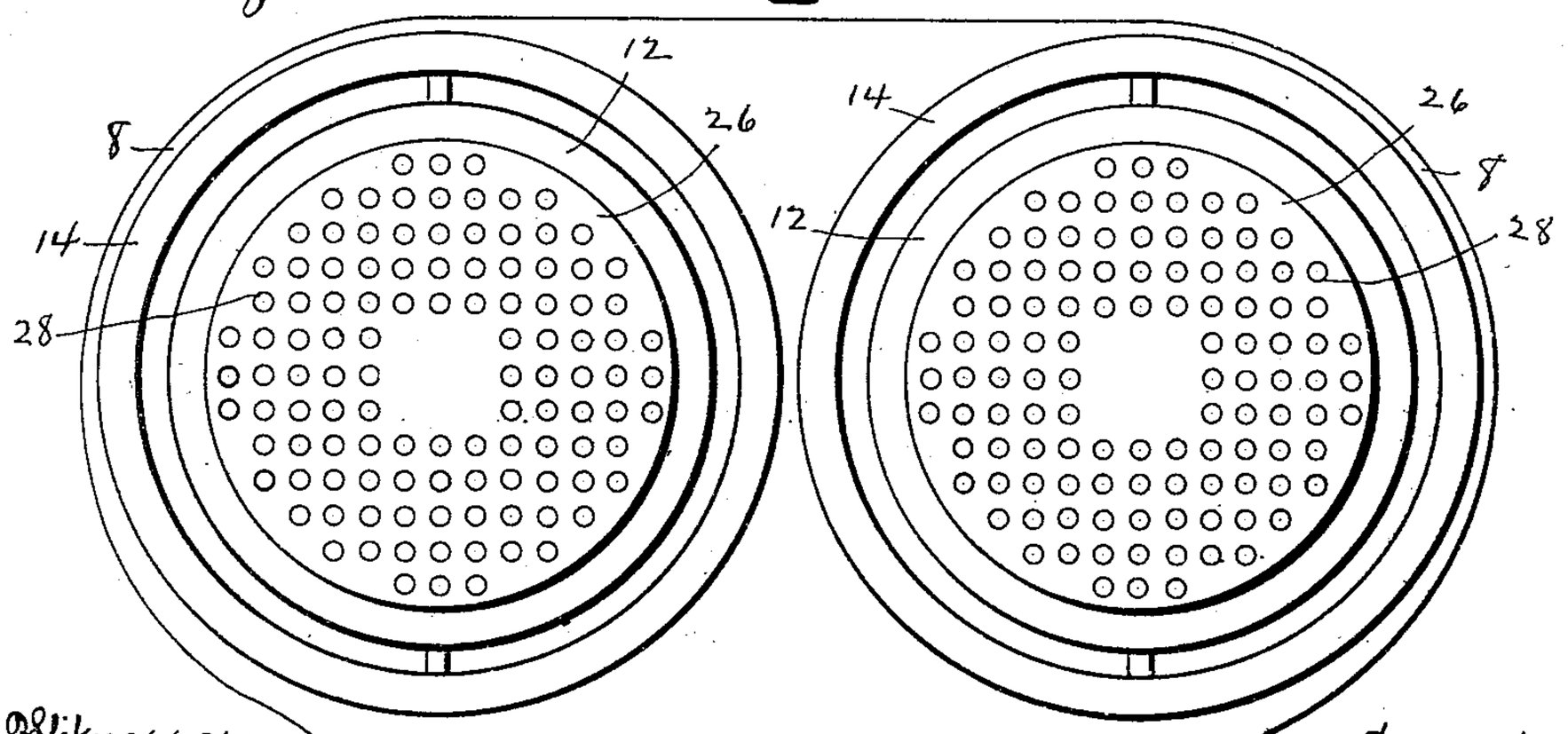


Fig. 3.

Fig. 4.





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UNITED STATES PATENT OFFICE.

HARRY M. PUTNAM, OF FITCHBURG, MASSACHUSETTS, ASSIGNOR TO THE FITCHBURG STEEL BALL COMPANY, OF SAME PLACE.

MACHINE FOR GRINDING BALLS.

SPECIFICATION forming part of Letters Patent No. 664,823, dated December 25, 1900.

Application filed March 9, 1898. Serial No. 673,210. (No model.)

To all whom it may concern:

Be it known that I, HARRY M. PUTNAM, a citizen of the United States, and a resident of Fitchburg, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Machines for Grinding Metal Balls, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 represents a side view of a machine embodying my invention for grinding metal balls. Fig. 2 is a vertical central sectional view of one of the tables for supporting the balls during the operation of grinding. Fig. 3 is a top view of that portion of the framework in which the ball-supporting tables are held, showing two tables for supporting the balls held therein; and Fig. 4 represents in sectional view a portion of one of the ball-retaining plates, showing one of the balls held therein.

Similar numerals refer to similar parts in the different figures.

