No. 620,851. Patented Mar. 7, 1899.

H. T. MORSE.

BALL GRINDING MACHINE.

(Application filed Feb. 28, 1898.)

(No Model.)

FIG. I

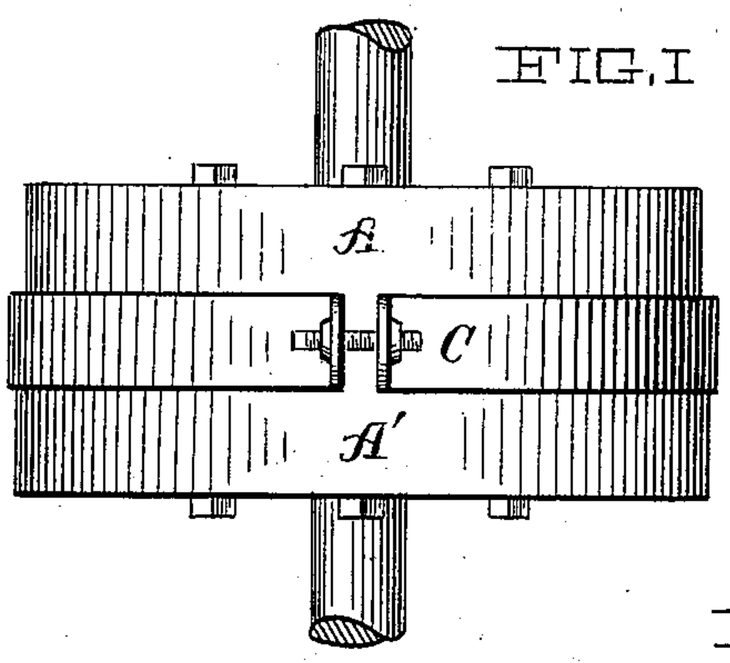


