(No Model.) 2 Sheets—Sheet 1.

F. W. RODD.

AUTOMATIC BALL GRINDING MACHINE.

No. 598,536. Patented Feb. 8, 1898.

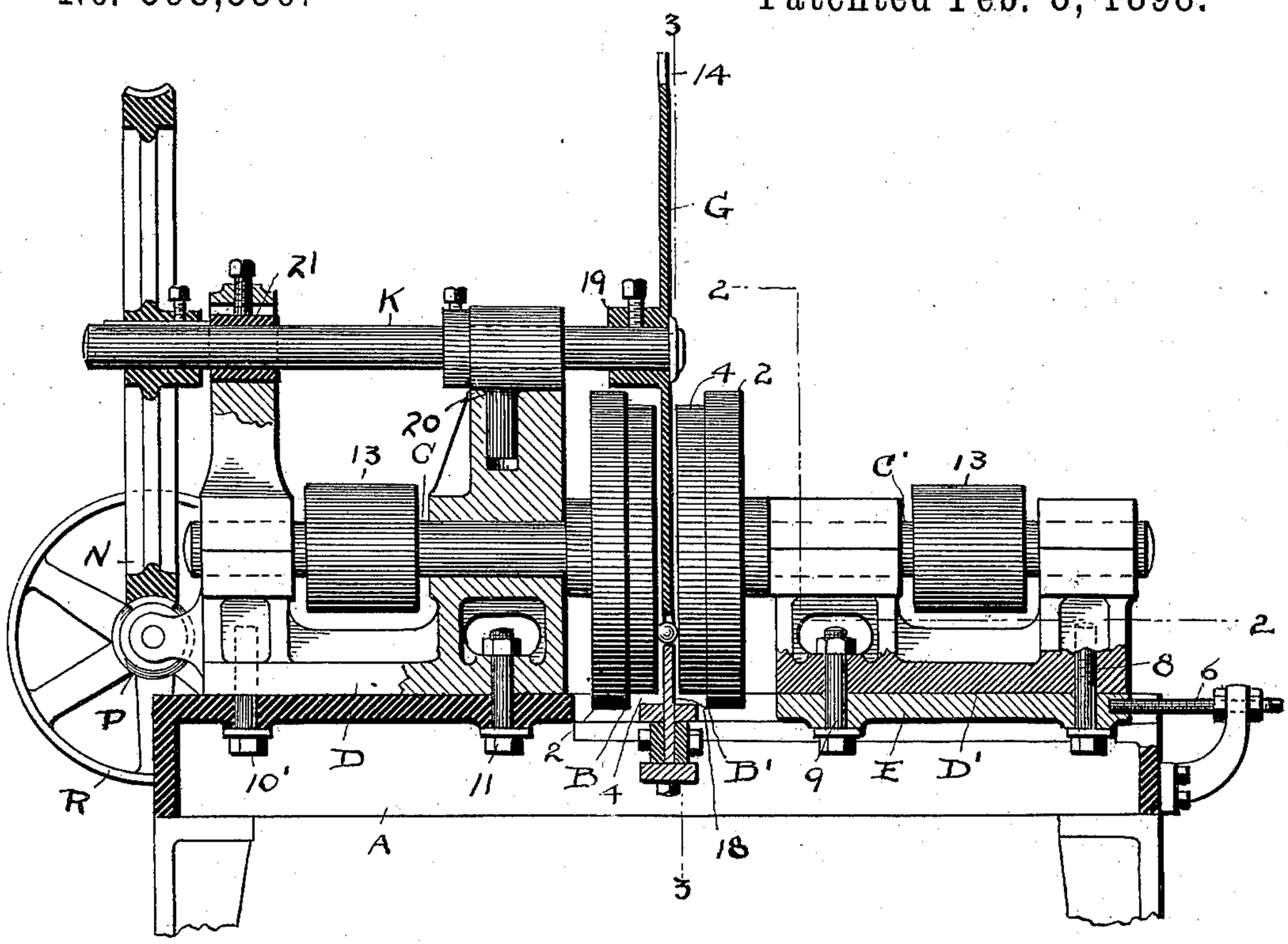
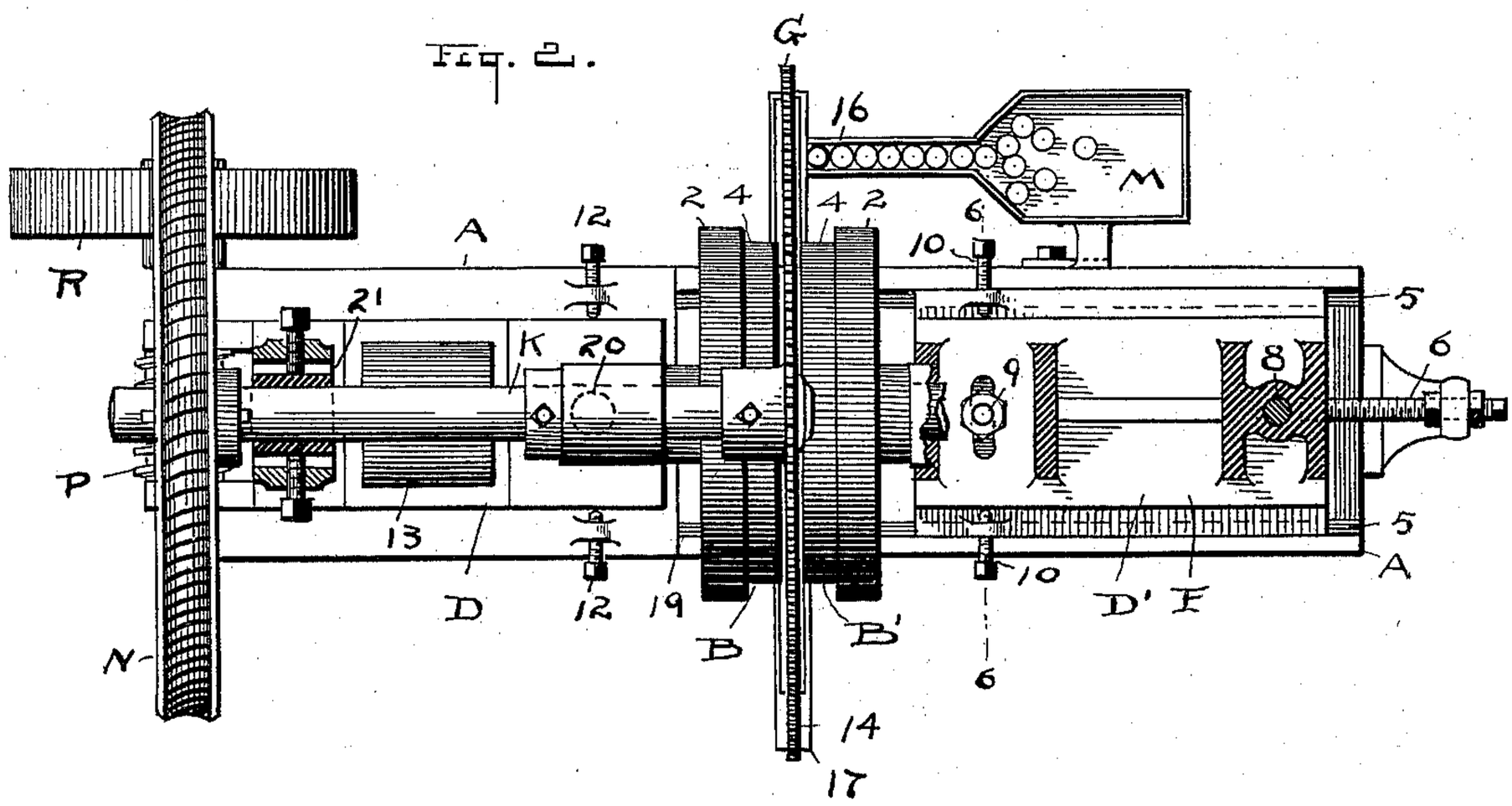


Fig. 1

Fig. 2.