The object of my invention is to provide an apparatus for grinding metal balls by which a ball after the operation of forging has been completed is reduced to true spherical shape; and it consists in the construction and arrangement of parts, as hereinafter described, and set forth in the annexed claims.

Referring to the drawings, 1 denotes the supporting framework or stand, and 2 a counter-shaft from which the operative parts of the machine are driven.

Journaled in the upper portion of the frame 1 is a vertical shaft 3, carrying a pulley 4, by which the shaft is rotated by means of a belt 5 from the counter-shaft 2. Attached to the lower end of the vertical shaft 3 is a grinding-wheel 6, consisting of emery or other abrasive material. The grinding-wheel 6 revolves in a horizontal plane and is adapted to grind metal balls brought into contact with its under side 7.

Projecting from the front of the stand 1 is a shelf 8, a portion of which is shown in plan view in Fig. 3. The shelf 8 projects beneath the revolving grinding-wheel 6 and is provided with two openings or holes arranged side by side to receive the tables 9 for supporting the balls during the operation of grinding. Fig. 2 of the drawings represents in sectional view a portion of the shelf 8, showing in vertical central sectional view one of the ball-supporting tables held therein. The ball-supporting tables 9 are duplicates of each other, and each table consists of a hollow cylinder 10, closed at its upper end and provided with an exterior screw-thread 11, which is engaged by the screw-thread 12 of an annular nut 13, journaled in the shelf 8 and having a hand-wheel 14 attached thereto in order to rotate the nut, and thereby raise or lower the cylinder 10 in order to carry the balls upon the table into contact with or to withdraw them from the grinding-wheel 6.

Journaled concentrically in the cylinder 10 is a hollow shaft 15, carrying a belt-pulley 16, which is attached to its lower end, and having a pair of spurs 17 17 projecting from its upper end above the closed end of the cylinder 10. Journaled within the hollow shaft 15 is a shaft 18, carrying a belt-pulley 19, which is attached to its lower end, and having its upper end 20 projecting above the upper end of the hollow shaft 15. The pulleys 16 and 19 are connected by belts 21 and 22 with pulleys upon the counter-shaft 2, by which each of the shafts 15 and 18 can be slowly rotated, if desired.

Supported upon the upper and closed end of the cylinder 10 is a removable steel plate 23, upon which the balls rest during the operation of grinding, said plate having holes 24 24 to receive the spurs 17 17, projecting from the end of the hollow shaft 15. The removable ball-supporting plate 23 is provided with a concentric rib 25, which supports a perforated ball-retaining plate 26, having a central boss 27 on its under side, which fits within the concentric rib 25, thereby centering the ball-retaining plate. The upper end 20 of the concentric shaft 18 enters the central boss 27 of the ball-retaining plate and has a spline connection therewith. The ball-retaining plate 26 is provided with a series of holes 28 to receive the balls to be ground. A portion of the ball-retaining plate 26, showing one of the holes 28, is represented in sectional view on a larger scale in Fig. 4, showing the formation of the holes 28 and the position of the balls therein. As represented in Fig. 4, each

of the holes 28 is preferably countersunk upon the under side of the plate 26, forming a beveled or flaring hole, with the diameter of the hole the smallest at the upper surface of the plate. The distance of the ball-retaining plate 26 above the removable ball-supporting plate 23 is determined by the height of the concentric rib 25, and it is such that each of the balls 29 will project slightly above the upper surface of the ball-retaining plate 26, so that the balls may be brought into contact with the grinding-wheel 6. Each of the holes 28 is made larger than that portion of the ball inclosed within the hole in order to afford a clearance between the balls and the ball-retaining plate 26, and as the holes 28 are beveled or flaring upon the under side of the plate the balls come in contact only with the acute-angled corner 30.

The ball-supporting plate 23 and ball-retaining plate 26 are each removable from the cylinder 10, and the balls 29 are applied by inverting the upper retaining-plate and placing the balls in the countersunk holes 28. The plate 23 is then placed over the balls, with the concentric rib 25 inclosing the boss 27. The two plates 23 and 26 are then pressed together and placed upon the upper end of the cylinder 10 in the position shown in Fig. 2, with the spurs 17 of the hollow shaft 15 entering the holes 24 24 in order to rotate the ball-supporting plate 23 and with the end of the shaft 18 engaging the ball-retaining plate 26. The cylinder 10 is then raised by the rotation of the annular nut 12 by means of the hand-wheel 14 in order to bring the balls 29 into contact with the under surface of the revolving grinding-wheel 6. During the operation of grinding both the ball-retaining plate 26 and the ball-supporting plate 23 can, if desired, be rotated by means of the belts 21 and 22, causing the balls 29 to be continually rolled upon the surface of the ball-supporting plate 23, so that the entire surface of each ball will be presented to the action of the grinding-wheel 6. The two ball-supporting tables represented in the present drawings are arranged beneath the grinding-wheel 6 and upon opposite sides and at equal distances from its center, and the diameter of the grinding-wheel is equal to the distance between the outer sides of the table, so that those balls farthest from the center of the grinding-wheel will be rotated faster than those balls nearer the center of the grinding-wheel, and the rotation of the balls at different speeds, depending upon the difference in their distances from the center of the grinding-wheel, will cause the ball-retaining plate to be rotated by the action of the grinding-wheel even if the belt 22 were removed. If desired, therefore, the operation of grinding can be carried on by the removal of the belts 21 and 22, allowing the ball-supporting plate 23 to be held from rotation by its frictional contact with the closed end of the cylinder 10 and rotating the ball-retaining plate 26 by the balls themselves, as the balls are rolled around upon the surface of the plate 23 by the action of the grinding-wheel.

