

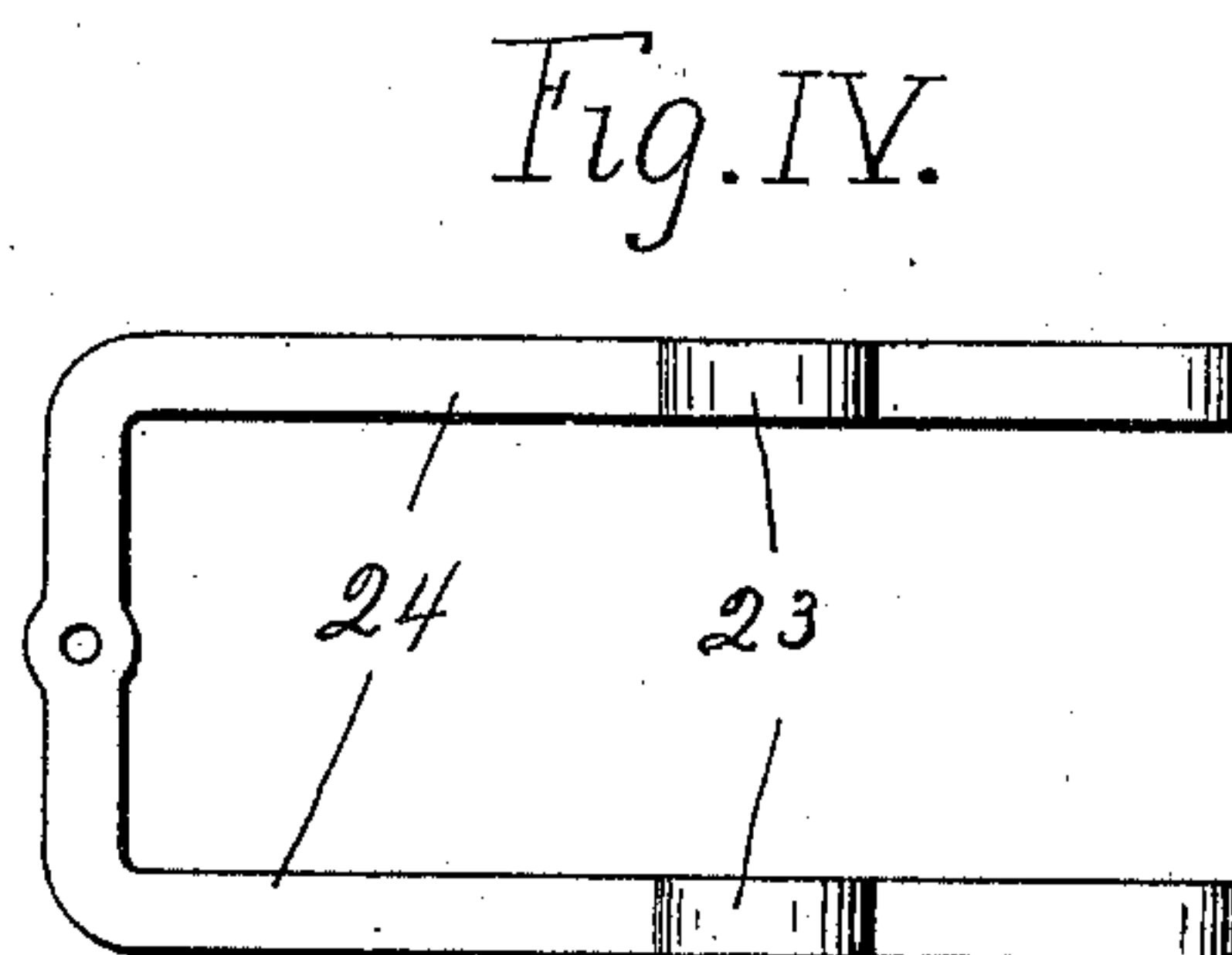
