

(No Model.)

3 Sheets—Sheet 1.

J. K. & E. C. GRIFFIN.
PULVERIZING MILL.

No. 515,673.

Patented Feb. 27, 1894.

Fig. 4.

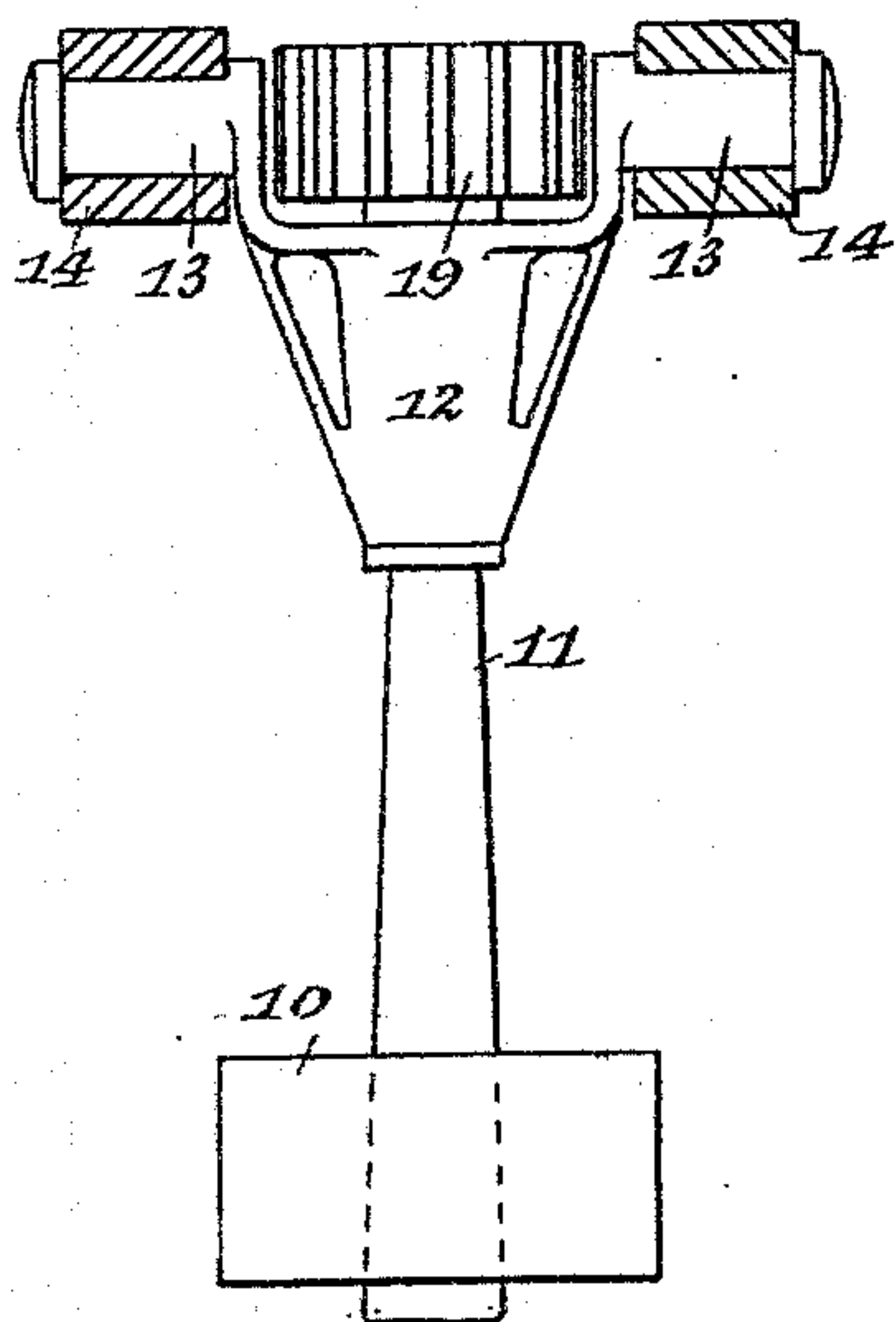


Fig. 5.

