O. W. SCHAUM.

MACHINE FOR GRINDING BALLS.

APPLICATION FILED NOV. 29, 1916.

1,252,364.

Patented Jan. 1, 1918.

3 SHEETS—SHEET 1.

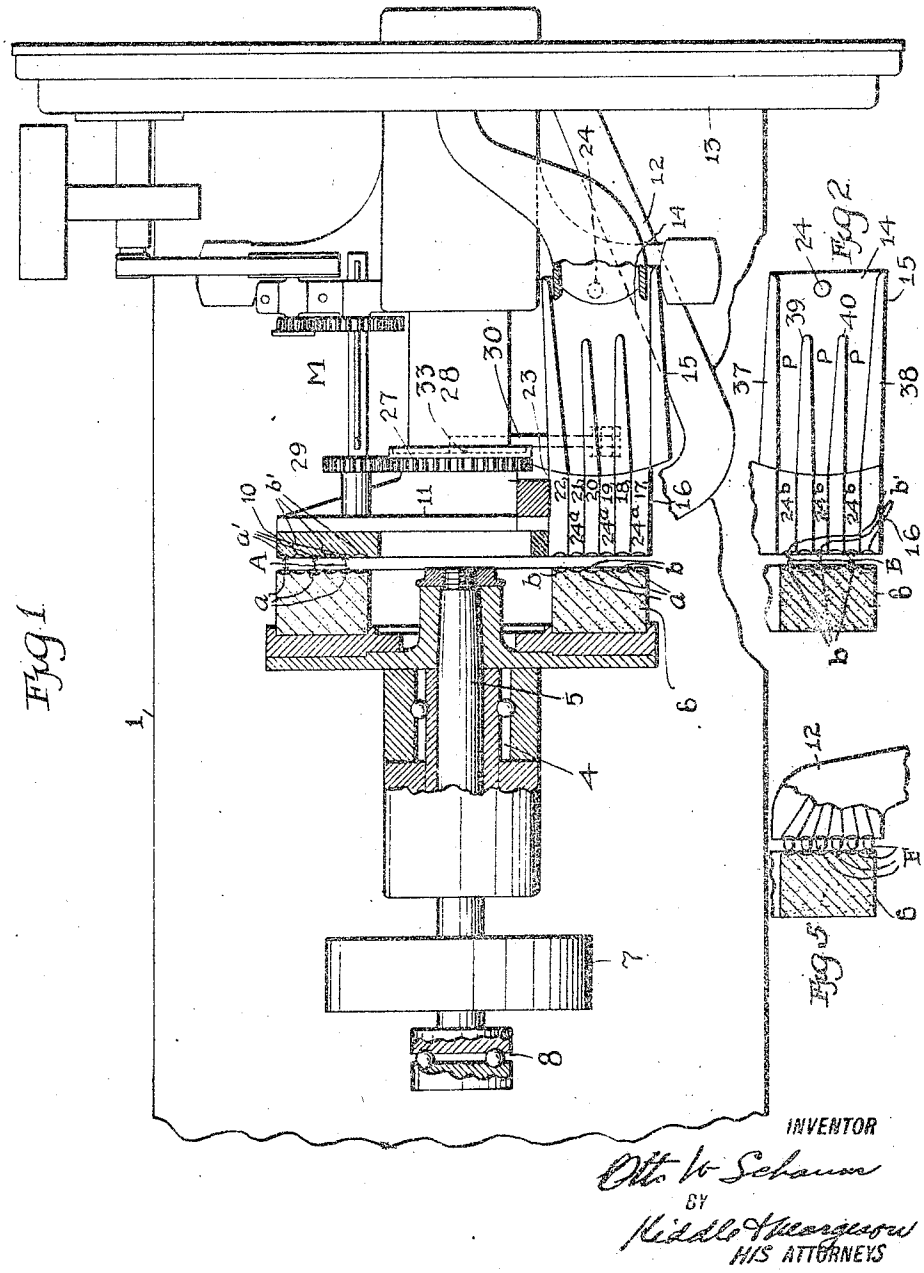


Fig 1

Fig 2

Fig 5

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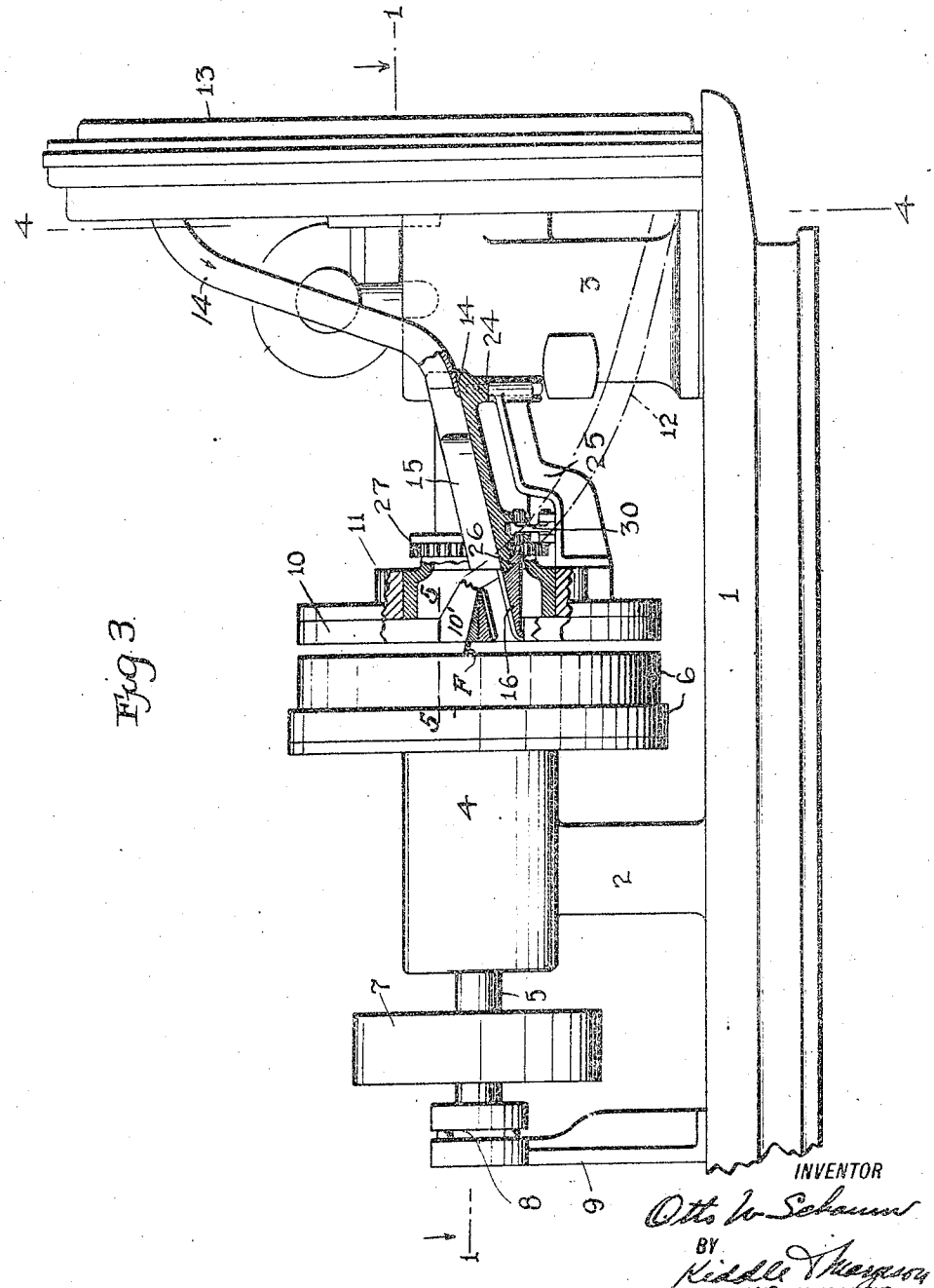


Fig 3.

