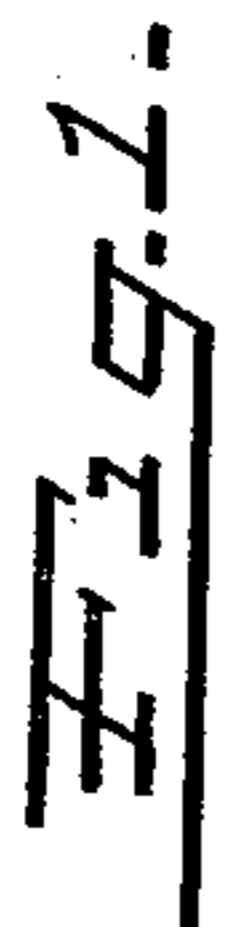


APPLICATION FILED JAN. 5, 1911.

3 SHEETS—SHEET 1.



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W. E. B. HASSELKUS.
 BALL GRINDING MACHINE.
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989,524.

Patented Apr. 11, 1911.
 3 SHEETS—SHEET 2.

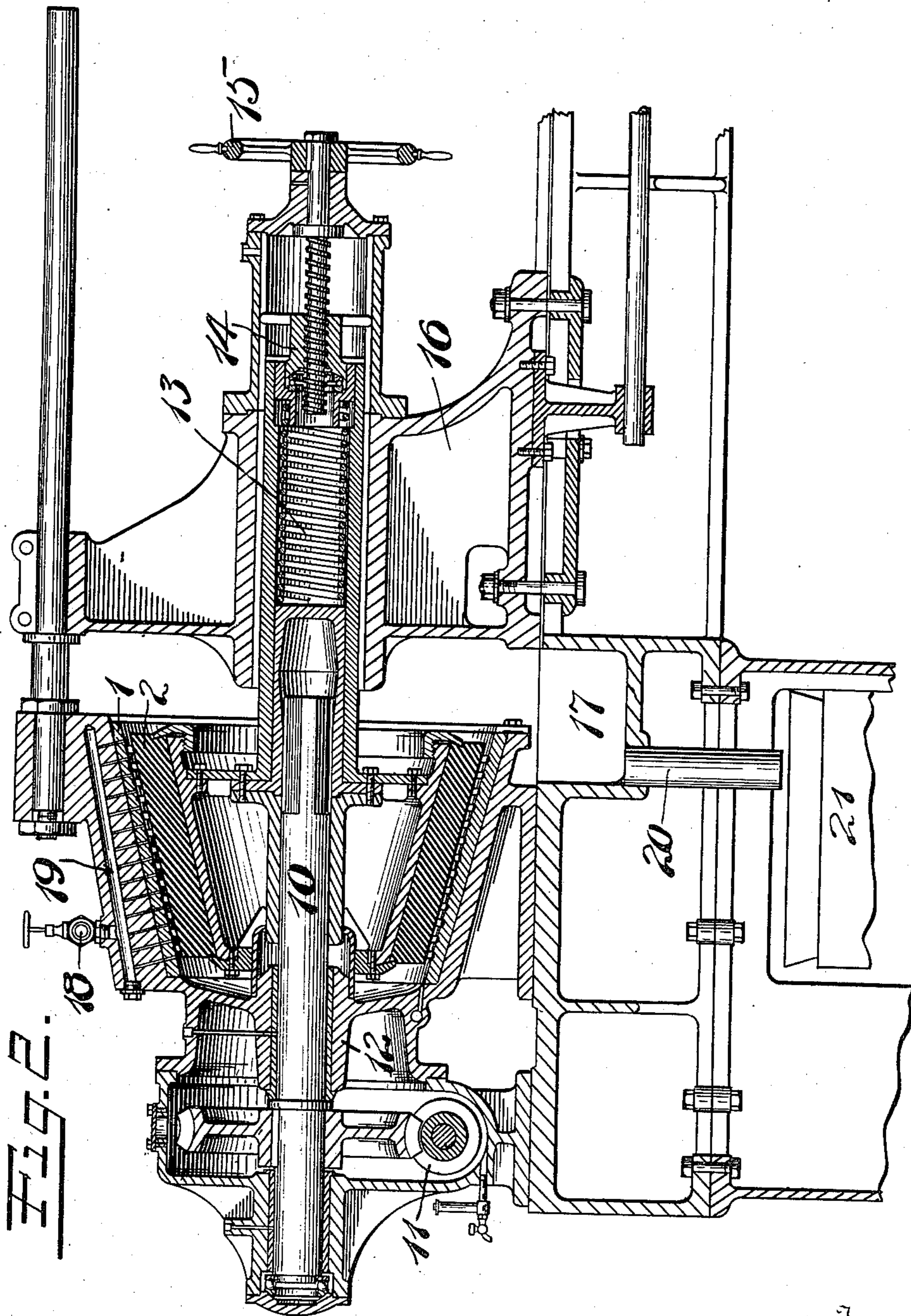


Fig. 2.