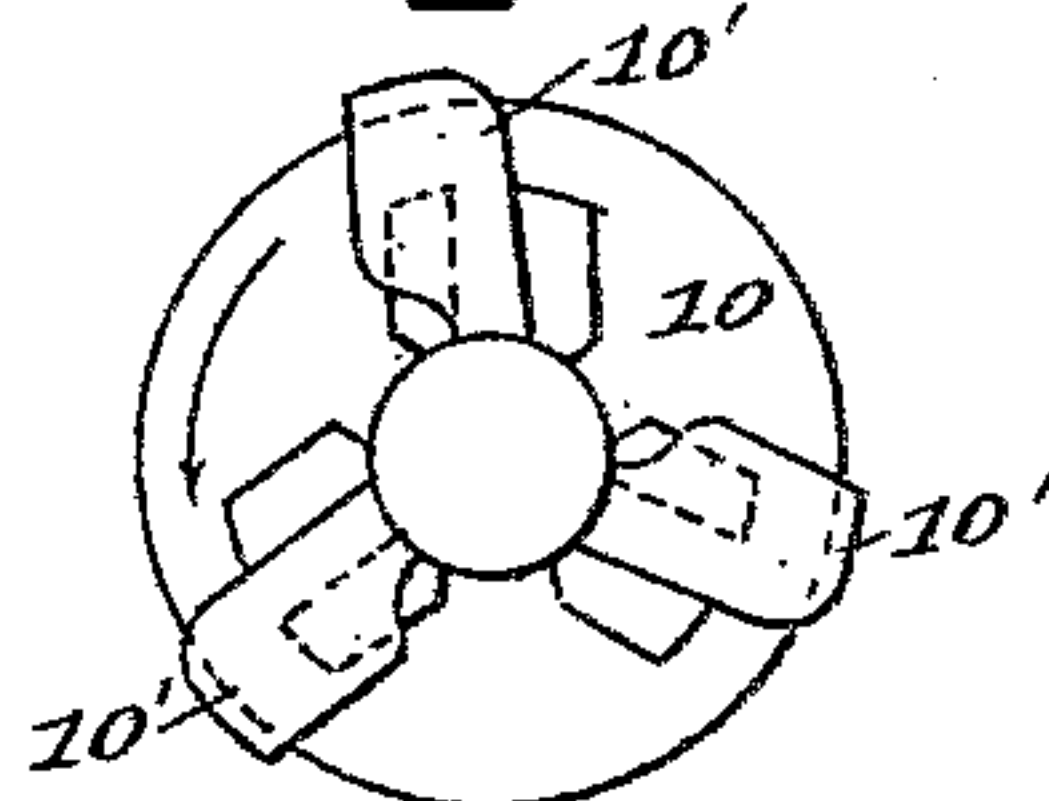


Fig. 6.