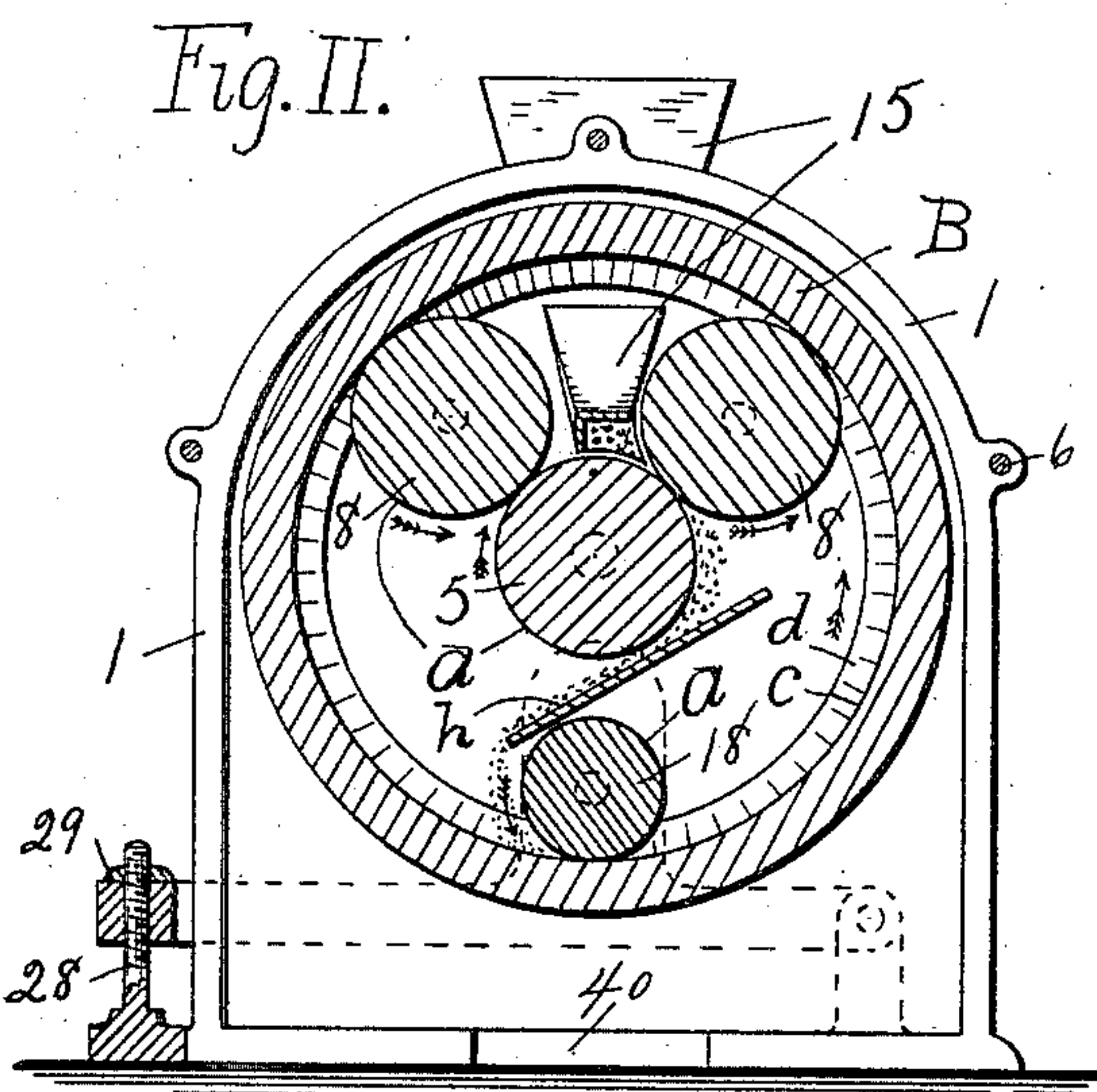