Attest

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(No Model.) 2 Sheets—Sheet 2.

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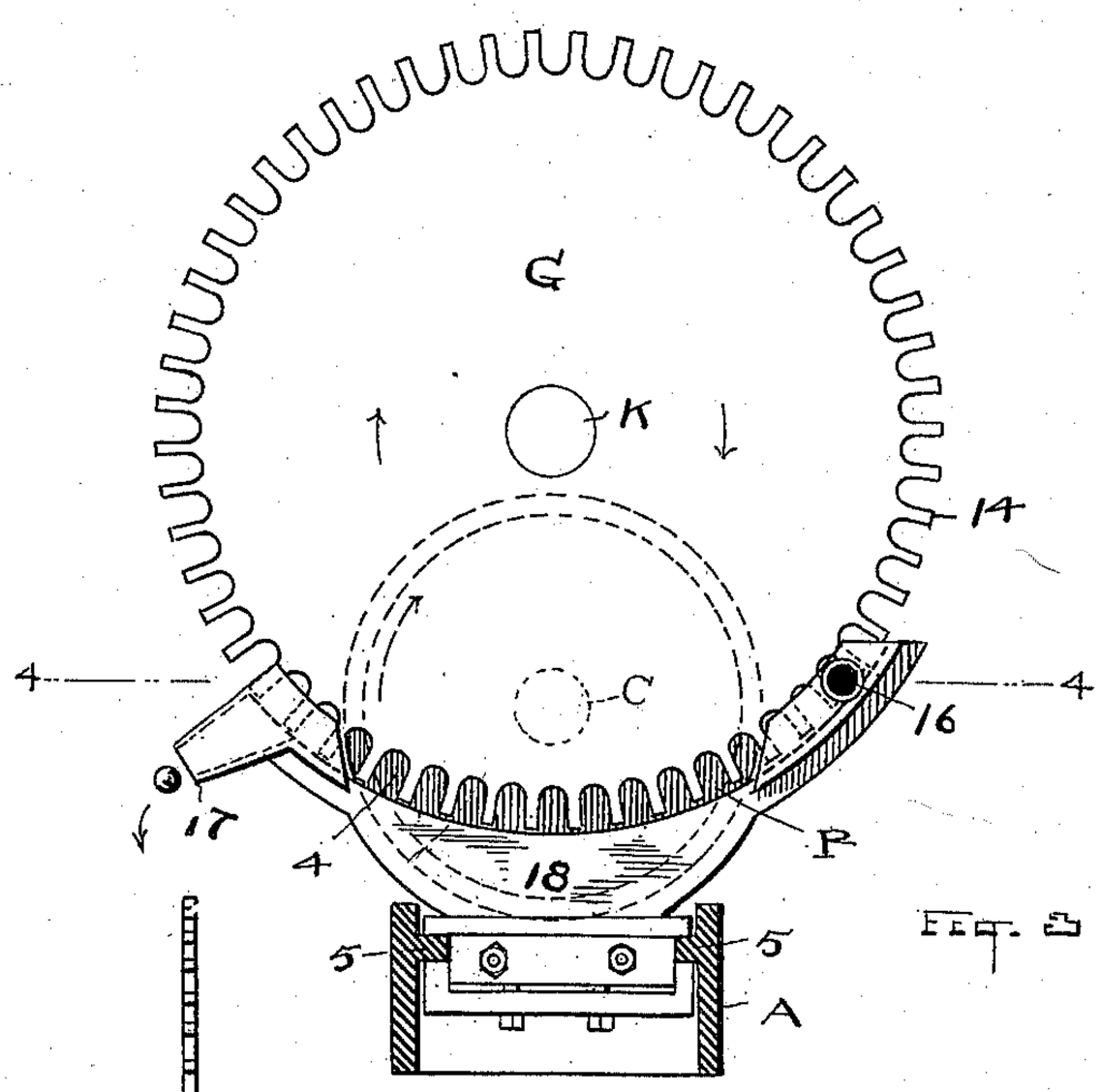


Fig. 3.