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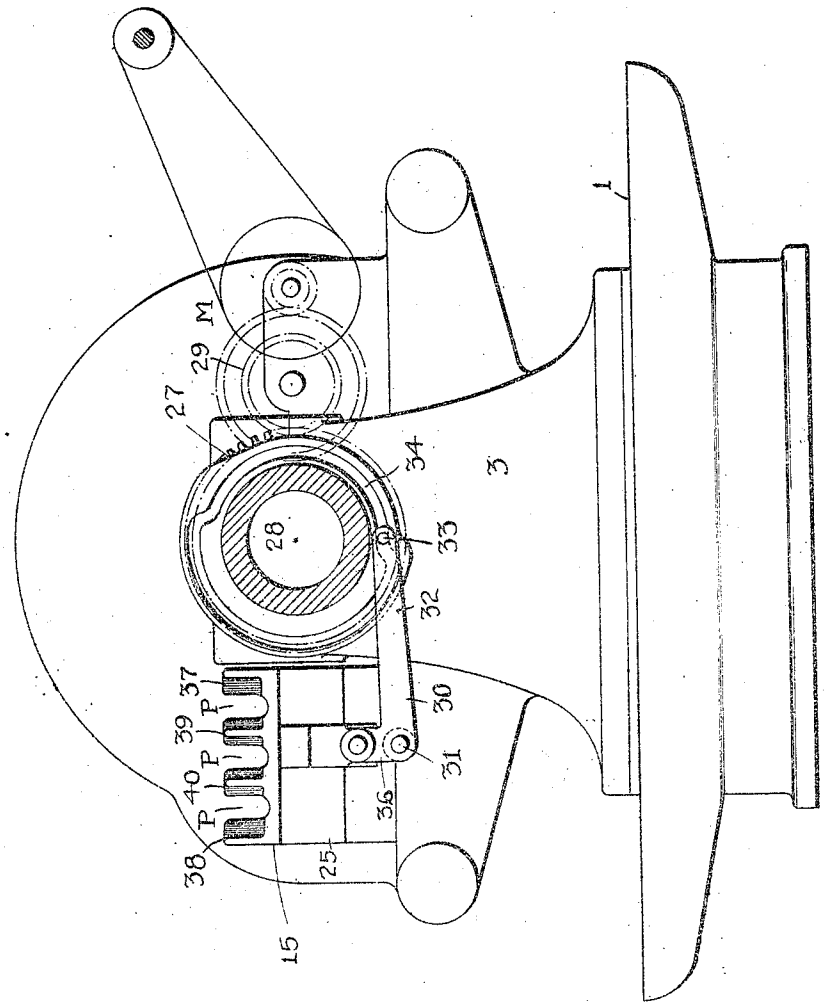
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3 SHEETS—SHEET 3.

Fig 4.



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MACHINE FOR GRINDING BALLS.

1,252,364. Specification of Letters Patent. Patented Jan. 1, 1918.

Application filed November 29, 1916. Serial No. 134,014.

To all whom it may concern:

Be it known that I, OTTO W. SCHAUM, a citizen of the United States, and a resident of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented new and useful Improvements in Machines for Grinding Balls, of which the following is a specification.

The invention relates to machines for the grinding of balls such as are used in ball bearings and for other purposes.

Machines for grinding balls usually comprise two opposing relatively movable members, such as plates or disks having in their working faces one or more grooves to receive the balls.

Since the inventions of one Ernst G. Hoffmann there have been extensively and commercially employed ball grinding machines in which one of the opposing members is a relatively stationary metal disk usually of cast metal having on its working face a series of concentric grooves and the other opposing member is a relatively rotatable disk of abrading material, such as emery or corundum.

Such a machine is shown and described in patents granted to said Hoffmann covering his inventions, one of which patents is No. 803,164, dated October 31, 1905, for ball grinding machines, another of which is No. 868,860, dated October 22, 1907, for grinding balls, and another of which is No. 868,926, dated October 22, 1907, for grinding balls.

In operating the machine shown in said patents grinding grooves are formed in the abrading disk—if grooves are not already therein—and the depth of these grooves gradually increases as the grinding proceeds. The grooved portion of the metal or stationary disk of course wears somewhat deeper with continued use, but not as fast as do the grooved portions of the abrading disk. In order that the product from such a machine will be accurate and uniform it has been demonstrated to be advisable in commercial manufacture to construct the stationary disk with an outlet to permit the discharge of the balls and to provide a means—a series of fingers—for positively dislodging the balls from the grooved portions in the abrading disk.

In the commercial machines there is also employed a means for mixing the balls and for subsequently returning or feeding the mixed balls to the grinding portion of the machine, to wit, the grinding grooves mentioned above.

The dislodging, mixing and feeding just referred to may be effected by a single means or mechanism and such a construction is shown in the Hoffmann patents above identified.