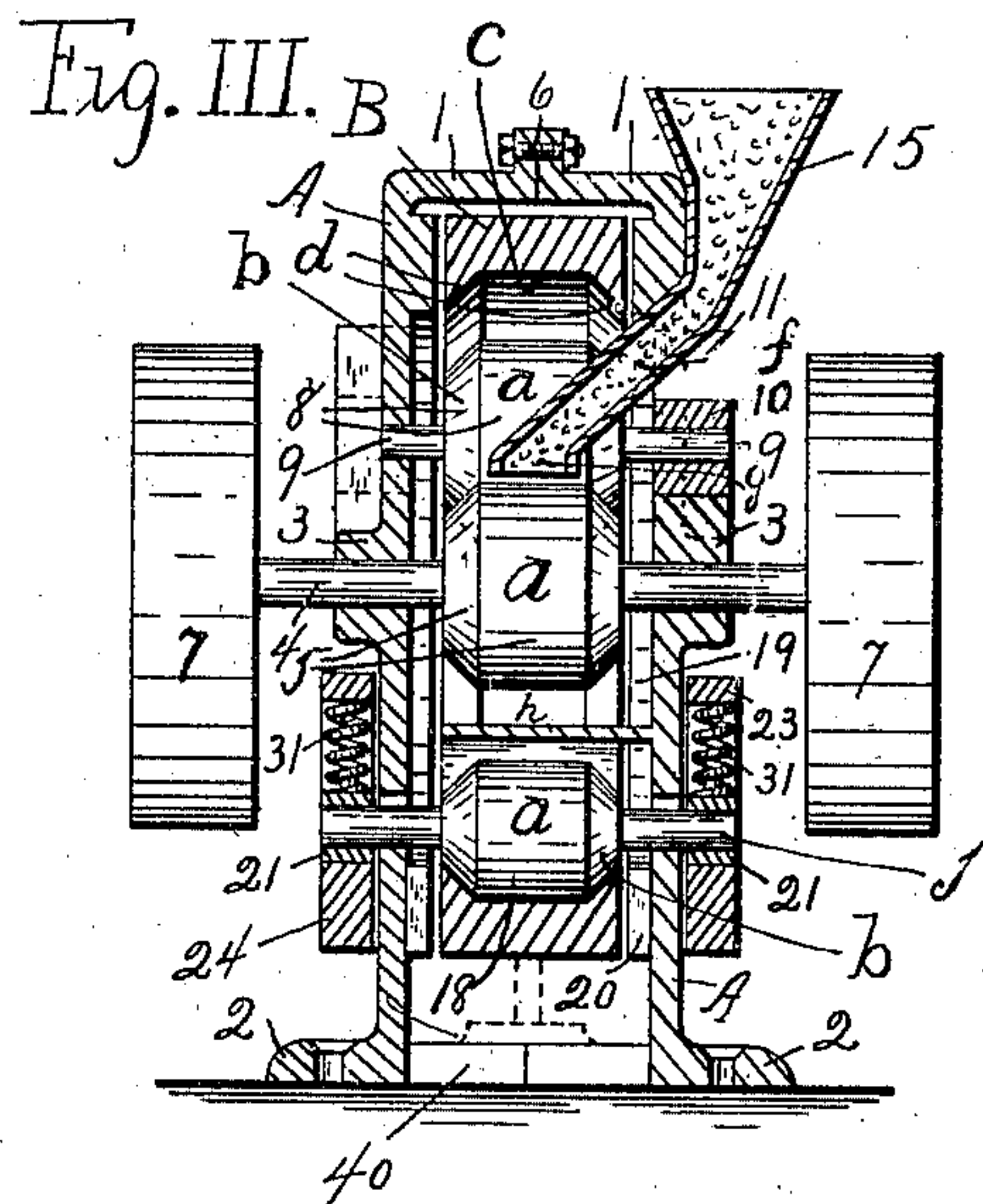
