(No Model.)

E. A. JONES.

MACHINE FOR GRINDING METAL BALLS.

No. 455,879. Patented July 14, 1891.

Fig. 1.

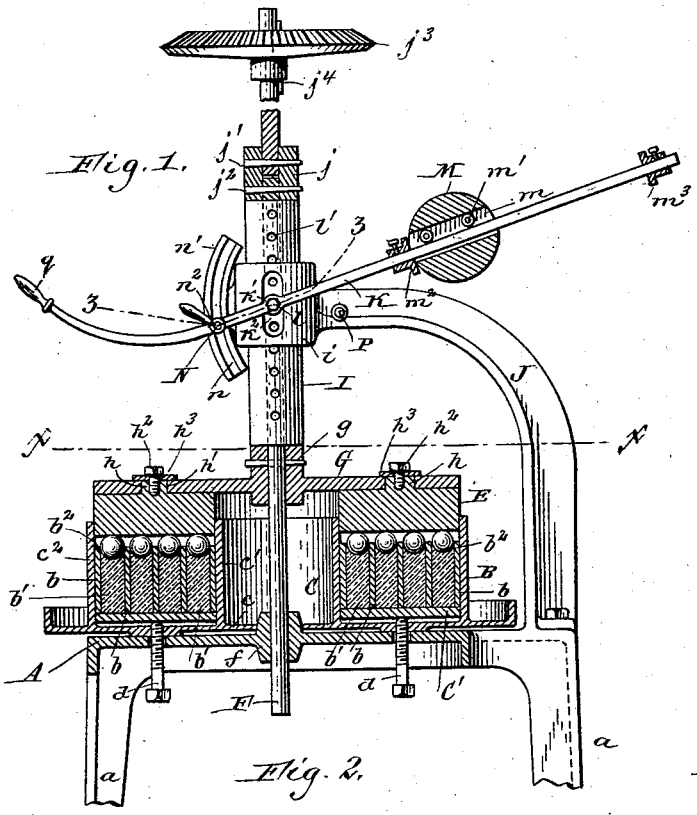


Fig. 2.

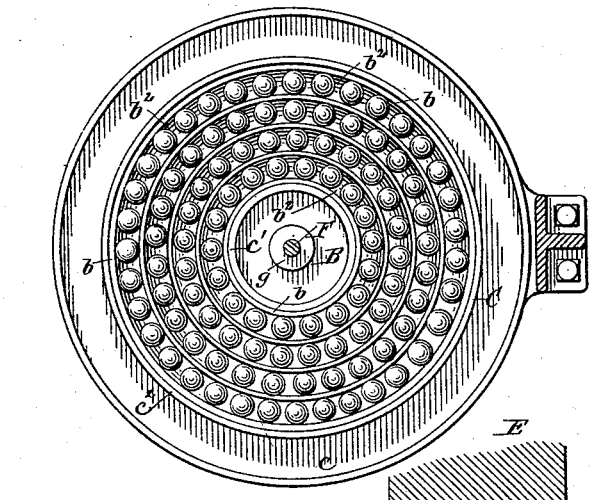


Fig. 3.

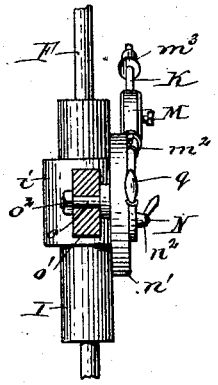


Fig. 4.

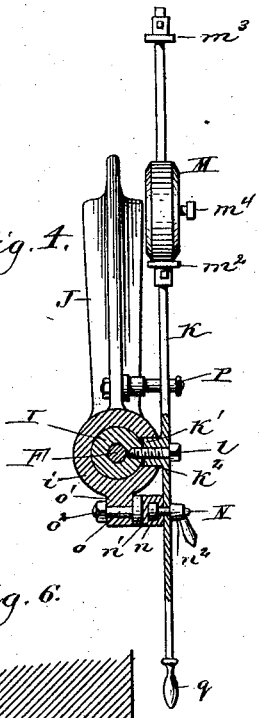


Fig. 5.

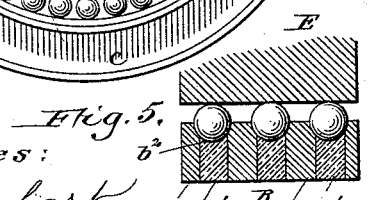
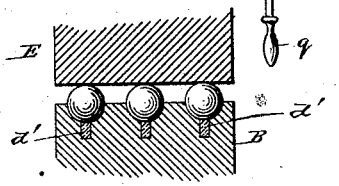


Fig. 6.