In performing the present invention there are employed a stationary or metal disk and a companion abrading disk, each of which is provided with two sets of grooves, the two sets of grooved portions in one disk cooperating with the corresponding sets of grooved portions in the other disk.

The apparatus which is the basis of the present invention is preferably constructed so that the balls being ground will be positively discharged from the grooved portions of the grinding disk when the balls reach a particular place, so that the balls thus discharged will be permitted to roll or will be conveyed to a suitable elevating and mixing means and so that finally the balls will roll or will be conveyed to a position where they can pass through a feeding means to the grinding portion of the machine whereby a subsequent grinding operation can be performed. In said feeding means there is preferably comprised a movable guide member, to wit an angularly movable throat member, which can be relied upon at one time to cause the balls to be fed into one set of grooves in the coöperating disks and at another time to feed the balls or to cause the balls to be fed into another set of grooves in the coöperating disks. This movable guide member is preferably actuated by mechanism which causes it to be positioned periodically as the grinding operation proceeds.

As illustrating a specific embodiment of the invention reference is made to the drawings forming a part of this specification and in which drawings,

Figure 1 is a plan view, partially in section, of a ball grinding machine in which the invention is realized. This figure is a view taken as on the plane indicated by the broken line 1—1 in Fig. 3 looking in the direction of the arrows.

Fig. 2 is a partial plan view, in section,

showing the angularly movable throat member in a different position from that which it occupies in Fig. 1.

Fig. 3 is a vertical view, partially broken away, of the machine shown in Fig. 1.

Fig. 4 is a transverse vertical-sectional view taken as on the plane indicated by the line 4—4 in Fig. 3; and

Fig. 5 is a partial plan view, in section, taken as on the plane indicated by the line 5—5 in Fig. 3.

The machine comprises any suitable main frame or bed plate 1 having thereupon standards 2 and 3. The standard 2 provides a bearing 4 having a shaft 5 that carries an abrading wheel or disk 6 which may be of such material as emery or corundum and the shaft 5 is driven by any suitable source of power as, for instance, through the medium of a belt passing over a pulley 7. The longitudinal thrust imparted to the shaft 5 during the grinding operation may be resisted as by means of any suitable thrust bearing 8 between the shaft 5 and a bracket 9 on the frame of the machine.

The standard 3 carries a relatively stationary disk 10 through the medium of any suitable mechanism as indicated by 11. Said standard 3 is fixedly secured to the base but it may be adjustably mounted on the base if such a construction is desired. The relatively stationary disk 10 is mounted by means of the mechanism 11 so that it can be moved relatively to the standard and consequently toward and away from the abrading disk in order to effect an adjustment between the metal disk and the abrading disk as the grinding operation proceeds. The metal disk 10, even though it is adjustable toward and from the abrading disk 6, is the relatively stationary member, and the disk 6 is the relatively revoluble abrading member. Each of these disks has two sets of grooved portions and the two disks cooperate so as to provide between them the two sets of grinding grooves, one set designated by A and the other set designated by B. The set A is defined by the grooved portions a of the abrading disk and by the grooved portions a' of the metal disk. The set B is defined by the grooved portions b of the abrading disk and by the grooved portions b' of the metal disk. A double set of fingers F extends into the two sets of grooved portions A and B whereby when the balls reach the fingers F on their downward travel they—the balls—will be ejected from the particular set of grinding grooves in which they are located. In this manner the fingers will serve to positively dislodge the balls from the grinding portion of the machine through the discharge opening 10' that is provided in the stationary or metal disk 10. From this discharge opening the balls are conveyed by means of the trough 12 to the lower portion of the mixing and elevating mechanism 13. From the mixing and elevating mechanism 13 the mixed balls, when properly elevated, pass into a suitable conveyer or trough 14 which constitutes a part of the feeding mechanism for conducting and directing the balls back to the grinding portion of the machine. This conveyer 14 comprises a movable member 15 and a fixed member 16. The fixed member 16 is in the form of a throat having guiding portions 17, 18, 19, 20, 21, 22 and 23 which define two sets of passageways, one set of which comprises grooves or passageways 24^a and the other set of which comprises grooves or passageways 24^b. The grooves or passageways 24^a correspond to or register with the grooves A between the opposing disks or grinding members and the grooves or passageways 24^b correspond to or register with the grooves B between said grinding members. The passageways 24^a are defined by the guiding portions 17 and 18, 19 and 20, and 21 and 22; while the passageways 24^b are defined by the guiding portions 18 and 19, 20 and 21, and 22 and 23. The balls are delivered from the passageways 24^a into the set of grinding portions designated by A and by the passageways 24^b into the set of grinding portions designated by B. The movable member 15 in this guideway is shown as being pivotally mounted at 24 at the end of a bracket 25 which is secured to the mechanism 11 that carries not only the relatively stationary metal disk 10 but also the fixed portion of the guideway or feeding means. It will be noted that the throat member 16 of the feeding means is secured to the carrier of the relatively stationary member 10. The movable member 15 which may be considered as a movable throat member swings about the pivot 24 as a center and can be moved angularly from the position shown in Fig. 1 to the position shown in Fig. 2. The free end of this pivoted member 15 is circular in form and the pivoted point 24 of this member 15 is the center of the circular portion which defines the free or movable end of the pivoted member 15. The free or laterally movable end of this member 15 is supported as by means of a ledge 26 that is on the fixed throat member 16. A combined cam and gear 27 is mounted upon a shaft or spindle 28 of the mechanism 11 and this combined cam and gear may be driven about said shaft or spindle 28 which serves as a support therefor through the medium of any suitable mechanism, for instance, the mechanism M comprising the gear 29. The mechanism M and gear 29 may be referred to herein as a continuously operating mechanism. Any suitable mechanism is interposed between the cam of the cam gear 27 on the one hand and the movable throat member 15 whereby the