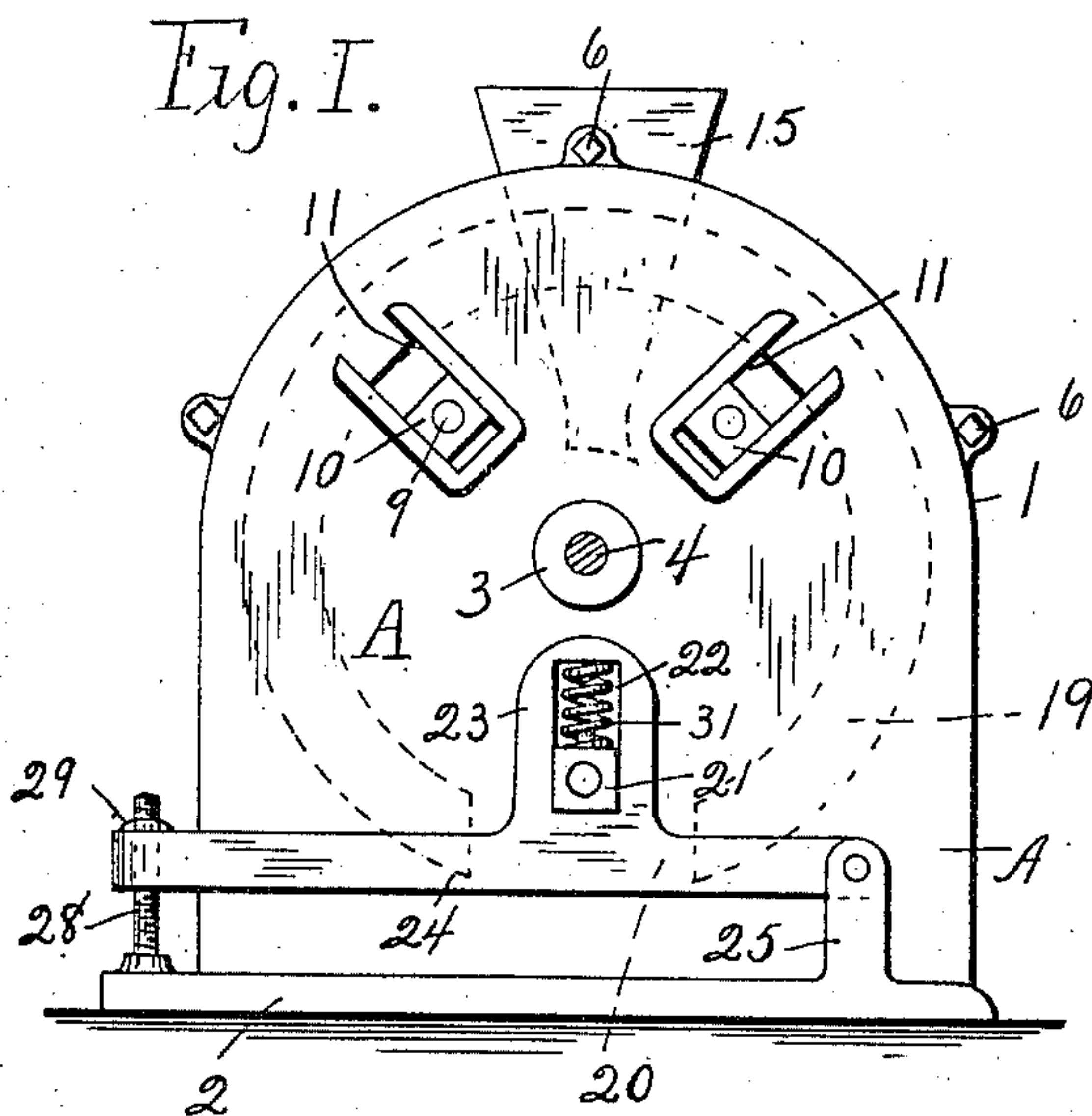
No. 704,650.