FIG. II

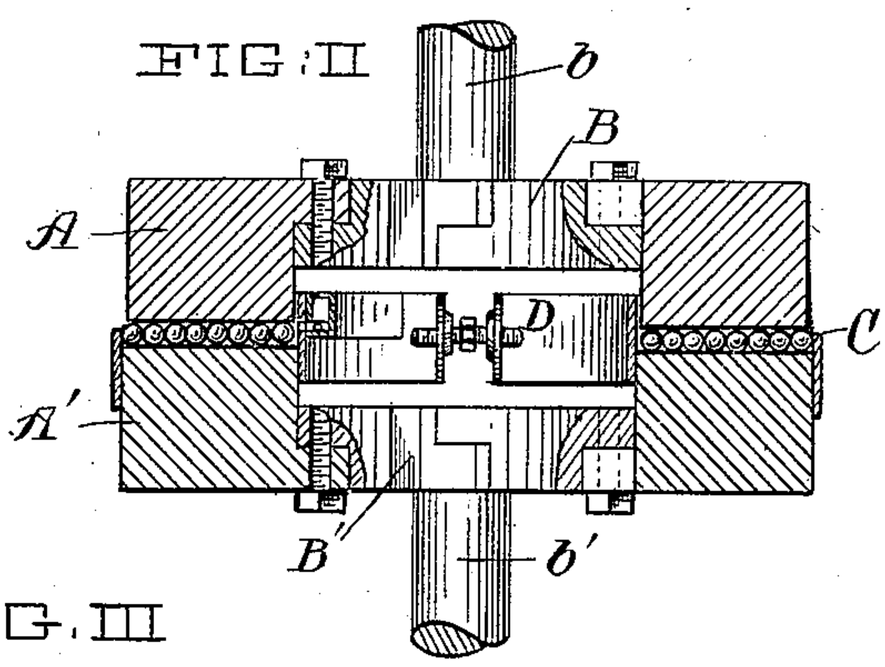


FIG. III

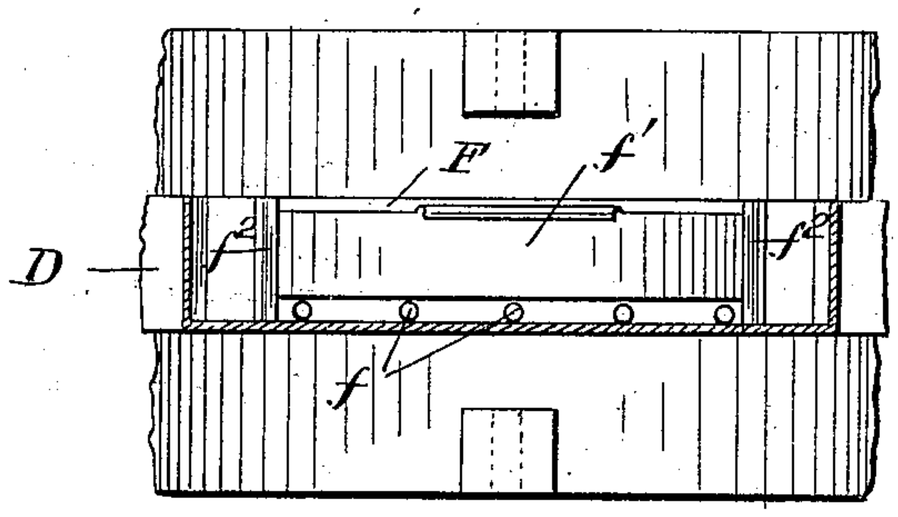
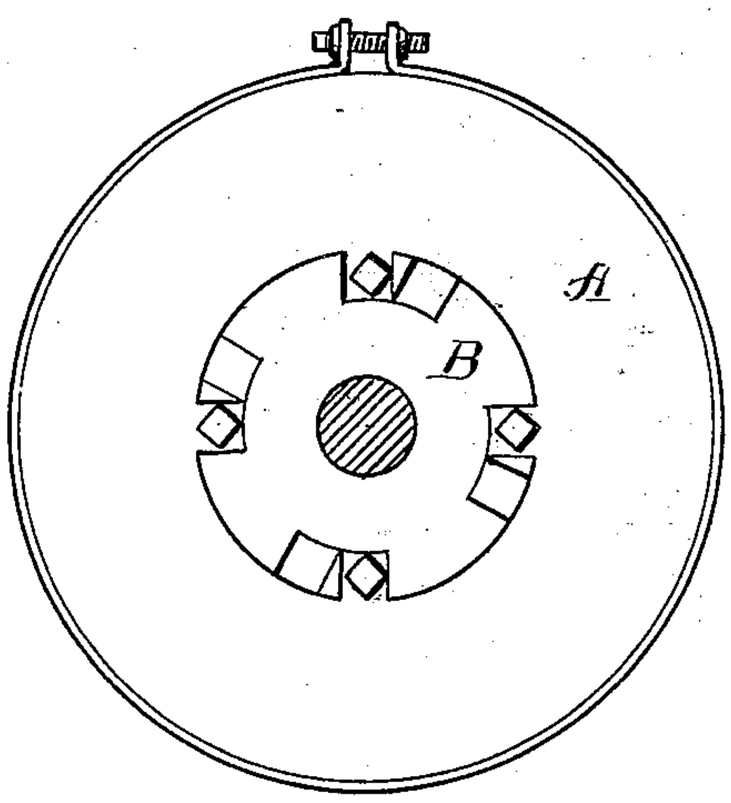