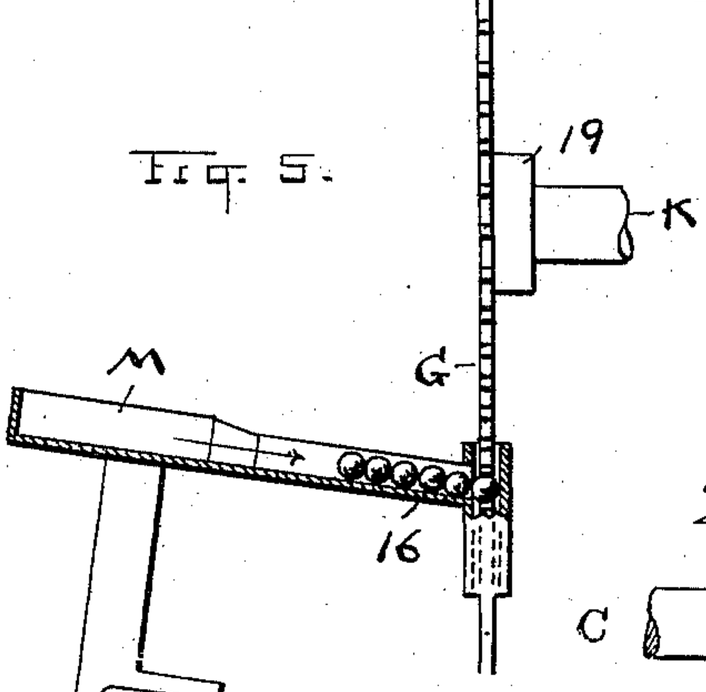


Fig. 5.

Fig. 4.

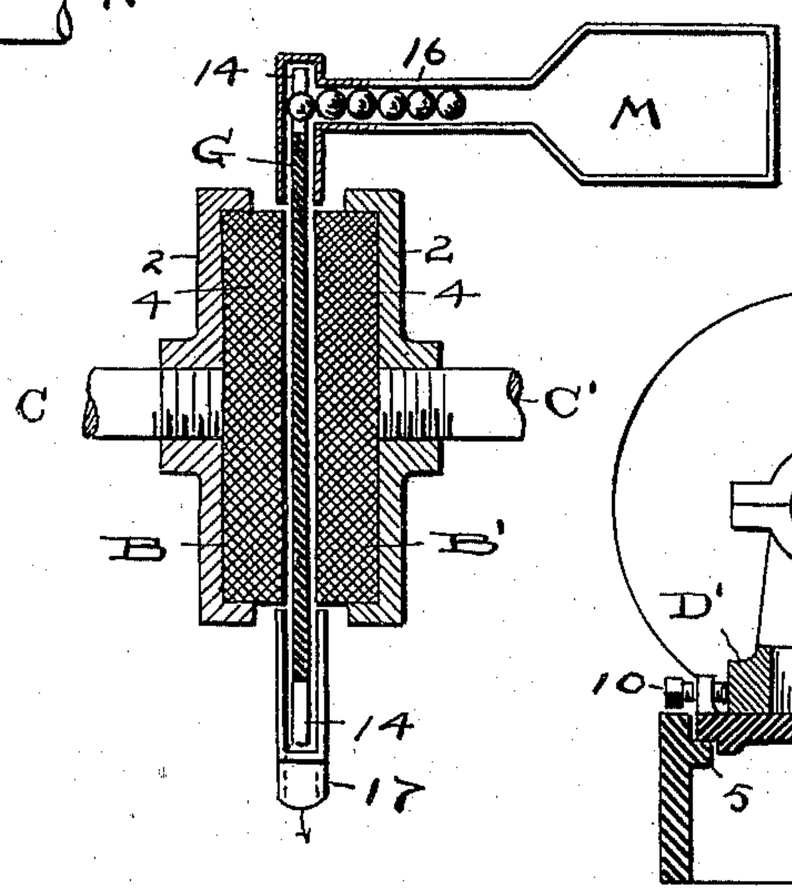
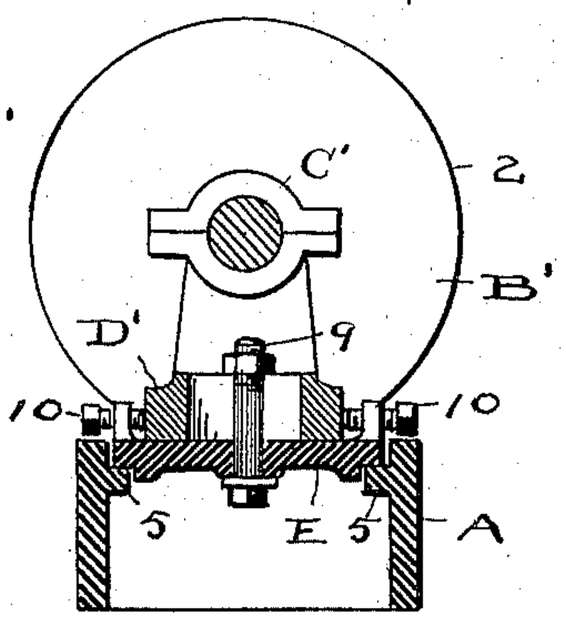