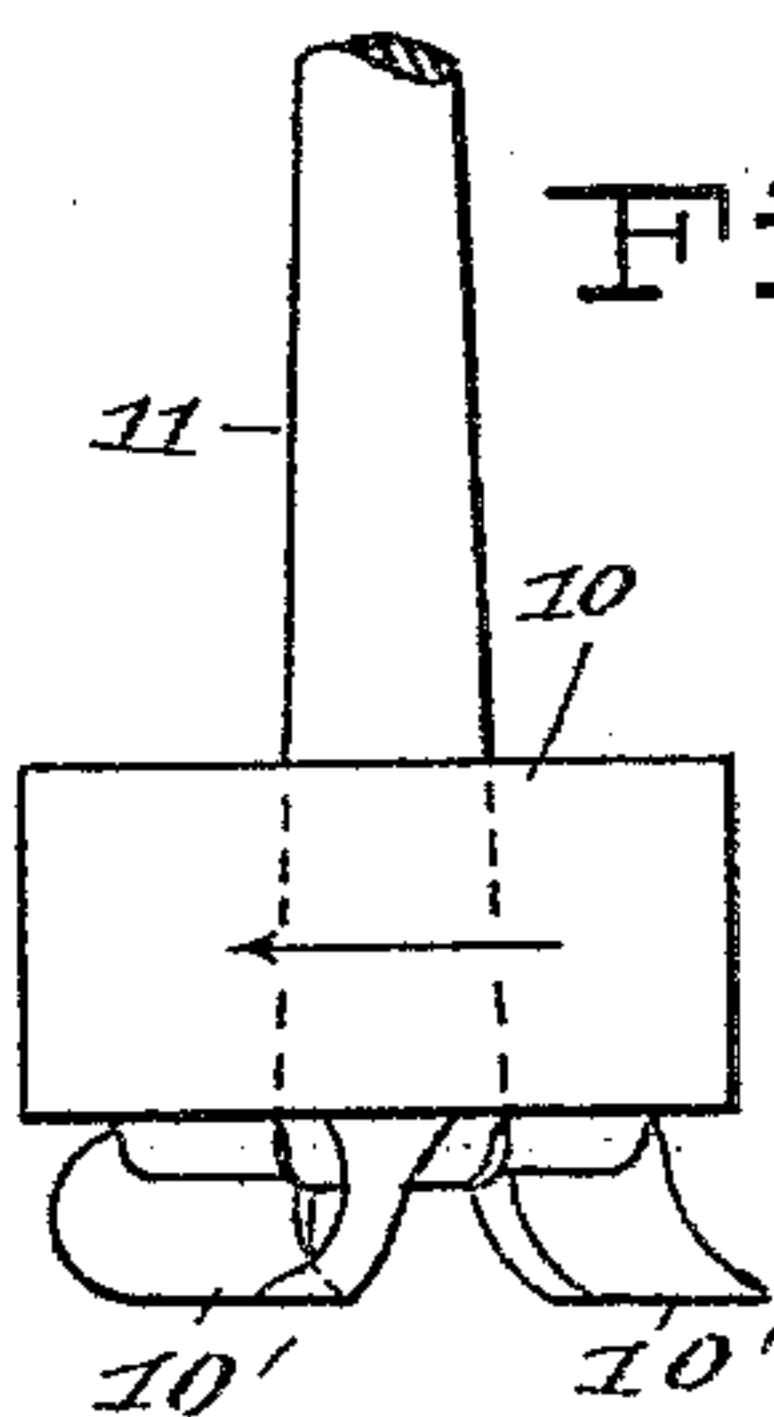
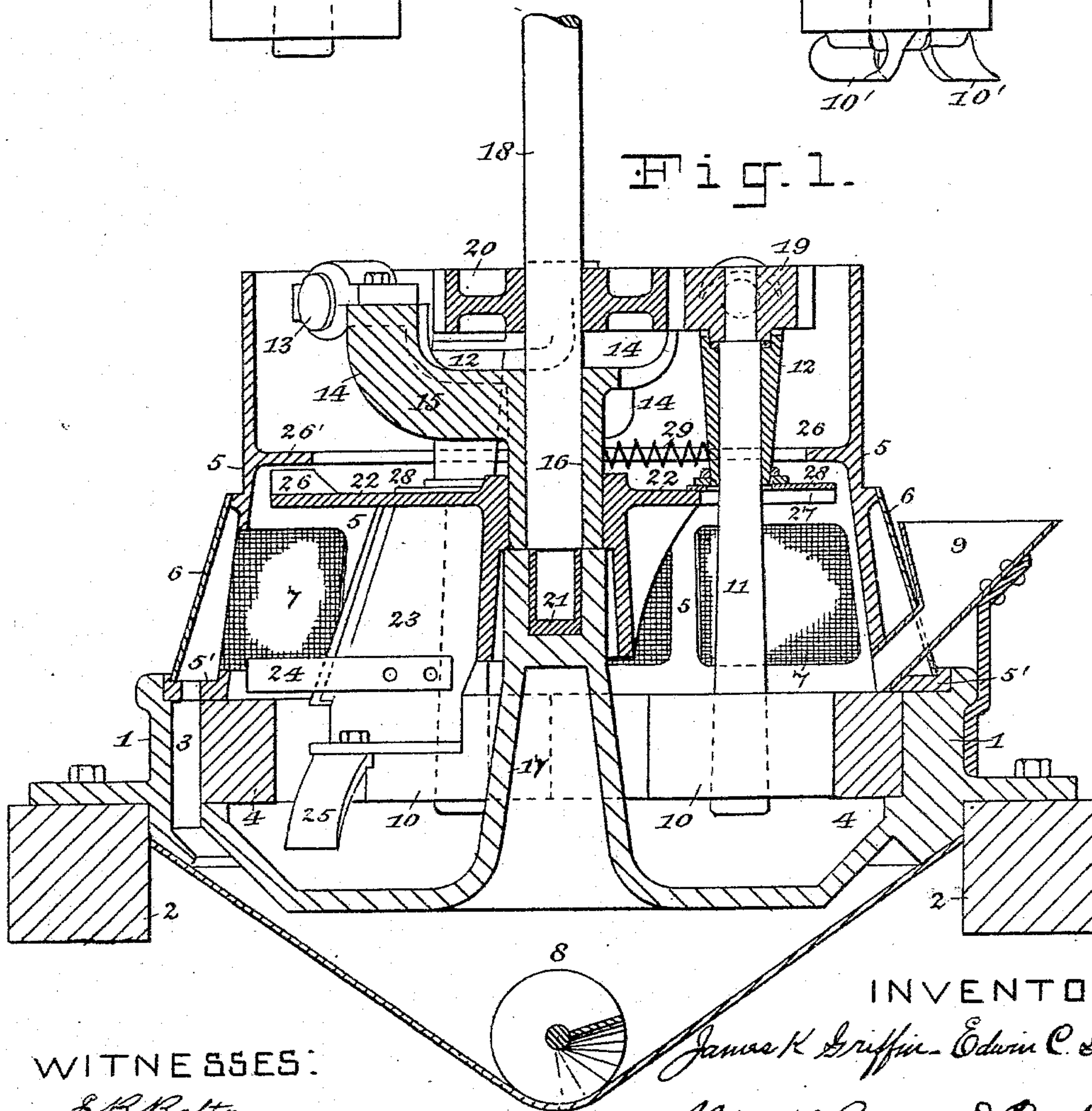