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UNITED STATES PATENT OFFICE.

EDWARD A. JONES, OF TONAWANDA, NEW YORK.

MACHINE FOR GRINDING METAL BALLS.

SPECIFICATION forming part of Letters Patent No. 455,879, dated July 14, 1891.

Application filed January 19, 1891. Serial No. 378,238. (No model.)

To all whom it may concern:

Be it known that I, EDWARD A. JONES, a subject of the Queen of Great Britain, residing at Tonawanda, in the county of Erie and State of New York, have invented a new and useful Improvement in Machines for Grinding Metal Balls, of which the following is a specification.

This invention relates to a ball-grinding machine in which metallic balls suitable for use in ball-bearings are ground and polished between two disks.

My invention has for its objects to improve the construction of the lower grinding-disk, so as to increase the effectiveness of its grinding-surface, and also to provide an automatic device for depressing and raising the upper grinding-disk.

In the accompanying drawings, Figure 1 is a sectional elevation of my improved ball-grinding machine. Fig. 2 is a horizontal section in line *x x*, Fig. 1. Fig. 3 is a fragmentary front elevation of the raising and depressing mechanism. Fig. 4 is a horizontal section in line *z z*, Fig. 1. Figs. 5 and 6 are fragmentary vertical sections showing modified forms of the lower grinding-disk.

Like letters of reference refer to like parts in the several figures.

A represents the bed-plate of the machine, which is supported on legs *a a*.

B and E represent the disks between which the balls are ground and polished. The lower disk B consists of a series of metallic division-rings *b*, arranged concentrically and separated from each other by annular spaces, which are filled with emery or other suitable abrading material. The emery is compacted in the annular spaces, so as to form solid rings or fillings *b'* between the metallic rings. The emery fillings are provided in their upper sides with annular grooves b^2, of half-round form, in which the rows of balls are seated. The emery rings may be made of greater or less width, but should be wide enough to form effective abrading-surfaces for the balls, whereby the latter are ground and polished when rolled between the disks. The metallic division-rings extend above the emery rings and form the sides of the grooves which receive the balls. The division-rings are somewhat harder than the emery in the bottom of the grooves, which causes the grooves to wear downwardly. This prevents the balls from moving laterally or radially with reference to the center of the disks and wearing the grooves wide, which would cause the balls to be ground irregularly.

C represents an annular frame or trough which contains the division and emery rings and an annular supporting-plate C', arranged on the bottom plate *c* of the trough between the inner and outer walls *c' c²* thereof, whereby the plate C' is guided vertically. This frame or trough rests upon the bed-plate and is provided with adjusting-screws *d*, arranged in the base-plate of the frame and bearing against the lower side of the supporting-plate, whereby the latter and the grinding-disk resting thereon are adjusted vertically. The adjusting-screws extend through enlarged openings in the bed-plate, which permits the grinding-disk to be adjusted from below and also holds the same against rotary movement.

In the construction of the lower grinding-ring represented in Fig. 1 the emery rings are equal in width to the balls which are being ground, so that a large portion of each ball is presented to the grinding-surface of the emery ring.

In the modified construction represented in Fig. 5 the emery rings are somewhat narrower than the balls, and the metallic division-rings extend underneath the balls, so as to form a portion of the bottom support for the balls. This arrangement causes the division-rings to retard both the lateral and downward wearing of the grooves and requires less frequent renewal of the emery rings.

In the modified construction represented in Fig. 6 the lower grinding-disk consists of one solid metallic disk having the annular grooves for the balls cut in its upper surface, and each of the grooves being provided in its bottom with a channel *d'*, which is filled with emery or similar abrading material. In each case an abrasive bearing-surface is provided for the lower portion of the balls, which accelerates the grinding and polishing of the

latter and retards the lateral wearing of the grooves.

Heretofore the emery has been introduced between the grinding-disks in a powdered form for the purpose of grinding the balls; but the centrifugal action of the rotating upper disk and the balls caused the powdered emery to work over the sides of the disks and required frequent renewal of the emery. By forming a bed of solid emery to support the balls a constant abrading-surface is furnished, which overcomes this difficulty and causes the balls to be ground more uniformly.

The upper grinding-disk E consists of one solid ring which extends downwardly between the walls of the annular frame and bears upon the balls.

F represents a vertical shaft whereby a rotary motion is imparted to the upper grinding-disk. This shaft is arranged within both grinding-disks and axially in line therewith and is journaled near its lower end in a bearing f, formed centrally in the bed-plate of the machine.