Fig. 6.



ATTEST

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UNITED STATES PATENT OFFICE.

FREDRICK W. RODD, OF CLEVELAND, OHIO.

AUTOMATIC BALL-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 598,536, dated February 8, 1898.

Application filed April 23, 1897. Serial No. 633,504. (No model.)

To all whom it may concern:

Be it known that I, FREDRICK W. RODD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Automatic Ball-Grinding Machines; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an automatic ball-grinding machine; and the object of the invention is to provide a machine whereby a more or less rounded slug, lump, or ball of metal or other solid material may be rotated about its axis and at the same time be exposed to a grinding process, so as to reduce it ultimately to a perfect sphere with a comparatively smooth surface, all substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal central sectional elevation of the machine, but with the legs or lower supports broken away. Fig. 2 is a plan view, partly in horizontal section, as indicated by line 2 2, Fig. 1. Fig. 3 is a central cross-sectional elevation looking to the left from a line corresponding to 3 3, Fig. 1. Fig. 4 is a plan view looking down from line 4 4, Fig. 3. Fig. 5 is a detail of the feeding-spout and associated parts. Fig. 6 is a cross-section on line 6 6, Fig. 2.

The several views show the various parts in operating relation and constitute an essentially automatic machine from start to finish, the balls being fed and the balls ground and discharged in finished condition, so far as grinding and rounding is concerned, without the interposition of handwork at any point. To this end the machine consists of the base or bed A, upon which are supported two opposed and in all respects similar emery or other equivalent and sufficient grinding-wheels B B′. These wheels are fixed, respectively, on the adjacent ends of corresponding pulley-shafts C C′ and in the construction here shown consist each of a metallic shell or case 2 and the emery or grinding portion proper, 4, of the wheel, set into or supported by the said casing. This or any substantially similar or equivalent construction and arrangement of grinding-wheels may be adopted. It will be noticed that the grinders B B′ have perfectly flat faces arranged face to face and with an intervening space in which the feed and carrying wheel rotates and the grinding of the balls occurs, as hereinafter fully described. Each of the shafts C and C′ is supported on its own head D and D′, respectively, and the head D rests directly on bed A, while the head D′ rests on a heavy plate E, which in turn lies upon the ledges 5 along the sides of the bed, as seen most clearly in Fig. 6. This plate E is adapted to slide in the guideways of these ledges and is adjusted to any desired position back or forth by means of the screw 6, Fig. 1. The head D′ is supported on this plate by pivot bolt or screw 8 at one end and screw 9, engaged through a slot in plate E, at the other or inner end. Set-screws 10 on each side, supported in lugs on plate E and bearing against the edges of the head, serve to coöperate with the screw 9 to give such lateral adjustment to head D′ as may be needed, while the head and plate combined are moved to and fro lengthwise by means of screw 6, as already described. On the opposite end of the machine, on the other side of the feed and carrying wheel, the screw or bolt 10′ is the pivot-point for head D, and the bolt 11 and screws 12 serve to make lateral adjustment of said head, the bed A being slotted for the bolt 11, as in the case of bolt 9. Each shaft C C′ has a pulley 13, by which it is driven from a counter-shaft or other source of power, and both shafts are rotated in the same direction.

