(No Model.) 3 Sheets—Sheet 1.

W. D. ORMSBY.

MACHINE FOR GRINDING SPHERICAL BALLS.

No. 422,966. Patented Mar. 11, 1890.

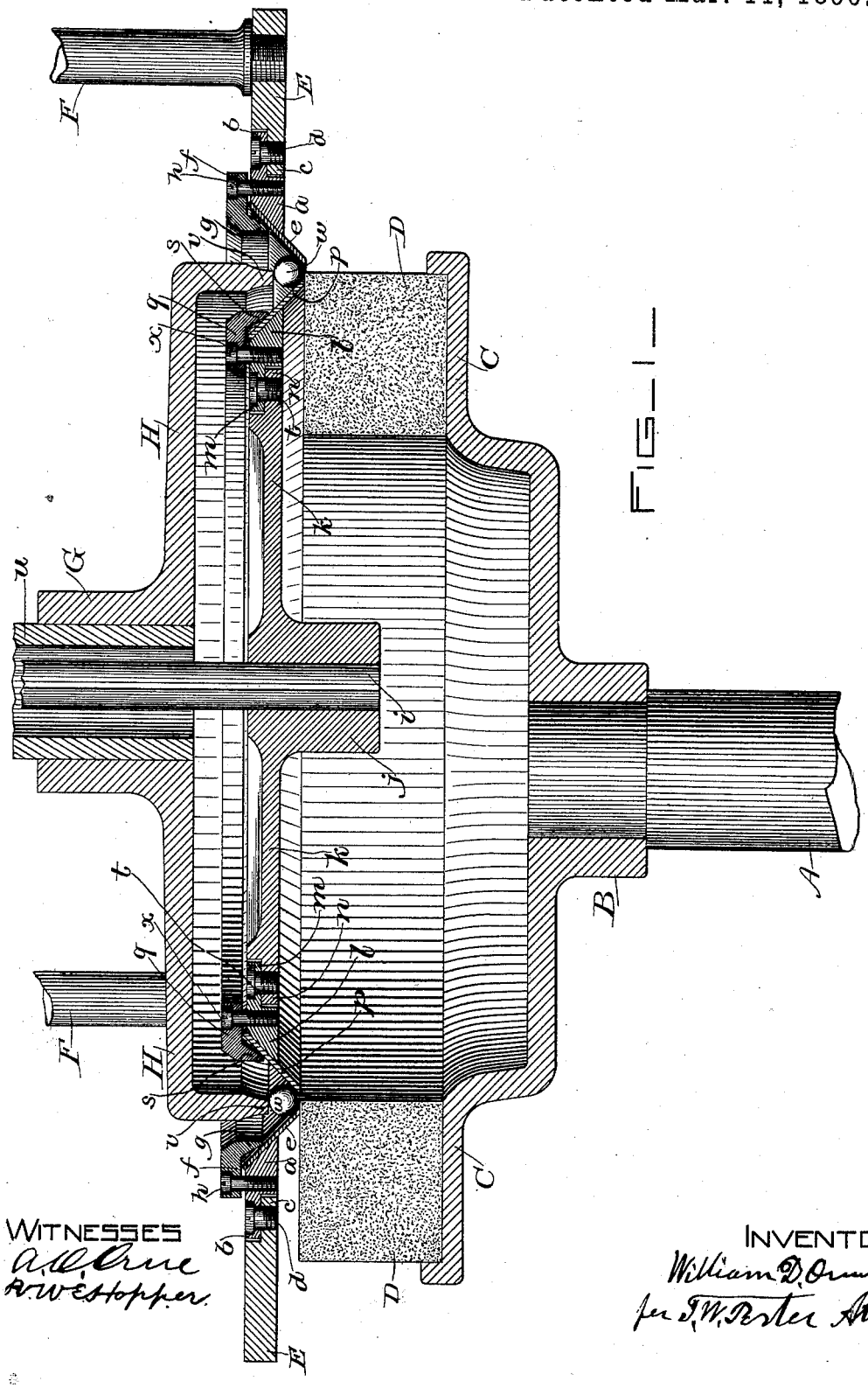

FIG. 1.

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FIG. 2.