Fig. 1.



WITNESSES:

E. B. Bolton
C. L. Davis

By

INVENTORS
James K. Griffin *Edwin C. Griffin*
Marble Mason Canfield
his Attorneys.

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Fig. 3.

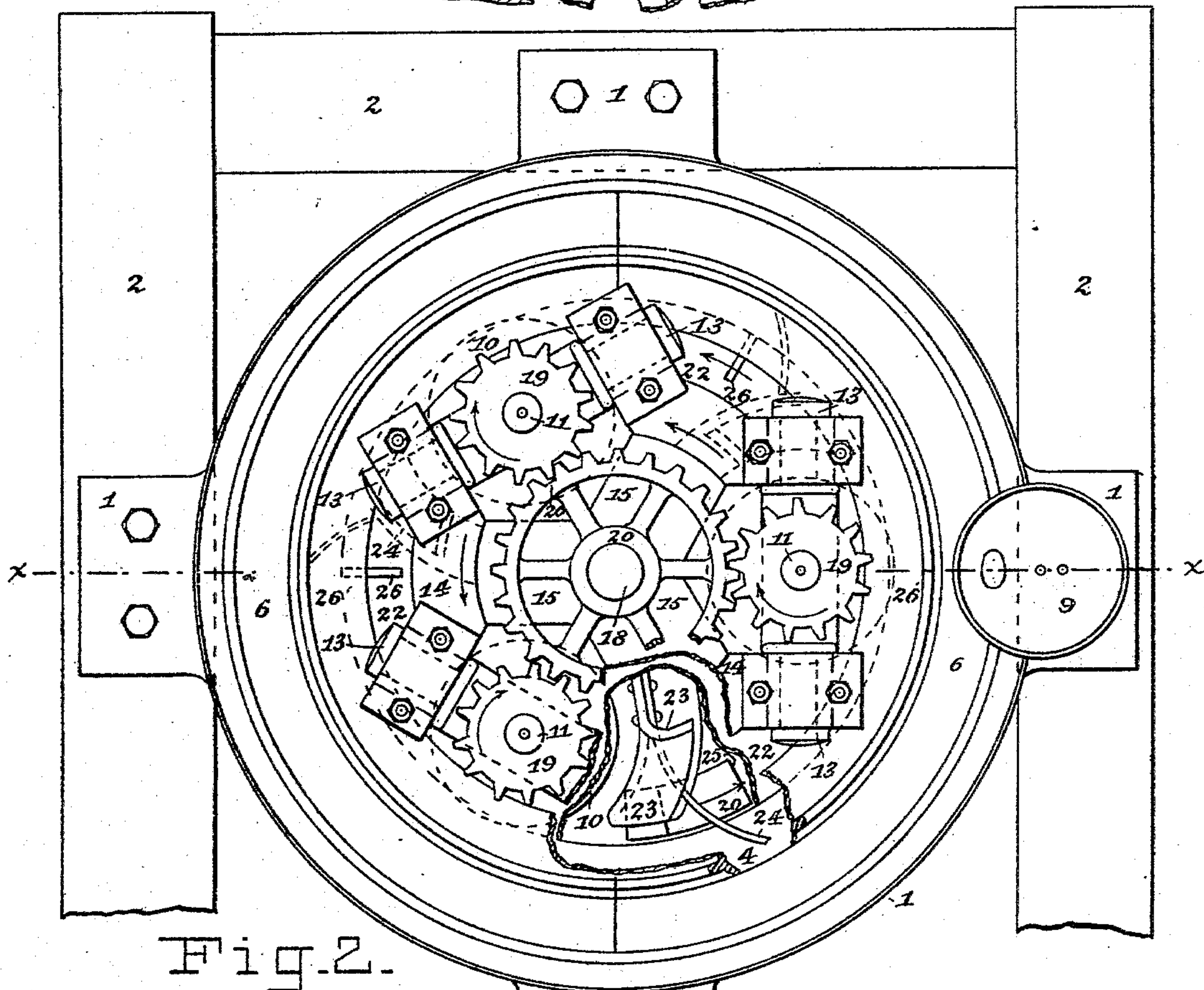
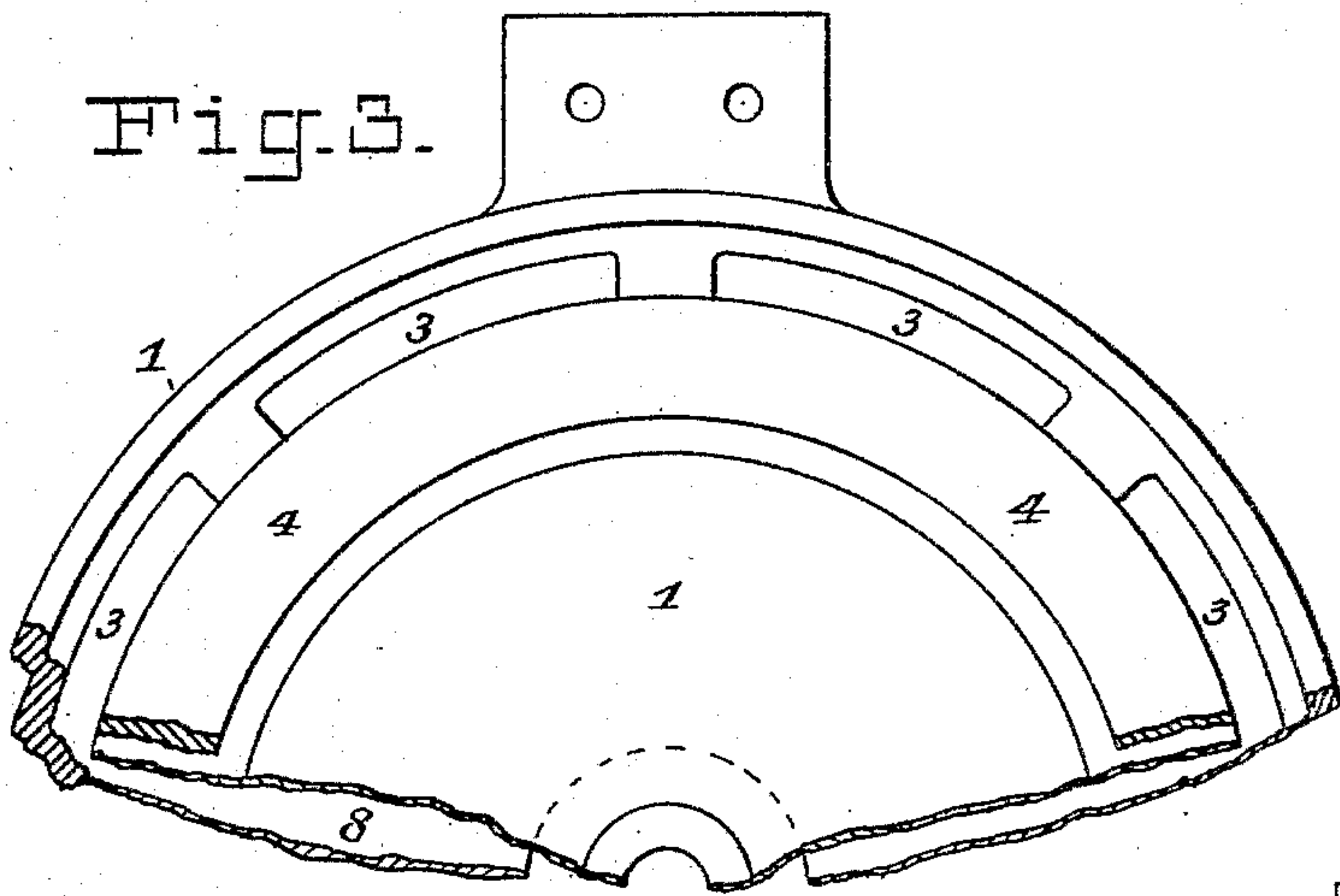


Fig. 2.

