

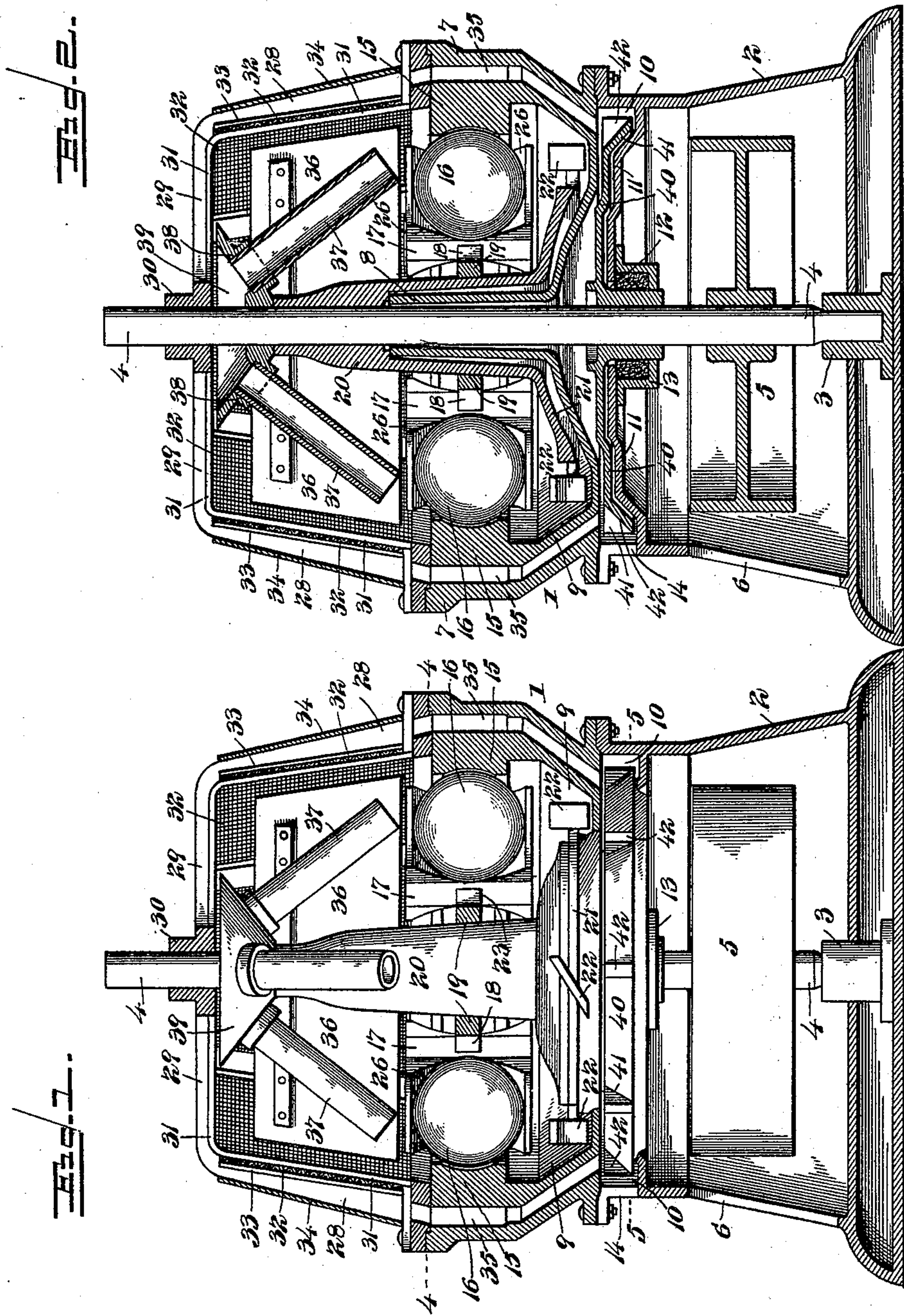
(No Model.)

3 Sheets—Sheet 1.

G. W. BROWNE.
PULVERIZING OR GRINDING MILL.

No. 582,520.

Patented May 11, 1897.