Patented July 15, 1902.

G. S. MAXWELL.
PULVERIZING MILL.

(Application filed July 3, 1901.)

(No Model.)



Witnesses.

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PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 704,650, dated July 15, 1902.

Application filed July 3, 1901. Serial No. 67,002. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. MAXWELL, of Madison, in the county of Morris, in the State of New Jersey, have invented new and
5 useful Improvements in Pulverizing-Mills, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to pulverizing-mills
10 in which a free ring is carried on supporting-rolls to crush and pulverize the rock or other material by impact; and it consists in improvements in construction and mode of operation by which the free ring is better sup-
15 ported, more certainly driven, a wider range of crushing is obtained, and the work more rapidly done, and a simple, compact, economical, and easily-adjusted mill is produced.

The essential features of my invention are
20 two corresponding pulverizing-rolls supporting the free ring and a driving-roll revolving in contact with the two rolls; also, a supplemental pulverizing-roll arranged in contact with the inner surface of the free ring and
25 an adjusting mechanism therefor by which the tension on the ring and the pressure between the ring and all of the rolls is regulated.

My invention will be better understood by
30 reference to the drawings herewith, in which the letters and numerals of reference used in the specification indicate the same parts in all the figures.

Figure I is a front elevation of my mill.
35 Fig. II is a vertical section through the mill parallel to Fig. I. Fig. III is a corresponding section at right angles to Fig. II. Fig. IV is a plan of the yoke detached.

In the figures, A A indicate the side plates
40 or halves of the main case, having inwardly-extending flanges 1 1, forming the edge of the case and securely connected together by bolts 6 6. The top of the case is preferably semicircular and the bottom squared and
45 provided with the integral base 2 2, by which the mill is secured in position.

3 3 are concentric bearings in the side plates for the main shaft 4, on which is supported within the case the driving-roll 5 and outside
50 the case one or more power-pulleys 7 7. In

contact with the driving-roll and a little above on each side are correspondingly arranged the two supporting-rolls 8 8 on shafts 9 9, journaled at one or both ends in boxes 10 10, fitting outwardly and upwardly
55 inclined ways 11 11, formed in one or both side plates, so that the supporting-rolls are to a certain extent free to adapt themselves to the material passing between them and the driving-roll. The supporting-rolls (and also, 60 preferably, the driving-roll) are formed with cylindrical centers or crushing-faces *a a* and with tapering ends *b b*, and on them is carried the free ring B, formed to fit the rolls with an annular crushing-surface *c* equal in width 65 to the faces *a a*, and sides *d d*, inclined toward the center, fitting the tapering ends *b b*, so that the ring is held in position.

At some convenient point on the case is arranged an external hopper 15, from which ex-
70 tends downwardly and inwardly into the space between the supporting-rolls a chute *f*, having an open mouth *g*, (substantially equal in width to the crushing-face *a* of the roll,) whose side plates are extended on one side in
75 the direction of the rotation of the driving-roll to fit closely said driving-roll 5 and the supporting-roll 8 on that side and the angle between them, so that the material is main-
80 tained between the cylindrical crushing-surfaces of the rolls until it has passed between them and does not escape longitudinally over their tapering ends. The material here hav-
85 ing been first crushed falls on an inclined chute *h*, suitably supported on one or both side plates, which delivers it to the free ring near its lower portion, so that it immediately passes under the tension-roll 18, where it is further crushed and pulverized. Thence held
90 against the ring by centrifugal force the material is carried up and around between the ring and supporting-rolls continuously until it is reduced to the desired mesh, regulated by the tension and speed of the mill. When
95 the particles are sufficiently ground, they escape through the space between the free ring and the integral rings or flanges 19 19 on the inner surfaces of the side plates, cut away at
20 to permit the escape of the pulverized material through the opening 40 in the base. 100