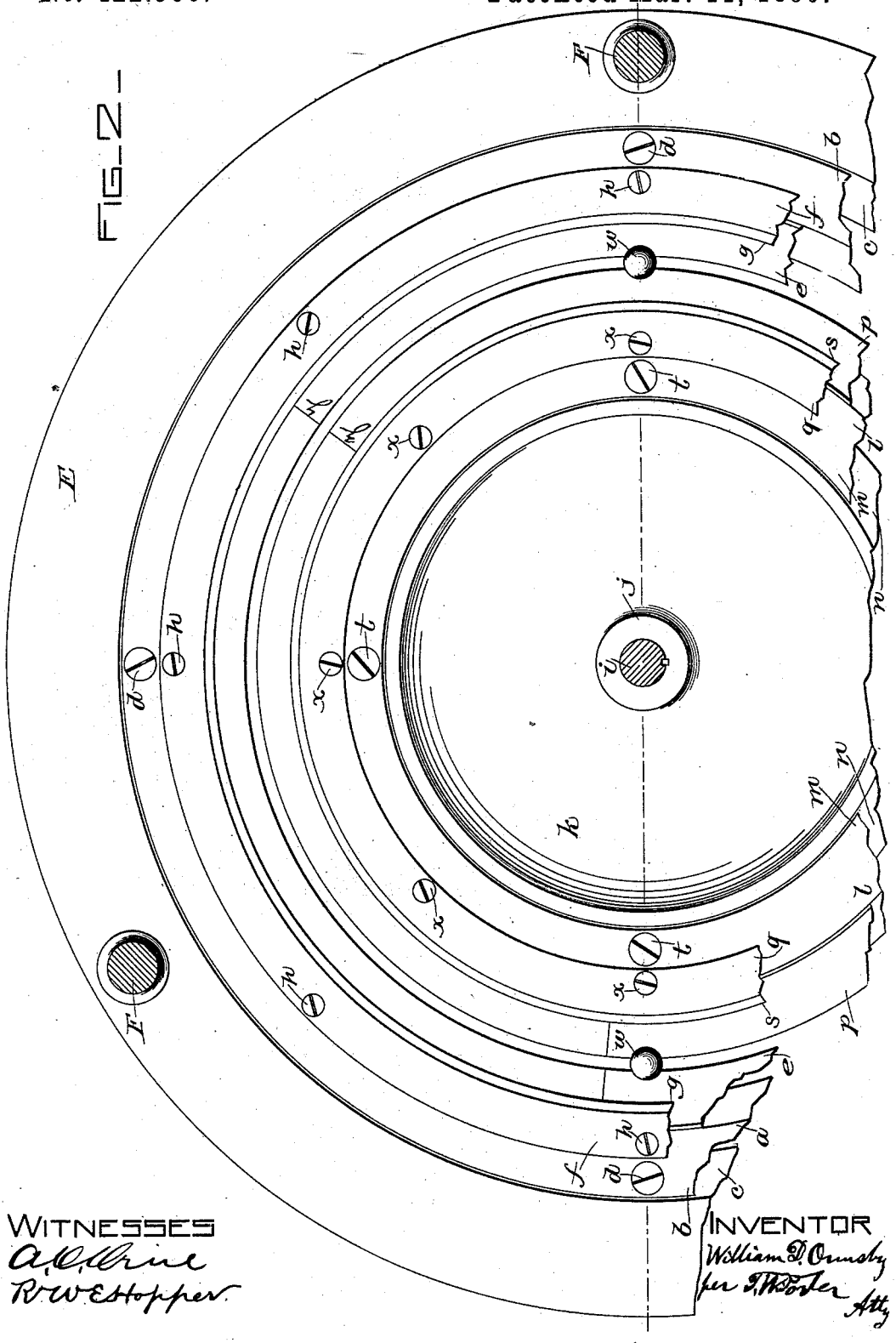

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Fig. 4.

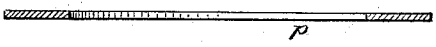


Fig. 6.

Fig. 3.

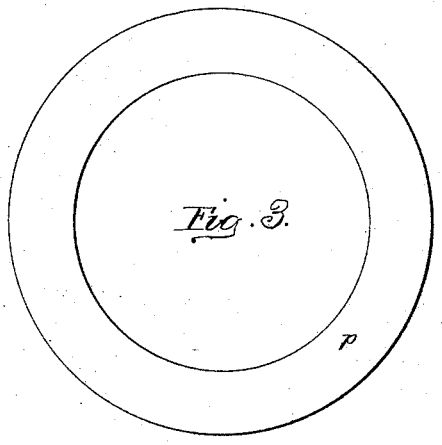


Fig. 5.