Inventor

Witnesses

E. H. Stewart
W. B. Brown

George W. Browne

By *his* Attorneys,

C. A. Snow & Co.

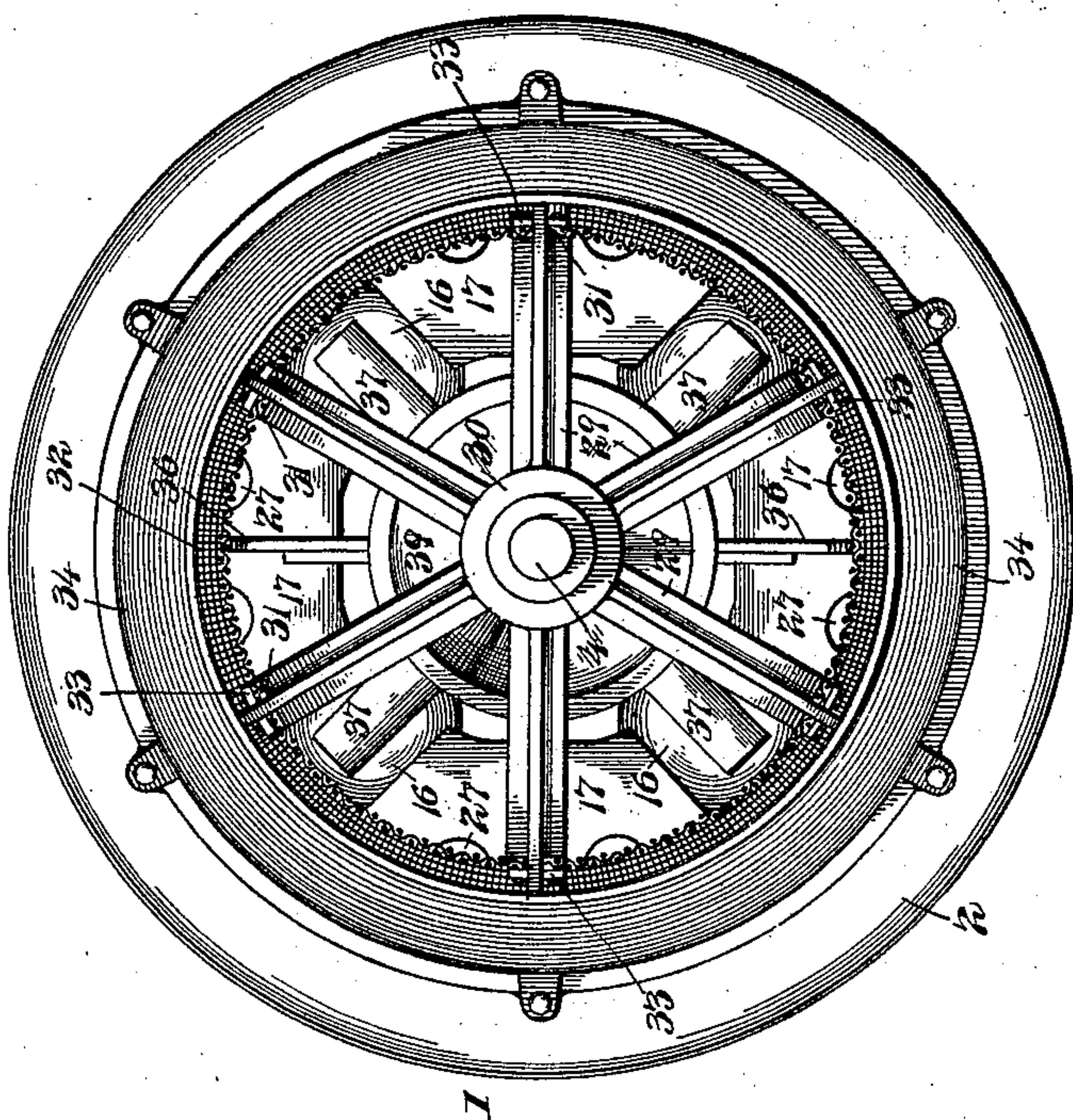
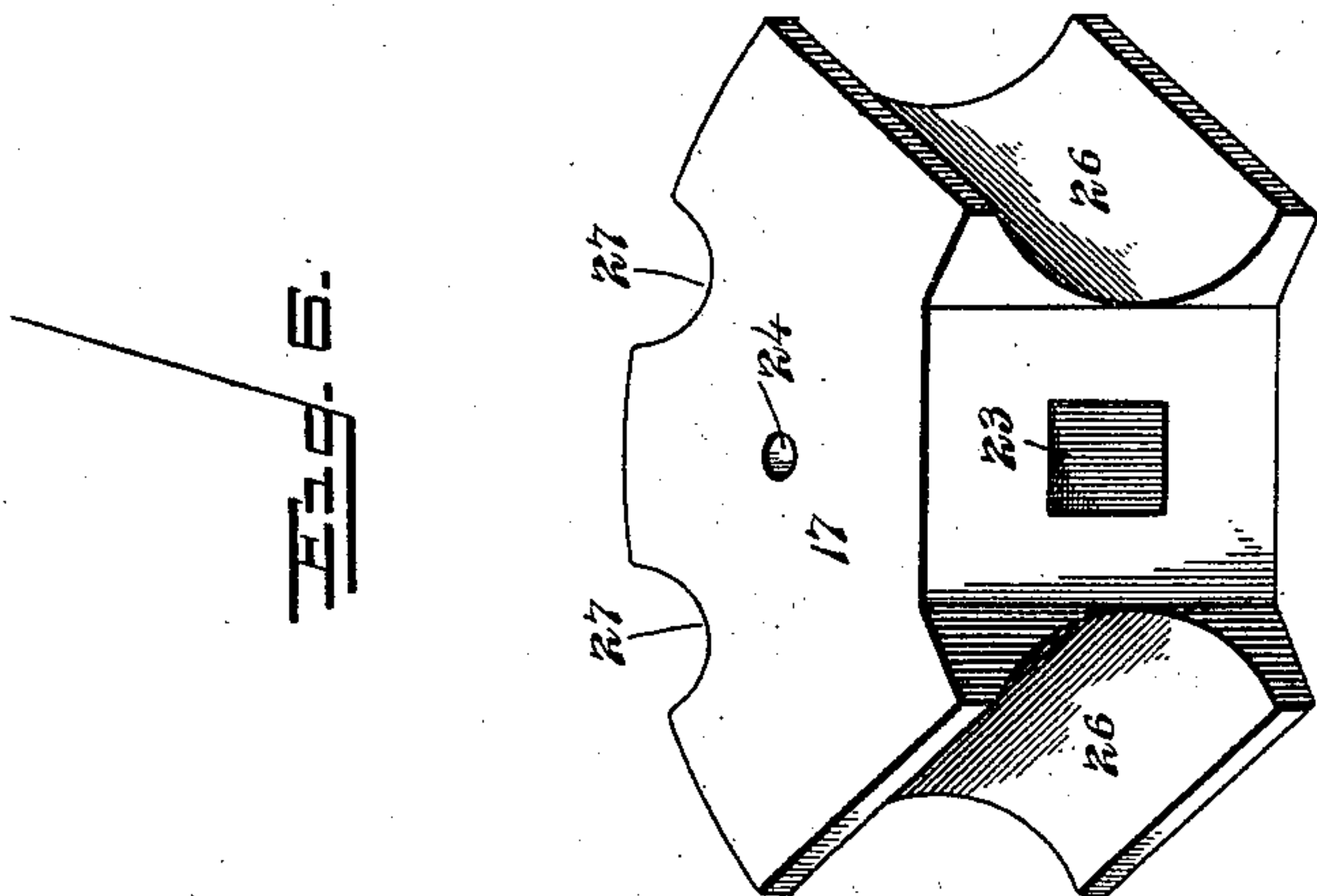
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Fig. 5.