latter will be intermittently actuated or positioned as the cam gear 27 continuously revolves. This is accomplished through the medium of a bell-crank lever 30 which is pivotally mounted at 31 on the mechanism that carries the relatively stationary disk. One portion, to wit the end 32 of this bell-crank lever, has upon it a pin or roller 33 that enters the slotted cam portion 34 of the cam gear 27. Another portion, to wit the end 36 of the bell-crank lever 30 is pinned or otherwise connected to a depending lug which is at the free or laterally movable end of the movable throat member 15. The cam of the continuously rotating cam gear 27 and the lever 30 serve as means whereby the continuously operating mechanism M can intermittently actuate or position the movable throat member of the ball feeding means. The movable throat member 15 has upstanding outer guide members 37 and 38 and intermediate guide members 39 and 40 which provide between them passageways P, P, P. The intermediate guide members 39 and 40 serve to direct the balls rolling downwardly along the member 15, which it will be observed is also an inclined member, into one or another of the three passageways designated as P. When the number 15 is in the position shown in Fig. 1 the balls roll from the passageways P into the passageways 24^a of the fixed throat member and finally enter the set of grooved portions A, between the opposing grinding members. When, however, the movable member 15 is in the position shown in Fig. 2 the balls roll from the passageways P into the passageways 24^b of the fixed throat member and finally into the set of grooved portions B. As the grinding operation proceeds the combined cam and gear 27 is being rotated and the construction of the cam gear and lever just described is such, as will be manifest from an inspection of Fig. 4 for example, that the movable member 15 will be held for a certain period in the position shown in Fig. 1. It will then be moved to the position shown in Fig. 2 and will be held in such position for a certain period, after which it will be returned to the original position whereby the cycle of movements can be successively repeated. In other words, the movable throat member 15 has a periodical movement imparted to it so that the balls will be fed into the set of grooves A at one time and into the set of grooves B at another time. The fingers F, however, are arranged so that they will extract the balls from the machine no matter in what grooves they are located.

The mechanism M has been heretofore referred to as mechanism whereby the movement can be imparted to the combined cam and gear 27. This mechanism M may be driven from or associated with the same mechanism which serves to elevate and mix the balls and it may be driven or associated with, either directly or indirectly, the mechanism which imparts the rotary movement to the abrading disk 6.

In the drawings the mechanism M is shown as being driven from the motor or continuously operating mechanism N which operates the mixing and elevating mechanism 13.

The improvements herein set forth are not limited to the precise construction and arrangment shown and described for they may be embodied in various forms and modifications without departing from the spirit and scope of the invention.