FIG. IV

FIG. V



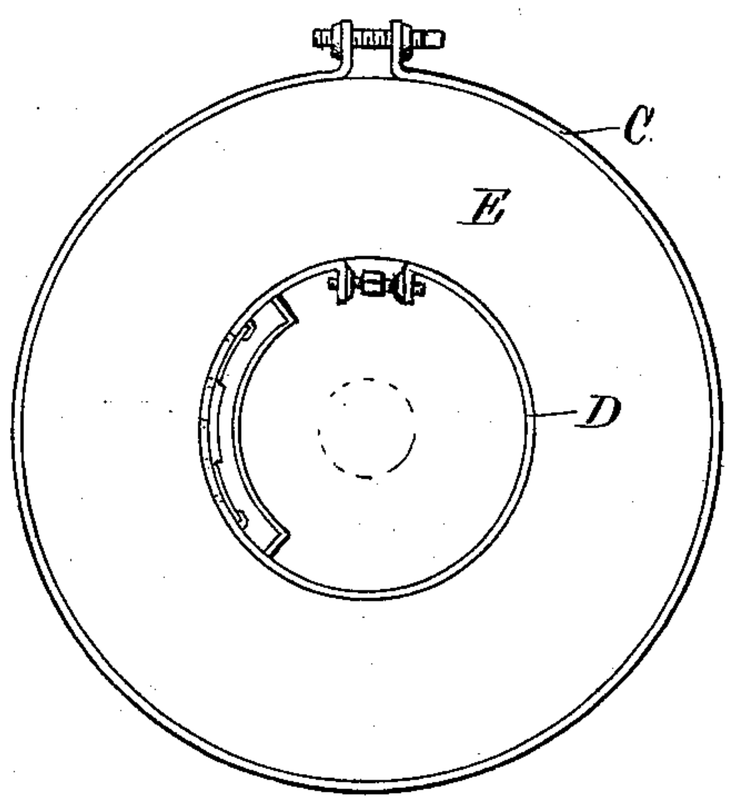


FIG. VI

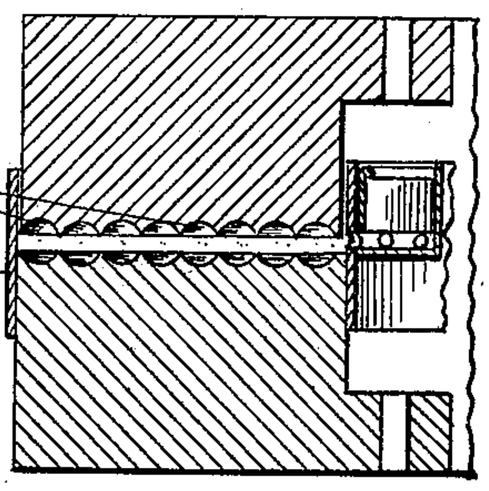
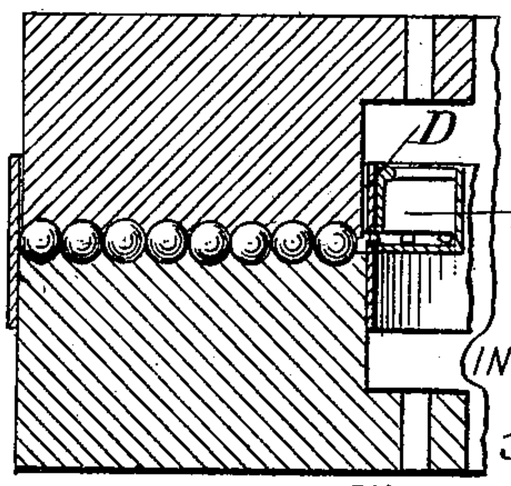


FIG. VII



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BALL-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 620,851, dated March 7, 1899.

Application filed February 28, 1898. Serial No. 671,943. (No model.)

To all whom it may concern:

Be it known that I, HORACE T. MORSE, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Ball-Grinding Machines, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle so as to distinguish it from other inventions.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings, Figure I represents a front elevation of my improvement. Fig. II represents a vertical central cross-sectional view. Fig. III represents an enlarged detail view. Fig. IV represents a top plan view. Fig. V represents a top plan view of the lower half of the apparatus, and Figs. VI and VII represent enlarged partial detail central cross-sectional views.

My improved apparatus consists of two concentric cast-iron grinding-rings, an upper ring A and a lower ring A′. Each ring is of annular cylindrical formation, and the diameter of the annulus of the upper ring is slightly less than the diameter of that of the lower ring. Each ring is formed with suitable means for securing it to the heads B and B′, respectively, said ring and heads being provided with suitable lugs and slots, whereby they may be caused to interlock and may be firmly secured by means of bolts or screws. The heads are formed integral with or secured to shafts *b* and *b′*, respectively, which shafts are connected by suitable means with motive power for rotating them in opposite directions. The upper ring only may be rotated, the lower being made stationary.

Upon the outer periphery of the lower ring A′ is secured by means of a suitable clamp a hard-steel band or ring C, which projects above the upper surface of the ring A′ and forms an adjustable and removable lateral wall. Upon the inner periphery of the annulus of ring A′ is removably secured by suitable dilating means a second band or ring D, of an altitude sufficient to permit it also to project above the upper surface of said ring A′. The two rings C and D form an annular ball-receiving space E, Fig. V, of which they form confining lateral walls, said walls being removable and adjustable up or down in the direction of the axis of the grinding surface or ring.