WITNESSES:

E. B. Kotton
C. L. Davis

INVENTORS

James H. Griffin, Edwin C. Griffin

By *Marble, Mason & Canfield,*
his Attorneys.

(No Model.)

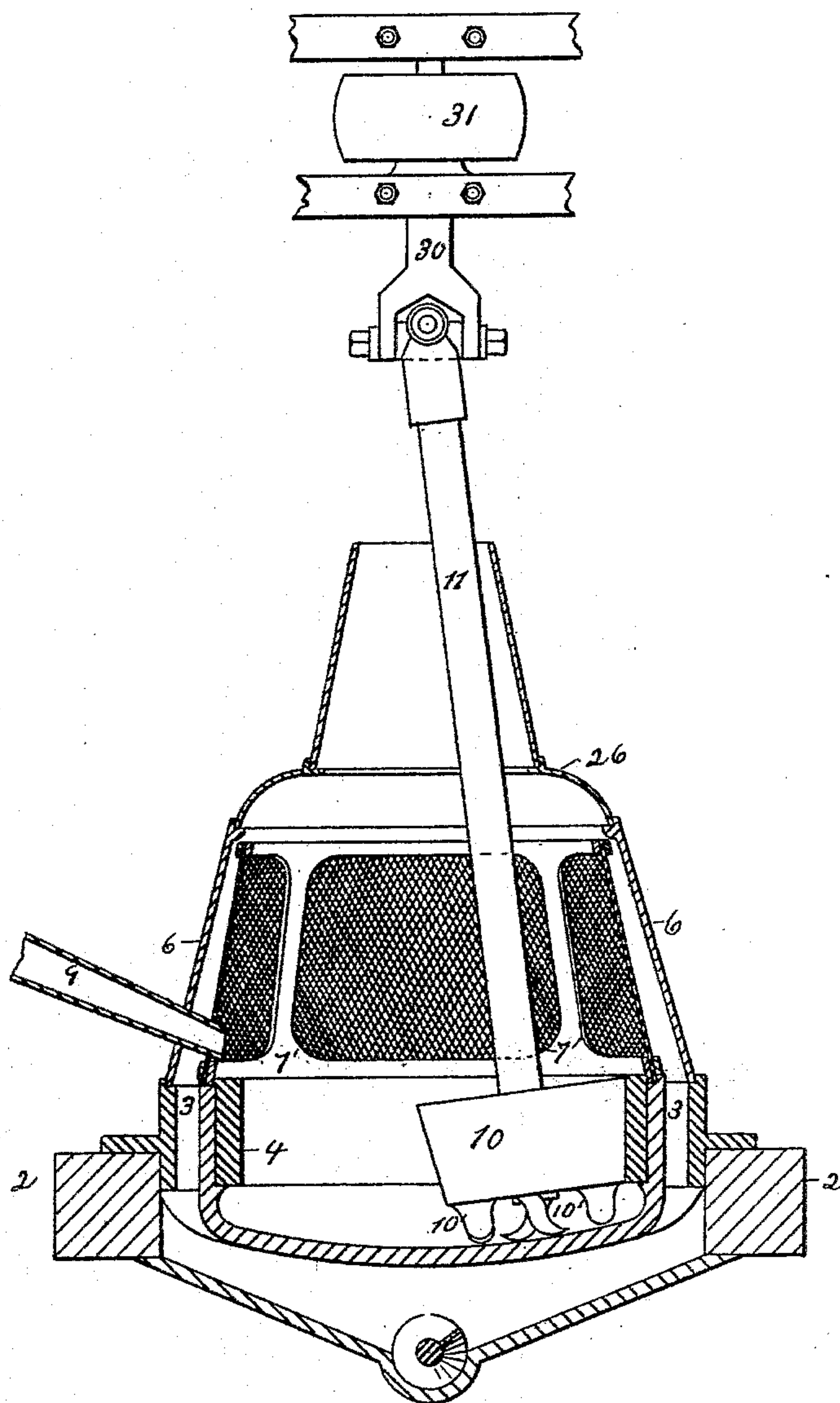
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Fig. 7.



WITNESSES:

E. B. Bolton
C. L. Davis

INVENTORS

James K. Griffin - Edwin C. Griffin
By *Marble Mason Ranfield*
his Attorneys.

UNITED STATES PATENT OFFICE.

JAMES K. GRIFFIN, OF BROOKLYN, NEW YORK, AND EDWIN C. GRIFFIN, OF
NEWTON, MASSACHUSETTS.

PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 515,673, dated February 27, 1894.

Application filed March 31, 1891. Serial No. 387,093. (No model.)

To all whom it may concern:

Be it known that we, JAMES K. GRIFFIN, residing at the city of Brooklyn, in the county of Kings and State of New York, and EDWIN C. GRIFFIN, residing at West Newton, in the county of Middlesex and State of Massachusetts, both subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Pulverizing-Mills, of which
10 the following is a specification, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates, generally, to pulverizing-mills, and particularly to that class
15 thereof in which the reduction or pulverization of ores and other substances is accomplished by the revolution of rolls against the inner surfaces of rings or annular dies, and in which said rolls are held in contact with
20 said rings or annular dies by centrifugal force, when the mills are in operation; and it consists in the improvements in the construction and arrangement or combination of parts hereinafter disclosed in the description and
25 claims.