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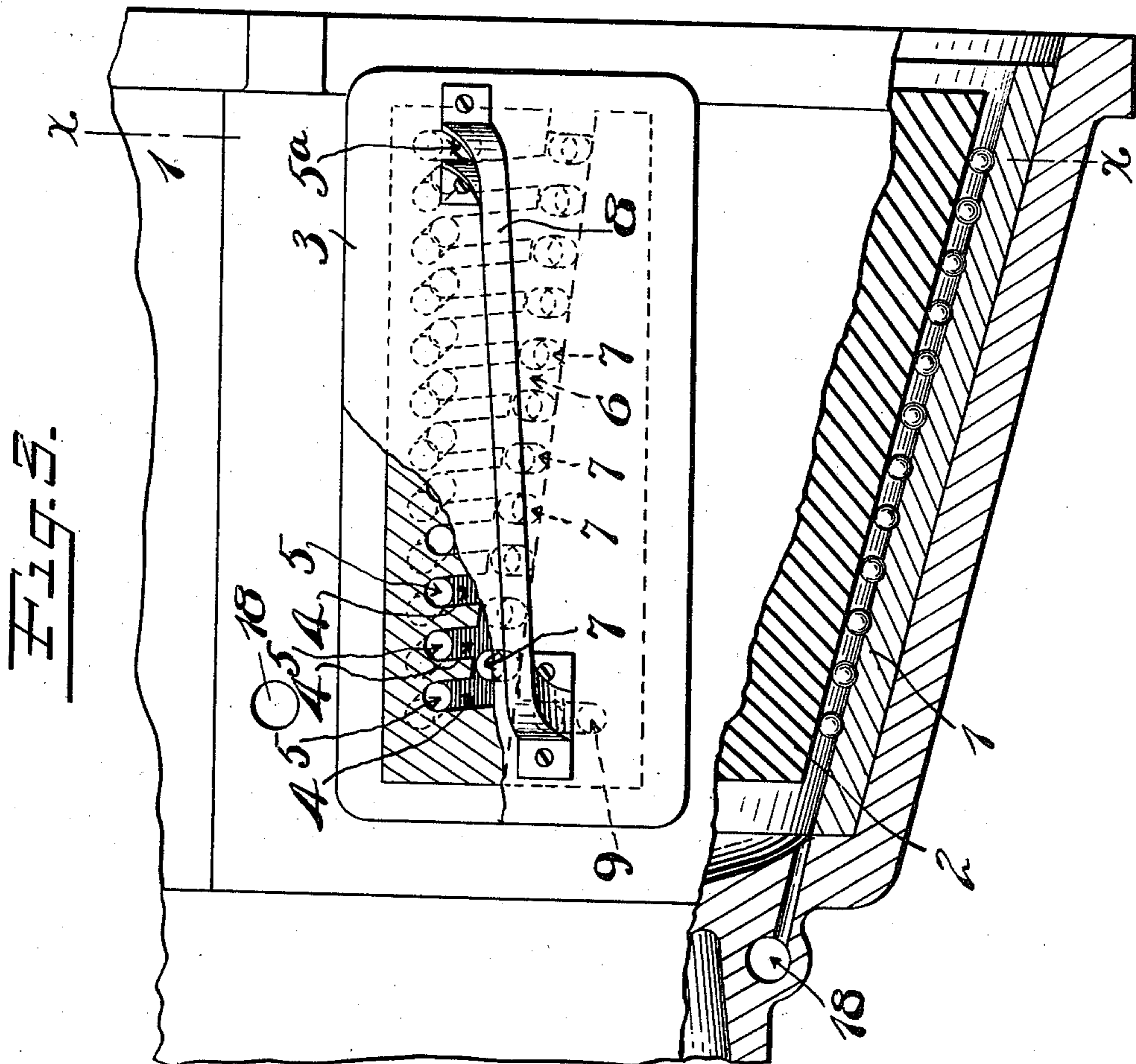
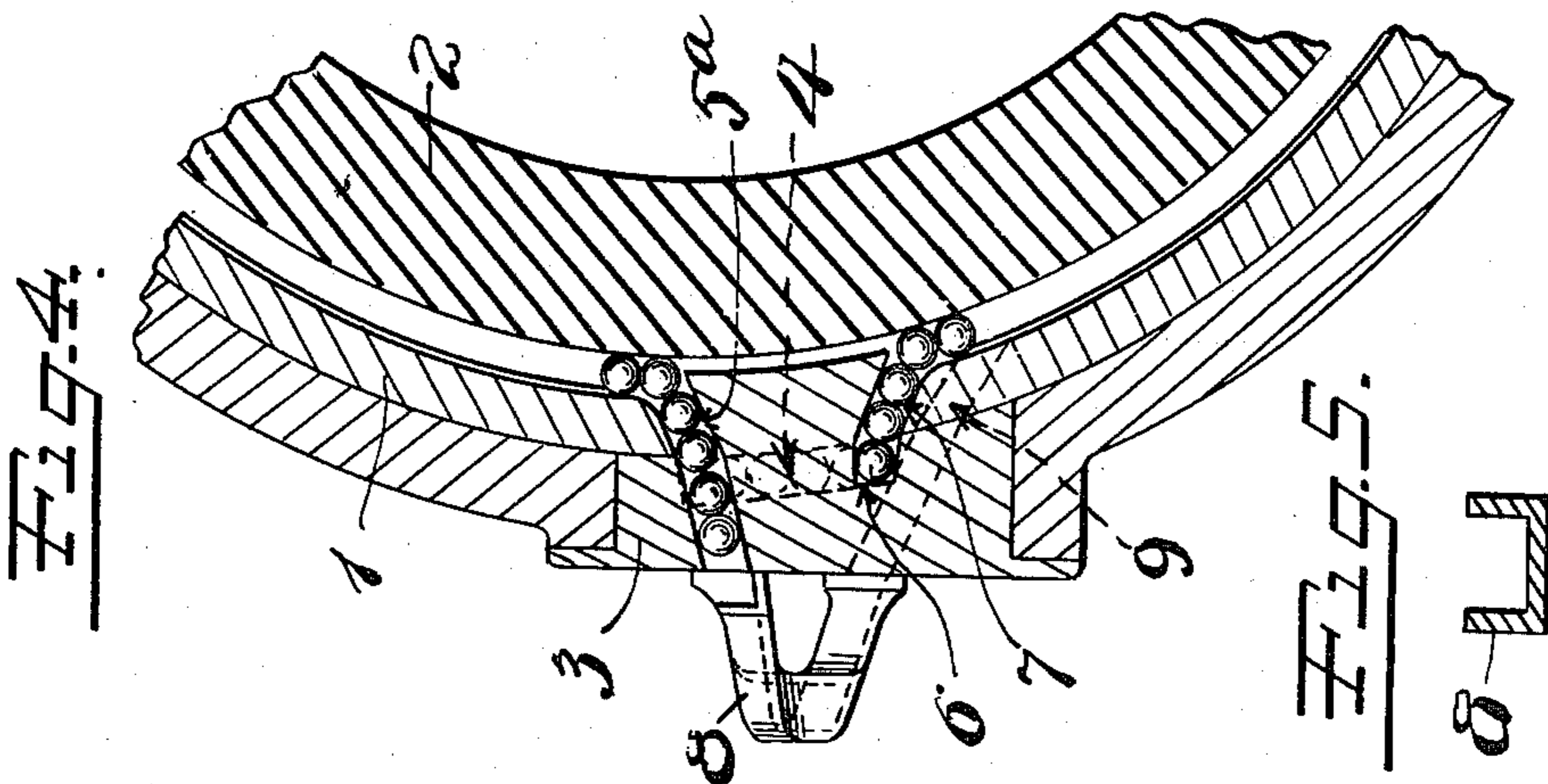
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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BALL-GRINDING MACHINE.