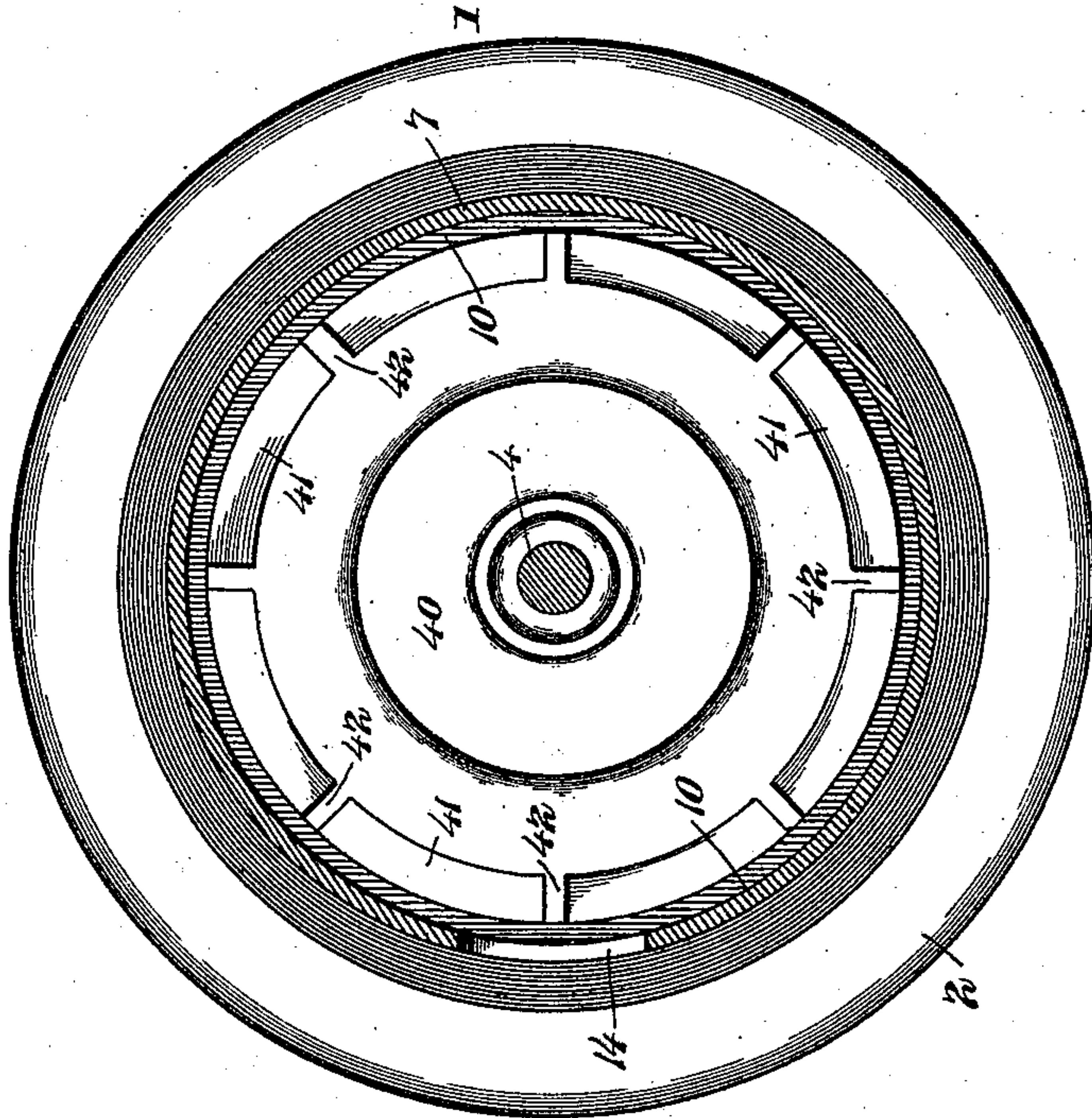
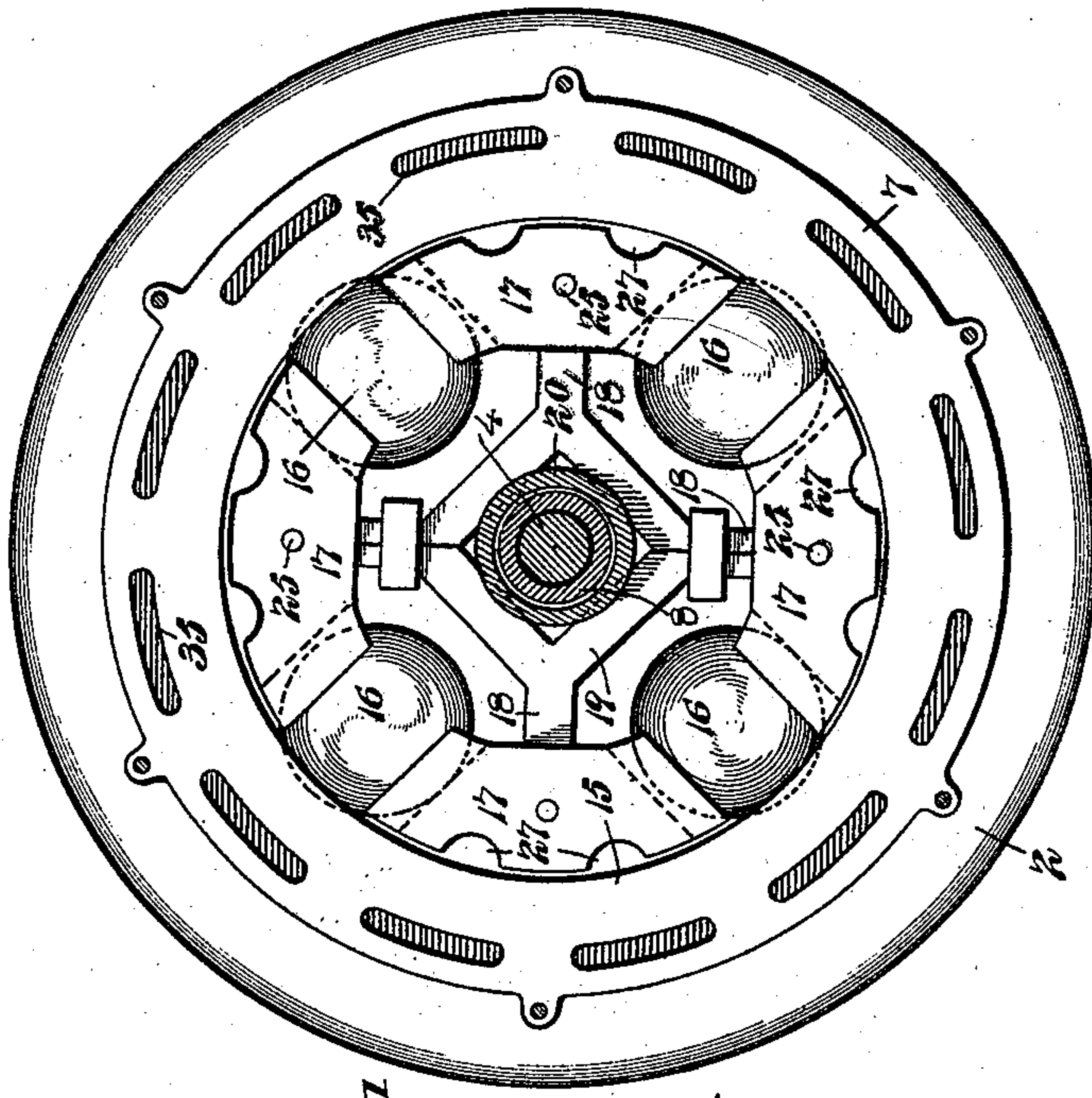