The objects of our invention are, first, the production of a mill in which ores or other substances, however hard and refractory, may be cheaply and rapidly crushed and pulverized or reduced to an almost impalpable powder; second, to suspend the roll shafts and rolls within the grinding chamber, and to effect the rotation of the rolls by the application of the power employed directly to the
35 roll-shafts, whereby the rolls will be caused to positively rotate against the annular die, around the inner surface of the same, and by their rotary momentum and centrifugal force, crush and pulverize the material between the
40 same and said die; third, to provide the driving and roll-shafts with suitable gearing, whereby the several radially-movable rolls, when used, may be positively rotated against the inner surface of the annular die; fourth,
45 to arrange the journal-boxes and connections of such of the operative parts as require lubrication outside of the pulverizing pan or chamber; fifth, to provide a novel arrangement of the feed hopper, the annular die and the connections for delivering the material
50 immediately in front of the rolls; sixth, to ef-

fect the movement of the material falling upon the bottom of the pan by a novel construction of lifting shoes, or inclines attached to the lower ends of the distributing chutes
55 and extending below the bottoms of the rolls; seventh, to provide the pan or pulverizing-chamber with a revoluble top or cover which is provided with feed-distributing chutes, sweeps or pickers and elevating shoes or inclines, said covers being attached to the revolving frame or center and carried around by the revolution of the roll-shafts and rolls; eighth, to provide said revoluble top or cover with wings or vanes on its upper surface,
65 around its periphery, for the purpose herein-after stated; ninth, to effect the agitation and elevation of the material falling upon the bottom of the pan or chamber, below the annular die, by means of stirrers on the lower ends
70 of the positively-revolved rolls; and, tenth, to provide an annular chamber surrounding the grinding-chamber, and separated therefrom by a screen through which the pulverized material is discharged into the annular chamber,
75 and from which it passes into a hopper or receptacle beneath the grinding chamber. These objects are accomplished by the mechanism illustrated in the accompanying drawings forming part of this specification, in
80 which the same reference numerals indicate the same parts, and in which—

Figure 1, represents a vertical section of our improved mill, the section being taken on the line $x-x$, of Fig. 2; Fig. 2, a plan view of
85 the same, parts being broken away to show other parts beneath; Fig. 3, a plan view of portions of the pan, annular die and discharge-hopper, showing the passages outside of and around said die through which the pulverized
90 material passes into the discharge hopper underneath; Fig. 4, a view of one of the trunnion-frames or supports carrying a roll, its shaft and the pinion for revolving the same, the stirrers being omitted; Figs. 5 and 6, a
95 bottom plan and side elevation, respectively, of a roll provided on its lower end or bottom with stirrers for agitating and elevating the material in the bottom of the pan or chamber; and Fig. 7, a central vertical section of
100 a mill showing a modification of one portion of our invention.

Referring to the drawings: the numeral 1, indicates the integrally-formed base and pan or chamber of the mill, within which the operation of pulverizing is carried on, and which is secured to a suitable support 2. This pan or chamber is formed double or provided with discharge passages 3, around the ring or annular die 4, which is suitably secured within said pan or chamber. A screen-frame 5, provided at its bottom with a horizontal flange 5', having openings registering with the passages 3, is secured on top of said annular die and pan or chamber. Around the lower portion of this screen-frame 5, is secured a cover or shell 6, for directing the material passing through the screens 7, into the passages 3, which lead down into the discharge hopper, 8. The feed-hopper 9, is secured to the pan or chamber 1, the spout thereof passing through the cover 6 and the lower part of the screen frame 5, and delivering the material upon the upper edge of the annular die 4. It will be seen that by this construction an annular chamber surrounding the grinding chamber is formed between the screen-frame and the cover or shell, and that the annular chamber is always in communication with the hopper or receptacle beneath the grinding-chamber, by means of the passages 3.

As shown in Figs. 1 and 2, three or more crushing or pulverizing rolls, 10, may be employed. They are attached to the shafts 11, which rotate in the journal-boxes 12, that are supported by the trunnions 13, which may be either an integral part of or attached to said journal-boxes. These trunnions are journaled in and supported upon the upwardly curved arms 14, of the frame 15, which is provided with a sleeve 16, which rests upon the central socketed boss 17, of the pan or chamber 1, and freely rotates around the drive-shaft 18. The roll-shafts 11, and rolls 10, are rotated by the pinions 19, which are securely fastened to the upper ends of said shafts, and which, in turn, are driven by the spur-wheel 20, which is attached to and operated by said drive-shaft 18, which is mounted in the step 21, and revolved by any suitable means. The bearings or journal-boxes 12, of the roll-shafts are arranged above and outside of the pulverizing pan or chamber and within the upper portion of the screen-frame, and hence are prevented from injury by flying dust particles. Their lubrication is accomplished by means of holes (not shown) formed in the centers of the upper-ends of the roll-shafts, or in any other suitable or well known manner.