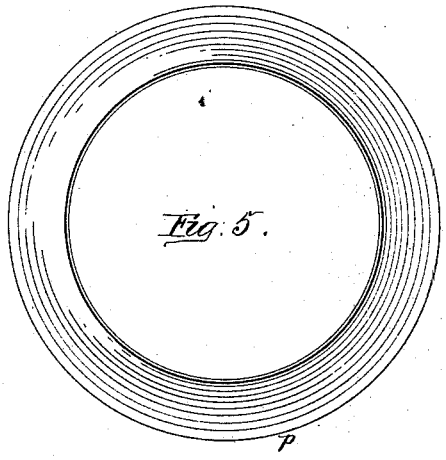
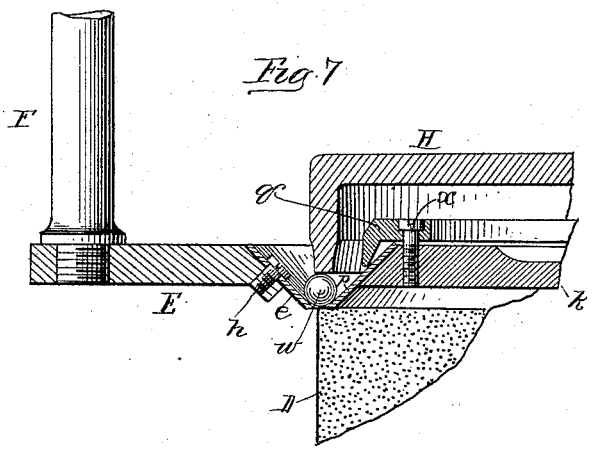


Fig. 7



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UNITED STATES PATENT OFFICE.

WILLIAM D. ORMSBY, OF WALTHAM, MASSACHUSETTS.

MACHINE FOR GRINDING SPHERICAL BALLS.

SPECIFICATION forming part of Letters Patent No. 422,966, dated March 11, 1890.

Application filed October 7, 1889. Serial No. 326,209. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. ORMSBY, of Waltham, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Machines for Grinding Spherical Balls, which will, in connection with the accompanying drawings, be hereinafter fully described, and specifically defined in the appended claims.

In said drawings, Figure 1 is a central vertical section of a machine embodying my invention, the upper portion being broken away in order to increase the scale of the drawings; and Fig. 2 is a top plan view of the portion of the machine shown in Fig. 1, except the ball-driver H, a portion of the parts at one side being broken away both for increase of scale and the better to show the various parts. Fig. 3 is a plan view of one of the walls of the ball-race as cut in one piece from sheet metal. Fig. 4 is a central vertical section through Fig. 3. Fig. 5 shows Fig. 4 as "struck up" or pressed into the required cone-like form for the inner wall of the ball-race. Fig. 6 is a central vertical section through Fig. 5. Fig. 7 is a detached section to be described.

This invention relates to the class of grinding-machines patented by Henry Richardson, June 28, 1887, No. 365,407, for grinding spherical balls; and it consists in the features of novelty that will be claimed at the end of this specification in connection therewith.

Referring again to said drawings, A represents an arbor, which is to be duly supported in journal-bearings and rotated by a pulley thereon engaged by a belt or by any suitable means. A hub B is rigidly secured to the top of said arbor, and has a concentric flange C, upon which is secured the abrading-ring D, formed as a "solid emery-wheel" or of analogous material. This arbor revolves in a fixed position, and ring D travels in a fixed orbit. A metallic ring-like circular plate E is supported from an upper portion of the frame through rods F, that depend therefrom, or in any suitable manner to retain it rigidly in position. A ring *a*, having an outwardly-extending flange *b*, which rests upon the inwardly-extending flange *c* of ring *a*, is thereto secured by screws *d*. The inner face of ring *a* is beveled, as shown, and a series of sections *e*, preferably three, are cut from sheets of steel of proper thickness and with the requisite edgewise curvature, and, being then curved sidewise to conform to the beveled inner face of ring *a*, are thereon secured by the ring-binder *f*, the angle *g* of which is forced against the inner or concave face of sections *e* by the binding-screws *h*, which are seated in said binder *f* and are threaded in ring *a*, the line of meeting or abutting together of the ends of said sections *e* being shown at *y*, Fig. 2.