G represents a supporting-plate whereby the upper disk is secured to the shaft. The central portion of this plate is provided with a hub g, which is secured to the shaft. The upper disk is provided on its upper side with bosses or lugs h, which enter openings h', formed in the upper supporting-plate, and the disk is secured to the latter by screw-bolts h^2, passing through washers h^3, arranged on the supporting-plate and entering the bosses of the upper disk.

The upper end of the shaft is journaled in a sleeve I, arranged to slide vertically in a collar i, formed at the upper end of an overhanging arm J, secured to one side of the bed-plate. The vertical shaft is preferably made in two sections for convenience in disconnecting the parts, the adjoining ends being connected by means of a coupling-collar j, secured to the ends of the shaft-sections by means of transverse pins j' j^2. The sleeve I bears with its ends against the hub of the upper disk and the coupling-collar, whereby lengthwise movement of the sleeve on the shaft is prevented. The upper portion of the shaft is provided with a bevel-gear j^3, for the purpose of transmitting motion to the upper grinding-disk. The gear-wheel is secured to the shaft by means of a key or spline j^4, which enables the shaft to move lengthwise through the gear-wheel, but compels them to rotate together.

K represents a lever whereby the upper grinding-disk can be depressed for grinding the balls or raised for the purpose of removing the balls. This lever is provided between its ends with a boss k', which is arranged in a vertical slot k^2, formed on one side of the collar i of the arm J, and is pivotally secured to the side of the sleeve I by means of a bolt l engaging with one of a vertical series of openings l', formed on the side of said sleeve.

M represents a sliding weight arranged on the rear arm of the lever, whereby the rear arm is depressed. This weight is provided with an opening m, through which the lever passes and which contains rollers m', which rest upon the lever and enable the weight to slide easily. The movement of the sliding weight on the lever is limited by adjustable stops m^2 m^3, secured to the rear arm of the lever and arranged on opposite sides of the weight.

N represents a fulcrum-bolt, which serves as the fulcrum of the lever K when the latter is in the position for depressing the upper grinding-disk. This bolt is arranged with its head in an undercut groove n, formed in an adjusting-bar n', and passes through an opening formed in the outer arm of the lever. The lever and adjusting-bar are pivotally secured together by a clamping-nut n^2, applied to the screw-threaded end of the fulcrum-bolt and bearing against the side of the lever. The adjusting-bar is provided on one side with a screw-threaded shank o, which passes through an opening formed in a lug o' on the front side of the collar i, and is secured thereto by a clamping-nut o^2, applied to the end of the shank. The shank and clamping-nut of the adjusting-bar enable the latter to be adjusted to the position of the fulcrum-bolt N in changing the fulcrum of the lever K.

P represents a fulcrum pin or roller secured to the side of the overhanging arm underneath the rear arm of the lever K. This pin or roller serves as a fulcrum for the latter when it is desired to raise the upper disk for the purpose of removing the balls and placing a new supply upon the lower disk. In the position of the parts represented in Fig. 1 the lever is fulcrumed on the bolt N, which causes the sleeve carrying the shaft and upper grinding-disk to be depressed, owing to the pressure of the weight at the opposite end of the lever. As the upper disk wears and becomes lighter the weight is moved toward the outer end of the lever by adjusting the stop m^2 to increase its leverage and compensate for the loss in the pressure resulting from the wearing of the upper disk. During the downward movement of the lever, as the upper disk wears away, its fulcrum-bolt is permitted to move outwardly by a slight turning of the adjusting-bar on its pivot. The groove in the adjusting-bar permits the fulcrum-bolt to be adjusted vertically in accordance with the thickness of the upper grinding-disk. When it is desired to raise the upper disk, the fulcrum-bolt is loosened, which permits the front arm of the lever to rise and the rear arm to descend until the latter rests upon the fulcrum pin or roller P. Upon lowering the rear arm of the lever slightly below a horizontal position the weight M slides toward the outer end of the rear arm by gravity, and thereby increases the leverage of the latter. This increased leverage