To the lower ends or bottoms of the rolls 10, are attached the stirrers 10', which may be made of steel, chilled iron or other hard material. They are driven into or secured in suitable dovetailed grooves or flanges formed in or upon the bottoms of said rolls before the lower ends of the roll-shafts are secured therein. It may be desirable for starting the mill to press the rolls against the annular die by springs 29, (only one being shown) press-

ing outward against the journal-boxes 12, but, as soon as the rolls begin to rotate against the inner surface of said die, they will press against it by centrifugal force, which alone will be sufficient for all practical purposes.

To the sleeve 16, of the frame 15, is rigidly attached the revoluble cover 22, which is provided with the curved, rearwardly-inclined, feed-distributing chutes 23, to which are bolted or otherwise secured the feed pickers or sweeps 24, and the elevating shoes or inclines 25. Small vanes or wings 26, are attached to the upper surface of said revoluble cover at suitable points around its periphery. Immediately over these vanes or wings and on the inside of the screen-frame, is formed a ledge or flange, 26', which in connection with the revolving top or cover 22, acts to retard the passage of the air and dust from the interior of the mill. The vanes or wings 26, revolving beneath the flange or ledge 26', cause a light current of air to be forced into the mill, so as to effectually prevent the escape of dust through the space between said ledge or flange and the revolving cover 22. Radial slots 27, are formed in this cover to provide for the radial movement of the shafts 11, said slots being partly covered by the plates 28. The revolution of the drive-shaft 18, and the roll-shafts 11, and also of the rolls 10, against the annular die, will cause the frame 15, the revoluble cover and all of their attachments to be carried around with them.

If desired a hole or opening may be made in the central hub or boss 17, of the grinding pan or chamber 1, through which the air forced out through the screens 7, and into the passages 3, and discharge hopper 8, may be returned to said grinding chamber, instead of, passing out of the spout or discharge opening of said hopper.

The operation of this form of construction is as follows: The drive-shaft 18, and spur-wheel 20, being in operation, rotary motion is communicated therefrom through the pinions 19, to the shafts 11, and the rolls 10. The latter are positively revolved upon their own axes and press against the inner surface of the annular die 4, and also rotate around the central axis of the mill, being pressed against said die by centrifugal force and their freedom for radial movement. When the rolls are thus revolved upon their own axes, and around the axial center of the mill, they will carry with them the revoluble frame or center 15, and arms 14, to which are attached the journal-bearings 12, which are provided with trunnions 13. This revoluble frame or center carries with it the top or cover 22, which is provided with the curved, rearwardly inclined, feed distributing chutes 23, to which are attached the sweeps or pickers 24, and the distributing and elevating shoes or inclines 25. The material to be ground having been introduced through the feed-hopper 9, will rest upon the upper edge of the annular die 4, until it is removed therefrom by

the sweeps or pickers 25, which owing to the inclination or curve at which they are arranged, guide said material onto the curved front faces of the feed distributing chutes 23, which in turn deliver the same against the inner surface of said die, immediately in front of the advancing rolls 10, by which it is pulverized; then the material falls to the bottom of the pan and is taken up and thrown by the distributing and elevating shoes or inclines 25, against the screens 7, the portion thereof which is sufficiently fine passing through said screens into the annular chamber, and down through the passages 3, into the discharge-hopper 8. The material that does not pass through said screens falls back and is operated upon again. As the rolls 10, swing radially upon the trunnions 13, it is necessary to provide for a slight yield or looseness between the spur-wheel 20, and the pinions 19, on the upper ends of the shafts 11, but not enough to interfere with the proper working of the gearing.

To wet grind with this mill, it is only necessary to introduce the water required; then the grinding can be satisfactorily done, even if the revolving cover, feed-distributing chutes and elevating shoes be dispensed with, the employment of the stirrers 10' on the bottoms of the rolls serving to agitate and elevate the material and discharge the same through the screens.

In this mill, as is obvious, the movement of the suspended rolls above the bottom of the pan against the inner surface of the die, and around the central axis of the mill, is accomplished by giving a positive rotary motion to each individual roll, and not by drawing or shoving them around on spindles carried and driven by revolving centers or drivers. This peculiarity in the manner of suspending and driving our rolls against the inner surface of the die causes far less strain on the driving connections than any construction heretofore devised for a similar purpose, so far as we are aware, and it also accomplishes the pulverization of refractory substances in a most satisfactory manner; also the arrangement of the gearing the upper ends of the roll-shafts, the journal-boxes, and parts that require lubrication outside of the pan or chamber in which the work of pulverization is effected, renders said parts far more durable than when they are arranged within said chamber; also the revolution of radially movable rolls within and against the die by rotating each individual roll positively and separately, causes a great deal less strain upon the journal-boxes within which the roll-shafts rotate, than in that type of mill in which the power causing the rotary motion of the rolls against the inner surface of the die is conveyed through the medium of said journals when mounted upon a positively or directly revolved center or driver; also, in the present invention, instead of the journal-boxes forcing or pushing the shafts around, as formerly, said shafts

and rolls by means of their positive rotation upon their own axis, and the friction of the rolls against the inner surface of the die, carry around said journal-boxes, the revolvable frame or center and all parts connected thereto.