989,524.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM E. B. HASSELKUS, a citizen of Germany, residing at New Britain, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Ball-Grinding Machines, of which the following is a full, clear, and exact description.

My invention relates to ball grinding machines, the object being to provide effective mechanism for the accurate and rapid finishing of steel bearing balls.

In the accompanying drawings, Figure 1 is a side elevation of the main portion of my invention. Fig. 2 is in the main a central longitudinal section. Fig. 3 is a relatively enlarged side view, partly in elevation and partly in section, illustrating a portion of the machine. Fig. 4 is a sectional view on the plane of the line $x-x$ Fig. 3 looking from right to left. Fig. 5 is a sectional view of a detail on a still larger scale.

The main elements of my invention comprise two members 1 and 2, both in the shape of truncated cones, the former being what I will term a grooved ball holder or guide, the latter being the grinder. The grinder element may be projected more or less into the holder element and to that degree necessary to produce a finished ball of the desired diameter. The grinder element 2, in the form shown, is rotatable, being driven from any suitable source of power. The holder element 1 is fixed or non-rotatable. The holder element has on its inner tapered surface a plurality of grooves in which the balls which are being ground are located and in which they turn and move forwardly during the grinding operation. These grooves form nearly a complete circle, as shown, but do not extend entirely around the inner wall of the holder. Broadly speaking, the grinder element may be formed of any suitable abrasive and of any suitable construction appropriate for the purpose intended.

3 represents what I will term the transfer block. This block is secured to the side of the holder 1 and is provided with a series of upright passages 4—4.

5—5 are upper outlet passages formed in the wall of the holder 1. All of these outlet passages 5—5, excepting the one at the extreme right of Fig. 3, indicated by the reference numeral 5^a, connect the grooves

in the holder element with the upright passages 4—4.

6 is an elongated transfer passage formed in the block 3 and inclined downward slightly, said transfer passage 6 being in communication with the lower ends of each of the upright passages 4—4 by return passages 7—7.

8 is a return trough on the outer side of the block 3.

All the passages described are of a proper size to receive balls of approximately one size and where balls of different sizes are to be produced than adapted to one set of passages, it is obvious that another block 3 may be readily substituted on the side of the machine having a set of passages of a proper size to conform to the particular sized balls to be produced.

Before describing the other features of the machine, a brief description of how the parts thus far described will operate is in order.

Assuming that the grinding machine is loaded, by which I mean assuming that all of the grooves and passages in the holder and block are substantially full of balls being operated on, it will be seen that the balls at the upper ends of the grooves in the holder will pass out through the outlet passages 5—5 and will then fall through the upright passages 4—4 into the transfer passage 6 down which said balls will run to the return passages 7—7, through which passages they again reënter the holder. This course of the balls is indicated clearly in Fig. 4, a few balls being there shown, some in solid lines and some in dotted lines, taking this course. Ordinarily a single ball from the first upright passage to the left, as shown in Fig. 3, would reënter the first of the return passages 7, shown in the same figure, but, if for any reason that passage is blocked by the presence of a ball therein, said first mentioned ball will pass on the next return passage 7 and there again reënter the holder to be again ground. In this way it will be seen that the course of a single ball would ordinarily be through each of the grooves in the holder in succession, but provision is made whereby this course need not be arbitrarily followed, because in some instances it might happen that one or more of the return passages 7 might be occupied or blocked, in which event, as above

described, the oncoming ball could skip said passage and take the next one or even the second one beyond. When said ball has reached the upper end of the last groove to the right, it will pass through the outlet passage 5^a into a duct or trough 8, by which it will be conducted back to the starting groove at the left hand end of Fig. 3, into which said ball is guided by what I will term an initial feed inlet 9, shown in dotted lines in Fig. 3. From the foregoing, it will be seen that all of the balls are kept in constant motion and traverse practically the same course (with the possible exception mentioned). The grinding of the balls occurs all the while the same are in the grooves within the holder, and this grinding operation is kept up until, upon testing the balls in the trough 8, it is found that said balls have been reduced to precisely the proper diameter, whereupon the machine is stopped and the grinder element 2 is retracted as hereinafter described to permit all of the balls to flow out.