Secured to the inside of the wall formed by ring D, Fig. III, is an oil-well F, near the bottom of which on the side contiguous to the ball-space are formed a series of holes *f*, passing through said wall and having communication with said ball-space. A slide *f′* acts as a valve to open or close said holes, and hence control the communication between the well and the ball-space. The friction between the slide and its guides f^2 is made such that the said slide will remain in any desired vertical position in said slides when placed in such position.

The device operates as follows: Assuming that the grinding-surfaces of the grinding-rings are flat, the rough balls are placed in concentric rows in the ball-receiving space and emery sprinkled upon them, and the outer confining-ring C secured in a position such that it will project above the surface of ring A′ a distance just sufficient to hold the balls in the receiving-space, as illustrated in Fig. II. The two rings now being rapidly rotated the grinding operation is begun. The balls soon begin to wear concentric grooves *e* in both grinding-rings, the grooves in the lower ring reaching their maximum depth first. The centrifugal force exerted during the rapid rotation causes the balls to assume a position as far as possible toward the outside of the ball-space, so that the outermost row of balls bears against the outer wall C, and each row of balls presses outwardly against the contiguous row toward the outside, Fig. VII. The upper and lower contact of the grinding-rings and the lateral contact with themselves of the balls gives them a compound movement which causes all parts of their surfaces to be equally exposed to the abrasive action. In order that the grooves

shall be formed as quickly as possible, no oil is introduced in this grinding operation, and a groove is also ground in the contiguous inner face of the wall C, the pressure on it in the initial part of the operation being the greatest. As soon as the grooves *e* are worn sufficiently to determine a path for the balls the ring C is moved upwardly and secured, thereby bringing a new surface to form an outer confining-wall. By the continued wearing of the grinding-rings and the formation of the grooves both the upper and lower series of grooves reach a maximum depth, which is about one third the diameter of the balls, Fig. VI. After reaching the maximum depth the grooves remain at that depth, the thin ridges separating contiguous grooves continually wearing or breaking off. The oil-well having been filled with a supply of oil the slide is lifted and the holes opened sufficiently to feed the oil at a proper speed into the grinding-space. The oil being fed in from the inner wall of the ball-space works outwardly by virtue of the centrifugal force and spreads the entire grinding-surfaces. The grinding operation is now continued, the balls being confined in their respective grooves. The wear upon the ring C is now comparatively small, but it sometimes occurs that some wear takes places, in which event the ring is again readjusted in the direction of the axis of the ring A′ or its grinding-surface, thus causing the grooves to remain always practically true with respect to its circular cross-section, such trueness on the part of the grooves being a factor in the production of properly-ground and true balls.

When the grinding-rings and the outer wall have worn as much as is allowable, they are removed and new ones substituted.

Wall D is lowered and readjusted when the wearing of ring B′ causes the grinding-surface to approach too closely to the lower edge thereof.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means covered by any one of the following claims be employed.

I therefore particularly point out and distinctly claim as my invention—

1. In a ball-grinding machine, the combination of two relatively-rotatable surfaces adapted to grind balls, one of said surfaces provided with a ball-receiving space having an adjustable lateral confining-wall, substantially as set forth.

2. In a ball-grinding machine, the combination of two relatively-rotatable surfaces adapted to grind balls, one of said surfaces provided with a ball-receiving space having an adjustable outer confining-wall, substantially as set forth.

3. In a ball-grinding machine, the combination of two relatively-rotatable surfaces adapted to grind balls, one of said surfaces provided with a ball-receiving space provided with adjustable inner and outer confining-walls, substantially as set forth.

4. In a ball-grinding machine, the combination with two relatively-rotatable grinding-surfaces, one of said surfaces provided with an annular ball-receiving space having an inner and an outer confining-wall, of an oil-well communicating with said ball-space at the inner wall, substantially as set forth.

5. In a ball-grinding machine, the combination of two relatively-rotatable rings adapted to grind balls, one of said rings being annular and provided at its inner and outer periphery with confining-rings, the outer ring being adjustable in the direction of the axis of said grinding-ring, substantially as set forth.

6. In a ball-grinding machine, the combination of two relatively-rotatable grinding-rings, one of said rings being annular and provided at its inner and outer peripheries with removable and adjustable rings adapted to form lateral confining-walls, the wall of the outer periphery of the said ring being adjustable in the direction of the axis of said grinding-ring, substantially as set forth.

Signed by me this 21st day of February, 1898.

HORACE T. MORSE.

Attest:
D. T. DAVIES,
A. E. MERKEL.