This tension-roll 18 is carried on shaft *j*, journaled in boxes 21 21, sliding in ways 22 22, formed in extensions 23 23 on U-shaped yoke 24, pivotally supported near one edge of the case by both of its free ends on arms 25 25 and extending thence around the other edge of the case, where at its integral end it is adjustably held in position by screw 28 and nut 29 to regulate the tension applied by the tension-roll to the free ring through springs 31 31, arranged within the ways 22 22, bearing down on the boxes 21 21 and tending to hold the tension-roll against the inner surface of the free ring, whereby a cushion or spring tension is applied to the free ring and to all the rolls in contact therewith. Through said springs and this single adjustable yoke the tension is applied to all the parts at one point and is regulated easily by a single bolt and nut. The tension-roll is also formed with a cylindrical center *a* and tapering ends *b* to fit the free ring. The form and position of the three rolls in contact with the ring are shown in Figs. II and III, adapted to hold the free ring centrally in the case against axial and lateral displacement. The rolls being formed with the cylindrical center and the ring formed to fit gives a wide bearing-surface for grinding, pulverizing, and driving. The driving-roll not being in contact with the ring may be formed cylindrically without tapering ends, but preferably, as shown, to be interchangeable. In operation the free ring is cushioned on the rolls and held in position centrally by its form and axially by the single yielding tension of the tension-roll, so that it adapts itself to variations in the material and to permit the passage of foreign substances. The arrows indicate direction of rotation of rolls, and the supporting-rolls and the tension-rolls are formed with tapering ends, as aforesaid, to fit and retain in position the free ring, and the driving-roll may be correspondingly formed, as here shown, to be interchangeable, (or cylindrical throughout its entire extent,) for its surface is operative only as far as it lies in contact with the supporting-rolls. It would be possible to drive through one of the supporting-rolls, but better by my arrangement, where the fixed driving-roll is arranged in contact with the supporting-rolls indirectly to drive the ring, and the tension-roll is driven from the ring.

The mill has large grinding capacity, having four points for grinding. The material is first crushed to a large extent between the driving-roll and one of the supporting-rolls, where the tension is great. This first crushing reduces the material all practically to the same size before it reaches the free ring, where it is crushed a second time by the tension-roll, and then passes up and around the inner surface of the ring, between that and the two supporting-rolls.

My mill is simple, economical, and of comparatively few parts. Those are largely interchangeable, for all the rolls, shafts, jour-

nal-bearings, and boxes may be made of the same size. Adjustment is easy and for the whole machine may be at a single point. It is practically noiseless, dustless, and with little vibration. It works fast, its feed and discharge are perfectly free, grinds well with any charge or while wet, and cannot be choked. It is easily taken apart and assembled, easily set up in any suitable position, no special foundation being required. It is light, easily transported, may be shipped assembled and completely ready for use or in separate parts to be assembled. It is adjustable while running, durable, the wearing parts lasting indefinitely and not being ground by the dust, and all bolts are outside and visible. It is evenly balanced, cushioned, and equalizing and can be used for any hard material of any fineness without changing the mill. It has a wide range of crushing, for the free ring is supported on two rolls, one-half the weight on each roll. When the tension is released or reduced to its lowest, the crushing is effected by the weight of the ring and that divided by two, and any degree of high tension may be obtained by the adjustment. The ring is carried steadily on the two rolls and is thus driven at two points with little vibration and crystallization.

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

1. In a mill, the combination with a free ring, of two rolls supporting said ring, a driving-roll engaging with said supporting-rolls, and means for rotating the driving-roll.

2. In a mill, the combination with a suitable case and a free ring supported therein, of two supporting-rolls carrying the ring, a driving-roll engaging the supporting-rolls, and means for driving the driving-roll.