We have shown in Fig. 7, a modification of the construction hereinbefore described, which illustrates in its simplest form one feature of our invention, consisting of the annular chamber, formed between the screens 7, and the cover or shell 6, which is in communication with the hopper or receptacle beneath the grinding-chamber by means of passages 3. It will be observed that the flange or base of the screen frame does not in this case cover the passages 3, or extend over them; that there are no obstructions whatever within the grinding-chamber, and no portion of the mechanism excepting the roll-shaft and roll, which are suspended therein by means of a universal coupling, forming a connection between the roll-shaft 18, and a shaft 30, on which is mounted a pulley 31. The operation of the roll-shaft and roll, the pulverization of the material, its discharge through the screens 7, into the surrounding chamber, and its passage into the hopper or receptacle beneath, are all the same as with the construction hereinbefore described, the movement of the roll and the operation of the stirrers or plows on the bottom thereof, in discharging the material through the screens being essentially the same. The power to drive the roll-shaft and by which it is revolved and the roll carried around the annular die is applied to the pulley 31, and when first starting the shaft may be swung out by hand or otherwise until the roll comes in contact with the die; this, however, is not necessary as the centrifugal force of the revolving shaft and roll will bring the roll into contact with the die, when the pulley is revolved at the desired rate of speed.

Having thus fully described the construction, arrangement, and operation of the several parts of our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a pulverizing-mill, the combination of a chamber for the reception of the material to be pulverized, an annular die located therein, a roll or rolls positively rotated and adapted to travel around said die, a screen surrounding the pulverizing-chamber, a shell surrounding the screen so as to form an annular chamber between the screen and the shell, and a hopper below the pulverizing-chamber, and in communication with the chamber between the screen and the shell, substantially as shown and described.

2. In a pulverizing-mill, the combination of a chamber for the reception of the material to be pulverized, an annular die located therein, a suspended roll or rolls positively rotated and adapted to travel around said die, a screen surrounding the pulverizing-chamber, a shell surrounding the screen so as to form an annu-

lar chamber between the screen and the shell, and a hopper below the pulverizing-chamber, and in communication with the chamber, between the screen and the shell, substantially as shown and described.

3. In a pulverizing-chamber, the combination with a pan or chamber and an annular die, of one or more pulverizing-rolls, radially movable roll-shafts attached to and suspending said rolls on a line with the inner surface of said die, and above the bottom of said pan or chamber, and means for positively revolving said shafts and rolls upon their own axes, substantially as shown and described.

4. In a pulverizing-mill, the combination with a pan or chamber and an annular die, of a pulverizing-roll, a shaft attached to and suspending the same, said roll being provided with stirrers upon its bottom, and means for positively revolving said shaft and roll upon their own axis, substantially as shown and described.

5. In a pulverizing-mill, the combination with a pan or chamber and an annular die, of pulverizing rolls suspended and driven above the bottom of said pan or chamber, and provided with stirrers upon their bottoms, substantially as shown and described.

6. In a pulverizing-mill, the combination, with a pulverizing pan or chamber and an annular die, of radially movable shafts and rolls, a revoluble top or cover for said chamber, and means for positively revolving said shafts and rolls and carrying around said cover, substantially as shown and described.

7. In a pulverizing-mill, the combination, with a pulverizing pan or chamber and an annular die, of a revoluble top or cover provided with feed distributing chutes having sweeps or pickers arranged over the upper edge of said die, a stationary feed hopper, pulverizing-rolls, and means for positively revolving the same and said top or cover, substantially as shown and described.

8. In a pulverizing-mill, the combination with a pulverizing pan or chamber and an annular die, of a screen-frame, a revoluble top or cover provided with wings or vanes upon its upper surface, around its periphery, pulverizing-rolls, and means for revolving the same and said top or cover, substantially as shown and described.

9. In a pulverizing-mill, the combination with a pulverizing pan or chamber and an annular die, of a screen-frame provided with an inwardly-projecting ledge or flange, a revoluble top or cover arranged closely beneath

said ledge or flange, and provided with wings or vanes around its periphery, pulverizing-rolls, and means for positively revolving the same, and said top or cover, substantially as shown and described.

10. In a pulverizing-mill, the combination with a pan or chamber, a screen-frame, an annular die, and radially movable rolls, of a revoluble frame or center having elevating shoes or inclines, and means for positively revolving said rolls upon their own axis, and carrying around said center, substantially as shown and described.

11. In a pulverizing-mill, the combination with a pan or chamber, a screen-frame and an annular die, of radially movable rolls, a revoluble frame or center provided with a top or cover, feed-distributing chutes, feed sweeps or pickers and elevating shoes or inclines, and means for positively revolving said center, and also, the rolls upon their own axis, substantially as shown and described.

12. In a pulverizing-mill, the combination with a pulverizing pan or chamber, an annular die, a screen-frame and a revoluble top or cover, of rolls provided with shafts extending outside of said cover, and journal-boxes and gearing for said rolls also arranged outside of said cover, substantially as shown and described.

13. In a pulverizing-mill, the combination of the pan or chamber 1, the annular die 4, the radially-slotted revoluble top or cover 22, the radially movable rolls 10, provided with the shafts 11, having the journal-boxes 12, and pinions 19, arranged outside of said top or cover, and the drive-shaft 18, provided with the spur-wheel 20, substantially as shown and described.

14. In a pulverizing-mill, the combination of the pan or chamber 1, the annular die 4, the radially slotted revoluble top or cover 22, the radially-movable rolls 10, provided with the shafts 11, having the journal-boxes 12, and pinions 19, arranged outside of said top or cover, the revoluble frame or center 15, having the arms 14, and the drive-shaft 18, having the spur-wheel 20, substantially as shown and described.

Signed at the city and county of New York, in the State of New York, this 28th day of March, A. D. 1891.

JAMES K. GRIFFIN.
EDWIN C. GRIFFIN.

Witnesses:

J. P. GRIFFIN,
C. L. DAVIS.