causes the rear arm to continue its downward movement and swing on the roller P as a fulcrum, thereby raising the front arm of the lever and lifting the upper disk connected therewith. The adjusting-bar is preferably curved, so as to permit the fulcrum-bolt to move freely in the groove of the adjusting-bar when the lever swings on the roller P as a fulcrum. In this manner the weight M is utilized either to depress or raise the upper grinding-disk, thereby enabling the machine to be manipulated very easily. When it is desired to again depress the upper disk, the front arm of the lever is depressed by means of the handle *q* at the front end until the upper disk bears upon the balls and the rear arm of the lever is raised from the fulcrum-roller. Upon tightening the bolt N on the adjusting-bar said bolt again acts as the fulcrum of the lever, which causes the weight to depress the upper disk. By alternately locating the fulcrum on the bolt N and roller P it acts alternately in the capacity of a first and second class lever. The instant the rear arm of the lever is raised above a horizontal position the weight slides inwardly toward the fulcrum, thereby decreasing the leverage. In this manner a small leverage and a correspondingly light downward pressure can be applied to the balls in addition to the weight of the upper disk, while a larger leverage is used when it is desired to raise the upper disk. This change in leverage is automatically effected by the sliding of the weight M when the rear arm of the lever rises above or falls below a horizontal position. If desired, the weight may be rigidly secured in place after adjustment by means of a set-screw m^4.

The boss of the lever and its pivot-bolt *l* are free to move vertically with the sleeve I, owing to the slot k^2. The pivot-bolt *l* is placed in one of the higher openings *l'* as the upper disk becomes worn, so as to retain its relative position to the fulcra of the lever.

I claim as my invention—

1. A ball-grinding disk having its working-face composed of concentric metallic rings and intermediate abrasive fillings arranged between the metallic rings and depressed below the same, thereby forming concentric grooves having metallic sides and abrasive bottoms, substantially as set forth.

2. In a ball-grinding machine, the combination, with the upper grinding-disk, of a lower grinding-disk having its upper face provided with annular grooves having metallic sides and abrasive fillings forming the bottoms of the grooves, whereby the balls wear the grooves downwardly into the abrasive fillings and are restrained radially by the metallic sides of the grooves, substantially as set forth.

3. In a disk for ball-grinding machines, the combination, with the series of grinding-rings provided in their upper sides with annular grooves, and division-rings arranged between said grinding-rings, of a plate supporting said grinding-rings and division-rings, and adjusting-screws engaging against said plate, whereby the disk is adjusted, substantially as set forth.

4. In a disk for ball-grinding machines, the combination, with the series of grinding-rings provided in their upper sides with annular grooves, and division-rings arranged between said grinding-rings, of a plate supporting said grinding-rings and division-rings, adjusting-screws bearing against said supporting-plate, and an annular frame containing said rings and supporting-plate, substantially as set forth.

5. In a ball-grinding machine, the combination, with a grinding-disk and its support, of a weighted lever pivotally secured to said support and connected with said grinding-disk, whereby the latter is moved vertically, substantially as set forth.

6. The combination, with the movable grinding-disk and its supporting-frame, of a lever connected with said disk and having fulcra arranged on opposite sides of its connection with said disk, and a weight attached to the lever, substantially as set forth.

7. The combination, with the movable grinding-disk and its supporting-frame, of a lever attached to said disk, and a sliding weight arranged on said lever, whereby the leverage is automatically increased or decreased, substantially as set forth.

8. The combination, with the movable grinding-disk and its supporting-frame, of a lever connected with said disk and frame near one end, a weight arranged to slide upon the opposite end of said lever, and stops whereby the sliding movement of said weight is limited, substantially as set forth.

9. The combination, with the movable grinding-disk, a movable sleeve connected with said disk, and a supporting-frame in which said sleeve is guided, of a lever connected with said sleeve, a pivoted support on said frame for one arm of said lever, and a weight arranged on the opposite arm of said lever, substantially as set forth.

10. The combination, with the movable grinding-disk, a movable sleeve connected with said disk, and a frame supporting said sleeve, of a lever attached to said sleeve, a pivoted bar to which one arm of said lever is adjustably attached, and a weight arranged on the opposite arm of said lever, substantially as set forth.

11. The combination, with the bed-plate, the shaft, and the rotating disk secured to said shaft, of a sleeve surrounding said shaft and provided with a vertical series of openings, an arm secured to said plate and provided with a collar surrounding said sleeve, a lever pivotally supported by a bolt entering one of the openings in the sleeve, an adjusting-bar pivotally supported on said arm, a bolt capa-

ble of adjustment in said bar and adapted to serve as a fulcrum for the lever on one side of the sleeve, a pin or roller attached to the arm and adapted to serve as a fulcrum for the lever on the opposite side of the sleeve, and a weight attached to said lever, substantially as set forth.

Witness my hand this 13th day of January, 1891.

EDWARD A. JONES.

Witnesses:
THEO. L. POPP,
EMIL NEUHART.