Referring to Fig. 2, 10 represents a driving shaft driven in any suitable manner, as by a worm gear 11. This shaft has a suitable bearing 12 and preferably at the base of the holder 1. The grinder 2 is mounted to slide upon the shaft 10, said grinder being suitably keyed or held thereto against independent rotation. 13 is a spring which bears against the hub of the grinder tending to force it forwardly and into the holder 1. Any suitable means may be employed for adjusting the position and tension of the spring 13, for example, to the rear of the spring 13 may be a movable abutment block 14 controlled by a hand-wheel 15. 16 is a slidable bracket which supports the grinder when the same is retracted from the holder, said bracket being movable to and fro on the frame of the machine so that the grinder may be withdrawn from the holder when the balls are finished to permit all of the balls therein to run out. As the finished balls run out, they may be caught in a suitable receptacle which may be placed temporarily within the space 17. These various features having to do with the mounting of the various parts are susceptible of a variety of modifications, it being preferred, however, that the construction be substantially such as described and that a suitable means be employed for providing a yielding spring pressure against the grinder in order that as the balls are reduced in diameter, said grinder may have a forward automatic take-up.

8 represents a supply pipe for a suitable liquid lubricant that may be fed into the machine during the grinding operation, said lubricant entering a main passage 19 and flowing through separate ducts leading therefrom in the upper part of the holder

into the space adjacent to the several grooves within the holder so as to lubricate uniformly and at all times the balls being ground. This lubricant flows down the walls of the two parts, 1 and 2, and is finally discharged into the space 17 where it may flow through a pipe 20 into a suitable receptacle 21, from whence it may be transferred in any suitable way as by the ordinary feed pump, back to the feed pipe 18. The lubricant may be supplied not only at the top of the machine, but, indeed, at any points desired, said feed pipe 18 being indicated at various points of the machine by the same numeral.

What I claim is:

1. In a ball grinding machine, a holder having an open end and a tapered inner wall, and a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall a plurality of guide grooves, and transfer passages leading from the bottom of one groove to the bottom of another groove.
2. In a ball grinding machine, a holder having an open end and a tapered inner wall, and a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall a plurality of guide grooves, said grooves each nearly encircling said inner wall.
3. In a ball grinding machine, a holder having an open end and a tapered inner wall, a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall a plurality of guide grooves, said grooves each nearly encircling said inner wall, and means having transfer passages therein for connecting the upper terminal of one guide groove with the lower terminal of an adjacent guide groove.
4. In a ball grinding machine, a holder having an open end and a tapered inner wall, a grinder having to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall more than two guide grooves, said grooves each nearly encircling said inner wall, and means having transfer passages therein for connecting the upper terminal of one guide groove with the lower terminals of all the other guide grooves.
5. In a ball grinding machine, a holder having an open end and a tapered inner wall, a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall a plurality of guide grooves, said grooves each nearly encircling said inner wall, and means having transfer passages therein for connecting the upper terminal of one guide groove with the lower

terminal of an adjacent guide groove, and including a return duct leading from the guide groove at one end of the holder back to the guide groove at the other end groove 5 of said holder.

6. In a ball grinding machine, a holder having an open end and a tapered inner wall, and a grinder adapted to enter said open end and contoured to the tapered wall 10 of said holder, said holder having on its said tapered wall a plurality of guide grooves, said grinder and holder being relatively adjustable to and fro.

7. In a ball grinding machine, a holder 15 having an open end and a tapered inner wall, and a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said tapered wall a plurality of guide 20 grooves, said grinder and holder being relatively adjustable to and fro, and a spring for causing said parts to approach each other.

8. In a ball grinding machine, a holder 25 having an open end and a tapered inner wall, and a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its

said tapered wall a plurality of guide grooves, said grinder and holder being relatively adjustable to and fro, a spring for causing said parts to approach each other, and a movable abutment associated with said spring for controlling the position and tension thereof. 30 35

9. In a ball grinding machine, a holder having an open end and a tapered inner wall, a grinder adapted to enter said open end and contoured to the tapered wall of said holder, said holder having on its said 40 tapered wall a plurality of guide grooves, said grooves each nearly encircling said inner wall, and means having transfer passages therein for connecting the upper terminal of one guide groove with the lower 45 terminal of an adjacent guide groove, and including a return duct leading from the guide groove at one end of the holder back to the guide groove at the other end groove of said holder, said means being removable 50 from said holder.

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Witnesses:

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