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE W. BROWNE, OF FREEMANSBURG, PENNSYLVANIA.

PULVERIZING OR GRINDING MILL.

SPECIFICATION forming part of Letters Patent No. 582,520, dated May 11, 1897.

Application filed November 8, 1895. Serial No. 568,290. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. BROWNE, a citizen of the United States, residing at Freemansburg, in the county of Northampton and State of Pennsylvania, have invented a new and useful Pulverizing or Grinding Mill, of which the following is a specification.

My invention relates to a pulverizing or grinding mill of the class in which balls are operated centrifugally in connection with an annular die; and the object in view is to provide improved means for feeding the material to be ground whereby the coarse or unground material is concentrated in the plane of the balls, while the ground material is carried upward and discharged through an annular screen, the initial or main feeding devices being constructed to feed the material by gravity and centrifugal force combined, and, furthermore, to provide an improved construction of ball holding and carrying devices whereby when worn the carriers may be reversed and thus adapted for extended use.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side view of a mill constructed in accordance with my invention, the casing being shown in section. Fig. 2 is a vertical central section of the same. Fig. 3 is a plan view. Fig. 4 is a horizontal section on the line 4 4 of Fig. 1. Fig. 5 is a horizontal section on the line 5 5 of Fig. 1. Fig. 6 is a detail view of one of the ball carriers or holders.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

1 designates an outer casing of sectional construction, the lower or base section 2 having a central socket 3, in which is stepped the lower end of the driving-shaft 4. This driving-shaft may receive motion by any suitable means, such as a belt-pulley 5, arranged within the base-section of the casing, an opening 6 being formed in said section to allow the belt (not shown) to pass. Mounted upon the flanged upper edge of the base-section is an upper section 7, provided with an inner sleeve

or thimble 8, which is concentric with the driving-shaft 4, an annular trough 9 being formed between the outer shell of section 7 and the sleeve or thimble 8.