Either one or both of the belts 21 and 22 can be employed to impart a rotary motion to either one or both of the plates 23 and 26, as may be desired. The cylinder 10 is provided with a groove 31 to receive the end of a bar 32, which is attached to the framework of the machine in order to hold the cylinder 10 from turning as the nut 13 is rotated.

I deem it preferable to provide the ball-retaining plate with a series of circular holes, each of which is adapted to inclose a single ball, and the holes are preferably arranged in straight rows parallel with a line passing diametrically through the ball-retaining plate.

Although I have shown but two ball-supporting tables arranged beneath the grinding-wheel, a larger number can be used if desired. I prefer to arrange the tables in a row concentrically to the axis of the grinding-wheel and at a sufficient distance therefrom, so that the axis of the grinding-wheel if produced would pass between the ball-supporting tables. The holes 28 at the upper surface of the ball-retaining plate are preferably slightly smaller than the diameter of the balls 29 in order to prevent the balls from passing through the ball-retaining plate.

I have shown the grinding-wheel revolving in a horizontal plane, with the ball-supporting and ball-retaining plates placed beneath it. While this is a convenient and preferable arrangement, I do not confine myself to this position.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a rotating ball-supporting plate, a rotating ball-retaining plate concentric with said ball-supporting plate and having a series of holes, or openings, to receive the balls to be ground, and a rotating grinding-wheel with its sides in contact with the balls held on said ball-supporting plate and having its axis eccentric to the axis of said supporting-plate, substantially as described.

2. The combination of a pair of ball-supporting plates placed side by side and in the same horizontal plane, ball-retaining plates above said supporting-plates and having a series of openings to receive the balls to be ground and a rotating grinding-wheel having the line of its axis passing between said ball-supporting plates and with the side of said wheel overlapping said ball-supporting plates, substantially as described.

3. The combination of a grinding-wheel, a ball-supporting plate by which the balls to be ground are held against the side of said grinding-wheel, and a ball-retaining plate interposed between said supporting-plate and said grinding-wheel, said retaining-plate having a series of holes, or openings, through said plate and arranged in straight lines, parallel with a diametrical line passing through

the center of said plate, substantially as described.

4. The combination of a rotating grinding-wheel, a shaft, a ball-retaining plate supported on the end of said shaft, a ball-supporting plate held on the end of said sleeve and beneath said ball-retaining plate, a table beneath said ball-supporting plate and adjustably held in the framework of the machine, and means by which said table is moved into and out of contact with said ball-supporting plate, substantially as described.

5. The combination of a grinding-wheel, a non-rotatable supporting-table, a removable ball-supporting plate interposed between said table and said grinding-wheel, means for holding said ball-supporting and said ball-retaining plates concentric with each other, and means for bringing said table into contact with said ball-supporting plate, substantially as described.

6. The combination with a framework and a rotating grinding-wheel, of a cylinder held in said framework, means for moving said cylinder longitudinally in said framework, a removable ball-supporting plate supported in said cylinder, a rotating shaft engaging said plate, and a ball-retaining plate held concentrically on said ball-supporting plate and capable of an independent rotation, substantially as described.

7. The combination of cylinder 10, means for raising and lowering said cylinder, a plate 23 held on said cylinder, a perforated plate 26 held concentrically above plate 23, said plate 23 being capable of rotating, and a grinding-wheel, substantially as described.

8. The combination of a grinding-wheel, a shaft 18, parallel with the shaft of said grinding-wheel but eccentric thereto, a ball-retaining plate provided with a boss 27, inclosing the end of said shaft, a sleeve 15 concentric with said shaft, a ball-retaining plate held on the end of said sleeve, a table provided with bearings for said sleeve 15, and means for moving said table into contact with said ball-supporting plate, substantially as described.

9. The combination with a grinding-wheel and a table parallel with the side of said wheel, of a removable ball-supporting plate having a central boss entering said concentric rib, whereby said ball supporting and retaining plates are held concentrically with each other when removed from the machine, substantially as described.

10. In a machine for grinding balls, the combination with a rigid framework, of a rotating grinding-wheel, a cylinder held in said framework and provided with a screw-thread, a nut engaging said screw-thread and held from longitudinal movement, a ball-supporting plate carried by said cylinder, by which the balls are moved toward said grinding-wheel, substantially as described.

Dated this 3d day of March, 1898.

HARRY M. PUTNAM.

Witnesses:
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CHARLES F. BAKER.