3. In a mill, the combination with a suitable case and a free ring arranged therein, of two supporting-rolls journaled in the case and carrying the ring, a driving-roll also journaled in the case and engaging with both supporting-rolls, and means for rotating the driving-roll, a tension-roll journaled in the case in contact with the free ring, and means for regulating the pressure of the tension-roll on the ring.

4. In a mill, the combination with a suitable case provided with an opening at the top for the introduction of the material and an opening near the bottom for the outflow of the pulverized material, of a free ring arranged in the case, two supporting-rolls journaled in the case supporting the free ring, a driving-shaft journaled in the case, means for rotating the shaft, and a driving-roll on said shaft arranged in contact with the supporting-rolls.

5. In a mill, the combination with a suitable case and a free ring arranged therein, of three rolls journaled in the case and having their peripheries in contact with the inner surface of the ring, means for exerting a yielding pressure on one of said rolls to regulate the

tension of the ring, and a fourth roll engaging with one or more of said rolls to rotate the rolls and the ring.

6. In a mill, the combination with a suitable case having openings for the inflow and outflow of the material, of a free ring arranged in said case, two supporting-rolls journaled in the case and arranged to carry the free ring, a tension-roll also journaled in the case and arranged with its periphery in contact with the inner surface of the ring, means for exerting a variable spring-pressure on said tension-roll to regulate the tension of the ring and the mesh of the material, and a fourth roll also journaled in the case engaging with both supporting-rolls to drive the ring and the rolls, and means for rotating the fourth roll.

7. In a pulverizing-mill, the combination with a suitable case, of two supporting-rolls journaled therein having cylindrical central portions or crushing-surfaces and tapering ends, a free ring supported on said rolls and correspondingly formed with an annular crushing-surface equal in width to the crushing-surface of said rolls and with sides inwardly inclined toward the center, substantially fitting the tapering ends of the rolls, a driving-roll also journaled in the case and arranged to rotate in contact with said supporting-rolls, and means for rotating the driving-roll.

8. In a mill, the combination with a suitable case, of two supporting-rolls journaled therein having a cylindrical central portion or crushing-surface and tapering ends, a free ring carried on said rolls and having its inner surface formed with an annular crushing-surface and inwardly-inclined sides to fit said rolls, a driving-roll also journaled in the case and having its periphery in contact with said supporting-rolls, and of a chute for the introduction of the material to be crushed extending from the outside of the case inwardly with a mouth of substantially the same width as the crushing-surface of said supporting-rolls and arranged adjacent to the driving-roll.

9. In a mill, the combination with a suitable case composed of corresponding side plates bolted together, said side plates having outwardly-inclined ways in their upper portion, of boxes arranged to slide in said ways, shafts journaled in the boxes, supporting-rolls on the shafts, a free ring carried on the supporting-rolls, a driving-roll journaled in the side plates and in contact with the supporting-rolls, and means to operate the driving-roll.

10. In a mill, the combination with a suitable case, of two supporting-rolls journaled in the case, a free ring carried on the supporting-rolls, a tension-shaft arranged near the bottom of the free ring and extending outwardly through openings in the case, a suitable support pivotally journaled at one end, boxes on said support forming journal-bearings for the shaft, a tension-roll journaled

on the shaft within the case and in contact with the inner surface of the free ring, springs engaging the boxes and the support to force downwardly said tension-roll, means to regulate the tension of the springs and thereby of the pressure of the tension-roll on the inner surface of the ring, and means to rotate the rolls.

11. In a mill, the combination with a suitable case composed of corresponding side plates bolted together, said side plates having outwardly-inclined ways in their upper portion, of boxes arranged to slide in said ways, shafts journaled in the boxes, two supporting-rolls on the shafts, a free ring carried on the supporting-rolls, a tension-shaft arranged near the bottom of the free ring and extending outwardly through openings in the case, a suitable support pivotally journaled at one end, boxes on said support forming journal-bearings for the shaft, a tension-roll journaled on the shaft within the case and in contact with the inner surface of the free ring; springs engaging the boxes and the support to force downwardly said tension-roll, means to regulate the tension of the springs and thereby of the pressure of the tension-roll on the inner surface of the ring, a driving-roll journaled between the side plates and in contact with the supporting-rolls, and means to rotate the driving-roll.