Arranged in the base-section near the plane of its upper edge is a receiving-chamber 10, of which the floor 11 extends inward and is provided with an opening 12 for the driving-shaft 4, a stuffing-box 13 being secured to the under surface of said floor surrounding the shaft, and formed in the side wall of said receiving-chamber to allow the exhaust of ground material is an outlet-opening 14.

Arranged within the upper section 7 of the casing is an annular die 15, having a concaved face for contact with the grinding-balls 16, said balls being held from independent lateral movement and guided in radial movement by means of carriers or holders 17, supported by the radial arms 18 of a spider, said spider including a ring 19, which is fixed to the hub 20 of an auxiliary feeding device. This auxiliary feeding device embodies a disk 21, operating in the annular trough 9 and carrying a plurality of inclined plow-blades 22, which are adapted to engage particles of unground material falling into the trough 9 and by reason of its rapid rotation throw said particles upward into contact with the grinding-balls 16, the lower or advance edges of said blades 22 operating contiguous to the floor of the trough 9. Said ball carriers or holders 17 consist of blocks approximately segmental in plan, with convexly-curved outer edges which correspond in contour with the inner or grinding surfaces of the annular die, said blocks being provided with horizontal sockets 23, which receive the said arms 18 of the spider. These blocks are pierced vertically, as at 24, for the reception of securing-pins 25, as shown in Fig. 4.

The terminals of the carriers or holders are provided with concaved seats 26, struck by radii corresponding in length with the radii of the balls, whereby the facing seats of two contiguous carriers or holders form an approximately cylindrical guide for the reception of a ball to prevent lateral while permitting free radial movement due to the centrifugal force caused by the rapid rotary movement of the spider. The outer convex

faces of the guides or blocks are vertically grooved or channeled, as shown at 27, to allow unground or only partially-ground material, when projected upward by the plow-blades 22, to reach the operating-surface of the annular die.

Seated upon the upper edge of the upper section 7 of the casing are the ribs or standards 28, having horizontal upper extensions 29, connected at their contiguous ends to a sleeve or bearing 30, constituting the bearing for the upper end of the shaft 4, said ribs having lateral flanges 31, in contact with which are arranged the lateral edges of a series of screen-sections 32, said screen-sections combining to form an approximately cylindrical or trunco-conical screen. The lateral edges of the screen-sections are secured in place in contact with said flanges of the ribs by means of retaining-bars 33, (shown clearly in Fig. 3,) and held in place by the outer edges of the ribs is a shield or guard 34, preferably formed of sheet metal or its equivalent, and thus providing an annular drum with which communicate approximately vertical passages or channels 35, extending to the receptacle 10.

Secured to the hub 20 of the auxiliary feeding devices or otherwise to the driving-shaft are fan-blades 36, terminating at their outer edges contiguous to the inner surface of the screen and adapted to discharge the ground material through the screen into the drum; and interposed between the fan-blades are the feed tubes or chutes 37, arranged in a downwardly and outwardly inclined position and terminating contiguous to and above the plane of the balls 16, whereby the material to be ground is deposited upon the upper surfaces of the balls contiguous to their point of contact with the annular die. These feed-tubes are secured in openings 38, formed in the inclined sides of the feed-hopper 39, and the said feed-hopper surrounding and being concentric with the driving-shaft, said hopper being keyed with the hub 20 to the driving-shaft and hence rotated therewith. The rotation of the hopper and feed-tubes 37 causes the material to be fed by the combined action of gravity and centrifugal force to the upper surface of the grinding-balls 16, and simultaneously with the operation of these main feeding devices the auxiliary feeding devices, including the plow-blades 22, operate to feed unground material upwardly into operative relation with the balls and annular die, whereby the material to be ground is concentrated in the plane of the balls, being fed from opposite directions.

Obviously the material will not pass upward from the grinding devices under the influence of the fan until it has been thoroughly ground and pulverized, and when thus elevated it is discharged through the screen into the drum and from thence passes downward through the passages or channels 35 in the wall of the upper section of the casing to the

receptacle 10, which is formed in the lower section of the casing. Operating in said receptacle 10 contiguous to and conforming with the floor thereof is a discharging device embodying a disk 40, having a peripheral downwardly and outwardly inclined flange 41 and a series of radial wings 42, by which the material is carried to the outlet-opening 14.

From the above description it will be seen that choking of the main feeding devices, which include the central hopper 39 and the communicating inclined feed-tubes 37, is improbable from the fact that both gravity and centrifugal forces are utilized in conveying the material from the hopper to the pulverizing-point, and it is equally obvious that in case of choking of the tubes they may be readily cleared by introducing a suitable object through the upper ends of the tubes.