Now, having thus shown and described the means of support and adjustment of the oppositely-faced grinders B B′, the utility and advantage of this construction and arrangement of parts will become clear when considered in connection with the disk or wheel G. This disk or wheel is supported on shaft K in such position and is of such size as to reach down into the slight space between the grinders relatively about as shown in Fig. 1, though of course it might have greater or less size and come into somewhat different working position with respect to the grinders and serve a

very good purpose. The said wheel has a scalloped or recessed periphery or edge, the recesses therein being large enough each to accommodate a single ball and are shown as having fingers or projections 14 separating said recesses. The disk itself is made of comparatively thin metal, so that the balls will be freely exposed a good part of their depth on both sides to the faces of the grinders B B', and the said recesses are always large enough to afford room for the rough ball to turn and rotate therein, as it constantly does under the action of the grinders. As here shown, the edge of the said wheel rotates across the faces of the grinders some distance below their axis, thus affording the largest exposure and the most efficient service obtainable from an arrangement of this kind. The rough balls are received into the wheel from the hopper M or any suitable means of steady supply at the entering side of the machine and fed one by one through spout 16 into the empty recesses or cavities in the edge of the wheel as they come successively into receiving position. They are discharged on the other side through spout 17 in a ground and rounded condition. If one grinding is not sufficient, they may be put through the same machine again under a new adjustment suited to their reduced size or through another machine or machines until a perfect sphere of the desired size is obtained.

In traveling from entry-spout 16 to discharge-spout 17 the balls are supported from beneath by a plate 18, with a segmentally-curved upper edge corresponding to the arc of the circle over which they travel in the edge of wheel G, and the said plate enters between griders B B' relatively about as seen in Fig. 1.

The feed-disk G is secured on shaft K by means of an adjustable head 19; but the shaft itself also may be adjustable axially or alone to make the desired adjustment of said disk toward and from the grinder B. It will be noticed that in this instance head D has no back-and-forth adjustment like head D' through screw 6, so that the disk itself must be adjustable in relation to the grinder.

It will also be observed as a necessary requirement that the grinders should be separated relatively a greater distance at the entering side of the rough balls than at the finishing or discharging side, and so in addition to the axial adjustment on shaft K or through said shaft I provide the shaft with a pivot-bearing 20 at one end and a laterally-adjustable bearing 21 at the other end, and thereby effect the slight angular adjustment needed by the grinder. The bearings 20 and 21 may be placed in exchanged positions, if desired, and thus make this adjustment correspond more exactly with the like adjustment of head D'.

To operate shaft K, I provide said shaft with a worm-wheel N, which is rotated by worm P, which in turn is actuated through pulley, belt, or drive wheel R on the same shaft with the worm P or not, as may be found desirable, the object in any case being simply to impart a relatively slow rotation to shaft K and disk G. What this speed should be will depend on the character and amount of work to be done on the balls and may be varied according to these and other considerations. But the grinders B B' are designed to revolve in unison at a very high rate of speed. The balls therefore come under the action of the grinders the moment they enter the space between them, and a rapid work is done from that time until they are discharged, though the carrying-disk moves at comparatively slow speed. In a machine of this size having a disk in the neighborhood twenty-four inches across the feed may be from fifteen to thirty or more a minute, according to the work the balls require. Greater or less speed is within the range of the machine and relatively larger or smaller operating parts will enter as factors into all these calculations.