The inner wall of the ball-race consists of the sections *p*, also cut from sheet-steel, with proper edge curvature and bent sidewise to fit the beveled face of ring *l*, that is fitted to disk *k* by its flange *m*, resting upon flange *n* of said disk, to which the ring is secured by the screws *t*. A binding-ring *q*, having a flange *s* bearing upon sections *p*, is forced against them by the binding-screws *x*, the line of meeting or abutting together of the ends of said sections *p* being shown at *z*, Fig. 2. Said disk *k* is by its hub *j* secured upon and supported by rod *i*, which is secured in and depends from the upper part of the frame.

The ball-driver is represented at H as a disk having a concentric depending flange *v* to bear upon and drive the balls *w* around in the race formed of sections *e* and *p*, as described. Said driver H, has a central hub G, by which it is rigidly secured upon and rotated by the hollow vertical arbor *u*, that is mounted in and supported by journal-bearings secured to the upper portion of the frame, (not shown,) being driven through the instrumentality of a pulley and belt in the usual manner. It will be seen that the interior arbor or rod *i* has a splineway formed in it, in order that it may both be locked in the supporting-frame and held non-rotative, and that disk *k* may be so secured to it as to be held non-rotative, while the rotative ball-driver carried by arbor *u* will drive the balls in the circular race. The arbor *u* is central in the driver H, but eccentric to arbor *i*, in order that the bearing-face of flange *v* will have a lateral movement on the balls, so that it shall wear constantly level, the driver being shown as at one extreme of such lateral movement, and the arbor A of the abrading-ring D is arranged out of line with the axis of the ball-race, in order that the ring shall

have a constant lateral motion relative to the balls, in order that the entire upper face of the ring may be worn constantly level, the abrading-ring being shown at one of the extremes of its lateral movement.

By forming the oblique wall of the ball-race of sheet-steel, as specified, great durability thereof is secured at less expense than when the race is formed of cast metal in the former manner, and when said sections of the walls of said race are worn past use they are readily removed and others substituted for those so worn; and by forming the walls of the race in sections instead of entire or ring-like great saving in material is effected, for when the lower edge is worn away by the wearing contact therewith of the balls the ring-binders are slackened and the sections moved downward to bring their lower edges nearer together, which latter adjustment may be several times resorted to before the sections become too narrow for further use.

It will be obvious that all parts of the ball-race, except said removable sections, are exempt from wear or deterioration from use, and by forming the race with the removable rings *a* and *l*, I am enabled to quickly and easily remove one ball-race and replace it with another whenever a change in the size of the balls to be ground or other reason renders such change of races necessary.

In Figs. 3 to 6 is shown a method of forming each part or half of the ball-race as an entire ring instead of forming it in sections; but this modification of a sheet-metal wall for the race is much more costly than is the method of forming it in sections, as shown, and which is deemed to be the better method. The sheet-metal walls of the race might be secured directly to plate E and disk *k*, as shown in Fig. 7; but there are very great advantages in employing the rings *a l*, as above explained. While the removable walls of the race are in all respects preferable when cut from sheet metal that has been compacted by pressure-rolls, yet they might, for purpose of infringement, be lathe-finished, but at much greater expense than if formed of sheet metal; and though I have employed the term "sheet metal" to indicate the material of the walls of the race as constructed by me, yet being, as I believe, the first to employ removable walls for the race, I do not desire to limit myself merely to rolled metal.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the abrading-ring duly mounted and arranged to revolve, a ball-race non-rotating in both its walls, arranged with its center or axis out of line with the axis of said abrading-ring, and a rotating ball-driver arranged with its axis out of line with the axis or center of said race, substantially as specified.

2. In a ball-grinding machine having the central circular disk *k* and the external plate E, the bevel-edged removable rings *a l*, centered in and secured to said plate, substantially as specified.

3. In a ball-grinding machine, the ball-race faced with the sheet-metal ball-bearings *e p*, respectively secured to the beveled faces of the inner and outer supports thereof, substantially as specified.

4. In a ball-grinding machine, the sheet-metal walls *e p* of the ball-race formed in sections, substantially as specified.

5. In a ball-grinding machine, a ball-race having the ball-supporting walls formed separately from and removably secured, respectively, to the interior disk, and external ring that sustains said walls, substantially as specified.

6. In a ball-grinding machine, the combination, with the sheet-metal walls of the ball-race seated upon the supports thereof, of the binding-rings *f q*, formed with a lower angle to bear upon said walls and to be secured to the supports of said walls, substantially as specified.

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Witnesses:
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