The radial pulverizing-ball seats being open at their upper and lower sides allow the downward feeding of material deposited by the tubes and the upward feeding of material elevated by the plow-blades, whereby throughout the path of each pulverizing-ball material is being deposited upon the upper and lower sides of the ball, and hence is concentrated in the plane of the die in position for pulverization. Obviously this relative arrangement of downwardly and upwardly operating feeding devices necessitates the use of an annular die having an inner operative face, and the open upper and lower sides of the seats facilitate the operation of depositing the material at such a point as to be brought immediately between the pulverizing-faces. It will be seen, furthermore, that the holders or carriers for the balls are reversible, whereby when the seat at one end of a carrier has become worn the carrier may be reversed to bring the other end into operative position. The wearing of one end of a carrier more than the other is due to the rotation of the device in one direction, and hence the contact of said worn end of the carrier with the ball in imparting rotary movement thereto. Furthermore, the construction of the ball-carrier with spaced radial seats for the grinding-balls, the intervals between said seats being closed by the carrier-blocks, necessitates the above-described arrangement of feeding devices, including the rotary hopper, mounted coaxially with the ball-carrier, and radial downwardly and outwardly inclined feed tubes or spouts which communicate with and are carried by the hopper and terminate, respectively, above the grinding-balls. The rotary movement of these feed-tubes causes the material to be fed from the hopper by centrifugal force and discharge upon the upper sides of the balls at their points of contact with the annular die, whereby said material is brought directly into position for grinding and cannot drop through the seats without first coming in contact with the grinding-surfaces. The arrangement of the carrier-blocks,

which fill the intervals between the seats, prevents unground particles from dropping between the balls.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having described my invention, what I claim is—

1. In a grinding-mill, the combination with a casing, an annular die, and grinding-balls, of a rotary ball-carrier having spaced radial seats provided with open upper and lower sides, the intervals between the seats being closed, and feeding devices including a rotary hopper mounted coaxially with the ball-carrier and adapted for continuous rotation therewith, and a plurality of radial downwardly and outwardly inclined feed-tubes communicating with and carried by the hopper and terminating respectively contiguous to and above the balls, whereby the material to be ground is discharged by centrifugal force solely upon the balls contiguous to their points of contact with the annular die, substantially as specified.

2. In a grinding-mill, the combination with a casing having grinding or pulverizing devices, of a series of ribs rising from the casing above the grinding devices and provided with lateral flanges, screen-sections detachably secured at their side edges to said lateral flanges and combining to inclose a space above the plane of the balls, a shield or guard surrounding and spaced from the screen-sections and being held in place by the webs of outwardly-extending portions of said ribs, and a fan operating in said space above the balls, substantially as specified.

3. In a grinding-mill, the combination with a casing, a die and feeding devices, of horizontal ball carriers or holders provided with terminal radial semicylindrically-rounded seats, balls mounted in said seats for free

radial movement, and means for imparting rotary motion to the carriers or holders, said carriers being reversible to allow the arrangement of the unworn upper sides of the seats under the balls, substantially as specified.

4. In a grinding-mill, the combination with a casing, a die, and feeding devices, of a spider having radial arms, carrier or holder blocks having sockets removably fitted upon said arms, the carrier or holder blocks being provided with terminal cross-sectionally curved or concaved seats, balls arranged between the facing contiguous seats of adjoining carrier or holder blocks, and means for imparting rotary motion to the spider, substantially as specified.

5. In a grinding-mill, the combination with a casing, a die, and feeding devices, of a carrier having a spider provided with radial arms, segmental carrier or holder blocks provided with terminal cross-sectionally curved or concaved seats adapted to face the corresponding seats of contiguous carrier or holder blocks, the blocks being provided with sockets for the reception of the arms of the spider, pins fitting in perforations in the blocks to secure them to the arms, and means for imparting rotary motion to the carrier, substantially as specified.

6. In a grinding-mill, the combination with a casing, an annular die and feeding devices, of ball-carrying devices having radially-disposed semicylindrically concave seats open top and bottom and adapted to engage the balls at diametrically opposite points, and means for imparting rotary motion to the ball-carrying devices, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GEORGE W. BROWNE.

Witnesses:

ALONZO BROWNE,

WILLIAM V. SKIDMORE.