What I claim is:

1. A ball grinding machine comprising in combination a pair of opposing grinding members, each of which members has a plurality of sets of grooves, means for dislodging balls from the grooves when the balls reach a particular place, and means for feeding the balls back to the grinding portions of the machine, said means comprising a fixed throat member having passageways leading to said sets of grooves and a throat member movable relatively to said fixed throat member whereby balls to be ground will be fed into one set of the grooves at one time and into another set of the grooves at another time.

2. A ball grinding machine comprising in combination opposing relatively rotating members, each of which members has a plurality of sets of grooved portions that cooperate with corresponding sets of grooved portions in its opposing member, means for dislodging balls from between the opposing members when the balls reach a certain place, a movable throat member, continuously operating mechanism, and means between said mechanism and said movable throat member for periodically moving the throat member to a position where it will direct the balls into one of said sets of coöperating grooved portions and from that position to another position where it will direct the balls into another of said sets of coöperating grooved portions.

3. An apparatus of the class described comprising in combination opposing grinding members, one of which is a relatively stationary metal disk and the other of which is a relatively rotatable disk of abrading material, the abrading disk having a plurality of sets of grinding grooves therein and the metal disk having a plurality of sets of grooves which are opposed to the sets of grinding grooves in the abrading disk, means for positively dislodging the balls from the grinding grooves and for causing the balls thus dislodged to pass through an opening in the metal disk to a place where the balls are mixed, means for feeding the mixed balls back to the grinding disks where a subse-

quent grinding step can be performed, said last mentioned means comprising as a part thereof a movable throat member, and cam means for actuating the movable throat member whereby as the grinding operation proceeds the balls will be directed at one time to one set of the grinding grooves and at another time to another set of the grinding grooves.

4. A ball grinding machine of the class described comprising in combination opposing grinding members, one of which is a disk of metal and the other of which is a disk of abrading material, means for positively dislodging the balls from the space between the disks, for mixing the balls and for elevating the balls to a position where they can be fed back into the machine, means for feeding or directing the balls into the operating space between the disks, which said means comprises a movable throat member, and means for automatically positioning the throat member so that the latter will cause the balls to be directed to one set of grooves in the opposing disks at one time and to another set of grooves in the opposing disks at another time.

5. A ball grinding machine of the class described comprising in combination a relatively stationary disk and a relatively rotatable disk opposed to the stationary disk, each of which disks has a plurality of sets of grooved portions with the sets of grooved portions in one disk coöperating with the sets of grooved portions in the other disk, means for mixing the balls delivered from the grinding space between the disks, mechanism for elevating the balls, mechanism comprising a movable throat member for feeding or directing the balls from the elevating mechanism back to the grinding space between the disks, and a common means for actuating the elevating mechanism and for actuating the movable throat member whereby as the grinding operation proceeds the balls will periodically be conducted at one time to one set of grinding grooves between the disks and at another time to another set of grinding grooves between the disks.

6. A ball grinding machine of the class described comprising in combination a relatively rotatable abrading disk having a plurality of sets of grinding grooves, a relatively stationary metal disk having a plurality of sets of grooved portions which are opposed to said sets of grinding grooves, means carried by or secured to the relatively stationary disk for positively dislodging the balls from the grinding grooves in the abrading disk, mechanism for mixing and elevating the balls thus dislodged, and means comprising a movable member for feeding or directing the balls, after they have been elevated, back to the grinding space between the disks, and a common means for actuating the elevating mechanism and for actuating the movable member of the feeding means whereby, as the elevating mechanism is continuously operated, the movable member of the feeding means will be periodically positioned so as to feed or direct the balls at one time to one set of the grinding grooves and at another time to another set of the grinding grooves.

7. A ball grinding machine of the class described, comprising a relatively rotating abrading disk, a relatively stationary metal disk, each of which disks is provided with a plurality of sets of grooves whereby there will be a plurality of sets of grinding spaces between said disks, means for mixing the balls discharged from the grinding space, mechanism for elevating the balls, means for subsequently feeding or directing the balls back to the grinding spaces between the disks, said feeding or directing means comprising a movable throat or member, and means associated with said elevating mechanism, which means is constructed so that as the grinding operation proceeds the movable throat or member will be periodically positioned to direct the balls at one time into one set of the grinding spaces between the disks and at another time into another set of the grinding spaces between the disks.