12. In a mill, the combination with a suitable case, of two supporting-rolls journaled in the case, a free ring carried on said rolls, a driving-roll engaging the supporting-rolls, means for rotating the driving-roll; a single tension-roll arranged within the case in contact with the inner surface of the free ring near its lowest point, a shaft carrying said tension-roll, said shaft extending outwardly through openings in the sides of the case; a yoke pivotally supported on arms on the outside of the case near one edge by its free ends and extending around the other edge of the case, said yoke being formed with vertical ways, boxes arranged to slide in said ways and forming roller-bearings for the tension-roll shaft, springs arranged within said ways to force said boxes downwardly, and a single bolt and adjusting-nut engaging with the integral end of the yoke to regulate the tension of the springs and the pressure of the tension-roll on the inner surface of the free ring.

13. In a pulverizing-mill, the combination with a case having side plates, and formed with openings for the inflow and outflow of the material, a main shaft journaled between the side plates, a driving-roll arranged on said main shaft within the case; boxes fitted to upwardly and outwardly inclined ways in the side plates above the driving-roll, two supporting-roll shafts extending across the case and journaled in said boxes, supporting-rolls on said shafts in peripheral contact with the driving-roll, said supporting-rolls being formed with cylindrical centers and tapering-

ends; a free ring sustained on the support
 ing-rolls and correspondingly formed with an
 annular central portion and inclined sides
 inclined in toward the center to fit said sup-
 5 porting-rolls; a U-shaped yoke pivotally
 supported by its separated ends on integral
 arms arranged on the base of the case near
 one edge and extending around the other
 edge of the case, a single screw and nut se-
 10 cured to the base and engaging with the in-
 tegral end of the yoke to adjust its position
 and the tension of the free ring on its rolls,
 integral upward extensions on the legs of the
 yoke, on each side, formed with ways, boxes
 15 fitted to said ways, springs arranged in said
 ways to bear downwardly on said boxes; a
 tension-roll shaft journaled in the boxes, a
 tension-roll on said tension-roll shaft arranged
 within the case and in contact with the inner
 20 surface of the free ring at its lowest point,
 said tension-roll being of the same size and
 form as the supporting-rolls, and means to
 operate the driving-roll.

14. In a mill, the combination with a suit-
 25 able case, of a free ring arranged in said case,
 of two supporting-rolls journaled in the case
 and carrying the ring, a driving-roll also jour-
 naled in the case and engaging the support-
 ing-rolls, a yoke pivotally supported outside
 30 of the case by its free ends, a tension-roll

arranged within the case in contact with the
 free ring and journaled in said yoke, and a
 single bolt and adjusting-nut engaging with
 the integral end of the yoke to regulate the
 pressure of the tension-roll on the free ring. 35

15. In a mill, the combination with a suit-
 able case and free ring supported therein, of
 two supporting-rolls carrying the ring, a driv-
 ing-roll engaging the supporting-rolls, means
 for driving the driving-roll, an external hop- 40
 per for the material, and a chute extending
 from the hopper into the interior of the case
 and terminating in the open mouth arranged
 adjacent to the driving-roll, said mouth being
 extended outwardly and downwardly on one 45
 side in the direction of rotation of the driv-
 ing-roll, substantially to fit the driving-roll
 and one of the supporting-rolls.

16. In a mill, the combination with a free
 ring, of a plurality of rolls supporting said 50
 ring, a driving-roll engaging with one or more
 of said supporting-rolls, and means for ro-
 tating the driving-roll.

In testimony whereof I have hereunto
 signed my name.

GEORGE S. MAXWELL. [L. S.]

Witnesses:

C. C. SCHOENECK,
 E. L. DARLING.