The operation of the machine will be understood from the foregoing and need not be repeated here. After the parts are adjusted to the work in hand the machine is started and thereafter proceeds automatically. The balls are continually rotated while they are being ground, and this effect is obtained especially because the pull or action on the ball is in the same direction on both sides at the same time and in the same degree. In this operation the disk serves to confine and carry the balls forward, while the plate below chiefly supports the balls against the pull or draw of the grinders.

The balls which this machine is more especially designed to grind are known as "steel antifriction-balls"—for example, such as are used in bicycle-wheels; but of course other and different sizes of balls may be ground, and the operation is not confined to steel balls nor to balls for antifriction purposes, but may be used for other purposes as it shall be found useful.

It would of course be possible to so arrange the parts that the disk G should stand from below rather than from above the machine, in which case it would carry the balls even more essentially than it does now; but the present construction is altogether preferable.

The grinding-wheels may be accurately set at their discharge side to any desired diameter of ball, and when this is done all the balls will be of exactly the same size until a different adjustment is made. Of course if a very protracted run were made some slight readjustment might be required to take up any reduction of the grinders by wear upon their surface.

A modification of the feed and carrying wheel for the balls might be made with a series of holes through the wheel near its periphery in lieu of the open recesses here shown, and such holes or recesses in the wheel or disk are understood to be an equivalent con-

struction to what is herein shown and described, but are not deemed as desirable as the open recesses.

In this machine grinders are shown directly opposite each other; but as long as they set on opposite sides they are understood to be opposite in the sense of this invention. Hence one wheel may be set in advance of the other, if preferred, or one relatively above the other, or the wheels may be of different sizes and of different speeds of rotation.

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

1. In automatic ball-grinding machines, a set of oppositely-arranged flat-faced grinders and means to separately rotate said grinders, in combination with a rotatable ball-carrier between said grinders constructed to expose the balls to the faces of both grinders alike and to receive and discharge the balls automatically, substantially as described.

2. A set of ball-grinders having flat grinding-faces covering their entire surfaces and supports engaging the grinders at their backs, a carrier for the balls arranged to travel between said grinders and having open recesses to expose the balls at both sides alike, and means to rotate said carrier independently of said grinders, substantially as described.

3. A pair of flat-faced grinders and separate supports for each grinder engaged at the rear thereof and means to rotate the same, in combination with a ball-carrier between said grinders having a series of open ball-receiving recesses constructed to carry the balls across the faces of said grinders and expose them to the action thereof on both sides at the same time and to automatically receive the balls at one place and discharge them at another, and means to feed the balls successively to said carrier, substantially as described.

4. The oppositely-arranged flat-faced grinders and means to rotate said grinders separately in the same direction, in combination with the rotating ball-carrier between said grinders having its axis outside the grinders, and means to rotate said carrier uninterruptedly during operation, substantially as described.

5. In an automatic ball-grinding machine, a set of flat-faced grinders, in combination with a carrier between the faces of said grinders having open recesses to carry balls into and out of the space between the said grinders, and a circular support for the balls beneath said carrier and extending between the faces of said grinders to confine the balls in said recesses during their passage between the grinders, substantially as described.

6. In an automatic ball-grinding machine, the bed and the flat-faced grinding-wheels individually adjustable thereon, in combination with a ball-carrier entering between said grinding-wheels and having recesses to receive and discharge the balls automatically outside of the grinders, substantially as described.

Witness my hand to the foregoing specification this 17th day of April, 1897.

FREDRICK W. RODD.

Witnesses:
H. T. FISHER,
R. B. MOSER.