8. A ball grinding machine comprising opposing coöperating disks, one of which is a relatively rotating disk, and the other of which is a relatively stationary metal disk, means for dislodging the balls from the operating space between the disks, for mixing the balls, and for feeding or directing the balls back to the operating space between said disks, said means comprising as a part thereof a movable throat or member, a cam, and mechanism between the cam and said movable throat or member whereby the throat or member can be moved so that in one position the balls will be fed into one set of operating spaces between said disks and so that in another position they will be fed into another set of operating spaces between said disks.

9. A ball grinding machine comprising in combination a relatively stationary metal disk, a relatively rotatable abrading disk which coöperates with said stationary metal disk, said abrading disk having a plurality of sets of grinding grooves, means comprising a movable throat or member for directing or feeding balls into said grinding grooves and mechanism for automatically and periodically positioning said throat or member so that the balls will be directed at one time into one set of the grinding grooves and at another time into another set of grinding grooves.

10. A ball grinding machine of the class described comprising in combination a relatively stationary disk and a relatively ro-

tatable disk having a plurality of sets of grooves therein, feeding means comprising a relatively stationary throat member having sets of grooves which register with the sets of grooves in the relatively rotatable disk, a movable throat member, a cam, and mechanism between the cam and said movable throat member whereby as said cam is revolved the movable throat member can be periodically positioned to direct at one time the ball being ground into one set of grooves in the fixed throat member and at another time into another set of the grooves in the fixed throat member.

11. A ball grinding machine comprising in combination a relatively stationary metal disk, a relatively rotating abrading disk, each of which disks has a plurality of sets of grooved portions, the sets of grooved portions in one disk coöperating with the sets of grooved portions in the other disk, mechanism for supporting the relatively stationary disk, a feeding means carried by said mechanism which feeding means comprises as a part thereof a movable throat member, a revoluble cam and a lever pivotally secured to said mechanism, which lever is actuated by said cam and in turn actuates said movable throat member so that at one time the movable throat member will direct balls into one set of the grooves and at another time into another set of the grooves.

12. A ball grinding machine comprising in combination a pair of opposing grinding members having between them a plurality of sets of grinding grooves, means for dislodging the balls from the grooves, and means for feeding the balls back to the grinding grooves, said means comprising a fixed throat member having a plurality of sets of passageways leading to said sets of grooves and a throat member movable relatively to said fixed throat member whereby balls being ground will at one time be conveyed into one set of the passageways in said fixed throat member, thence into a corresponding set of grinding grooves, and by said movable throat member at another time into one set of the passageways in said fixed throat member, thence into a corresponding set of the grinding grooves.

13. A ball grinding machine comprising in combination a pair of opposing grinding members each of which members has a plurality of sets of grooved portions, and means for feeding the balls into the grinding grooves defined by said grooved portions, said means comprising a fixed throat member having passageways leading to the sets of grinding grooves and a throat member movable relatively to said fixed throat member whereby balls to be ground will be fed into one set of the grinding grooves at one time and into another set of the grinding grooves at another time, said fixed throat member being on the delivery side of the movable throat member.

14. A ball grinding machine comprising in combination opposing relatively rotating members each of which members has a plurality of sets of grooved portions that cooperate with the corresponding set of grooved portions in its opposing member, feeding means comprising a movable throat member, continuously operating mechanism, and means between said mechanism and said movable throat member for periodically moving the throat member to a position where it will direct the balls into one of said sets of coöperating grooved portions at one time when in one position and into another of said sets of coöperating grooved portions at another time when in another position.

15. An apparatus of the class described comprising in combination opposing grinding members one of which is a relatively stationary metal disk and the other a relatively rotating abrading disk, the abrading disk having a plurality of sets of grinding grooves therein and the metal disk having a plurality of sets of grooves which are opposed to the sets of grinding grooves in the abrading disk, means for conveying balls from the grinding members whereby the balls can be mixed, means for feeding the mixed balls back to the grinding members where a second grinding step can be performed, said last mentioned means comprising as a part thereof a movable throat member and continuously operating means having a cam whereby as the grinding operation proceeds the movable throat member will be automatically positioned so that at one time the mixed balls will be fed to one set of grinding grooves and at another time to another set of grinding grooves.

This specification signed and witnessed this 24th day of November, A. D., 1916.

OTTO W. SCHAUM.

Signed in the presence of—

WM. H. HICKS,

LEONARD G. SMYTH.