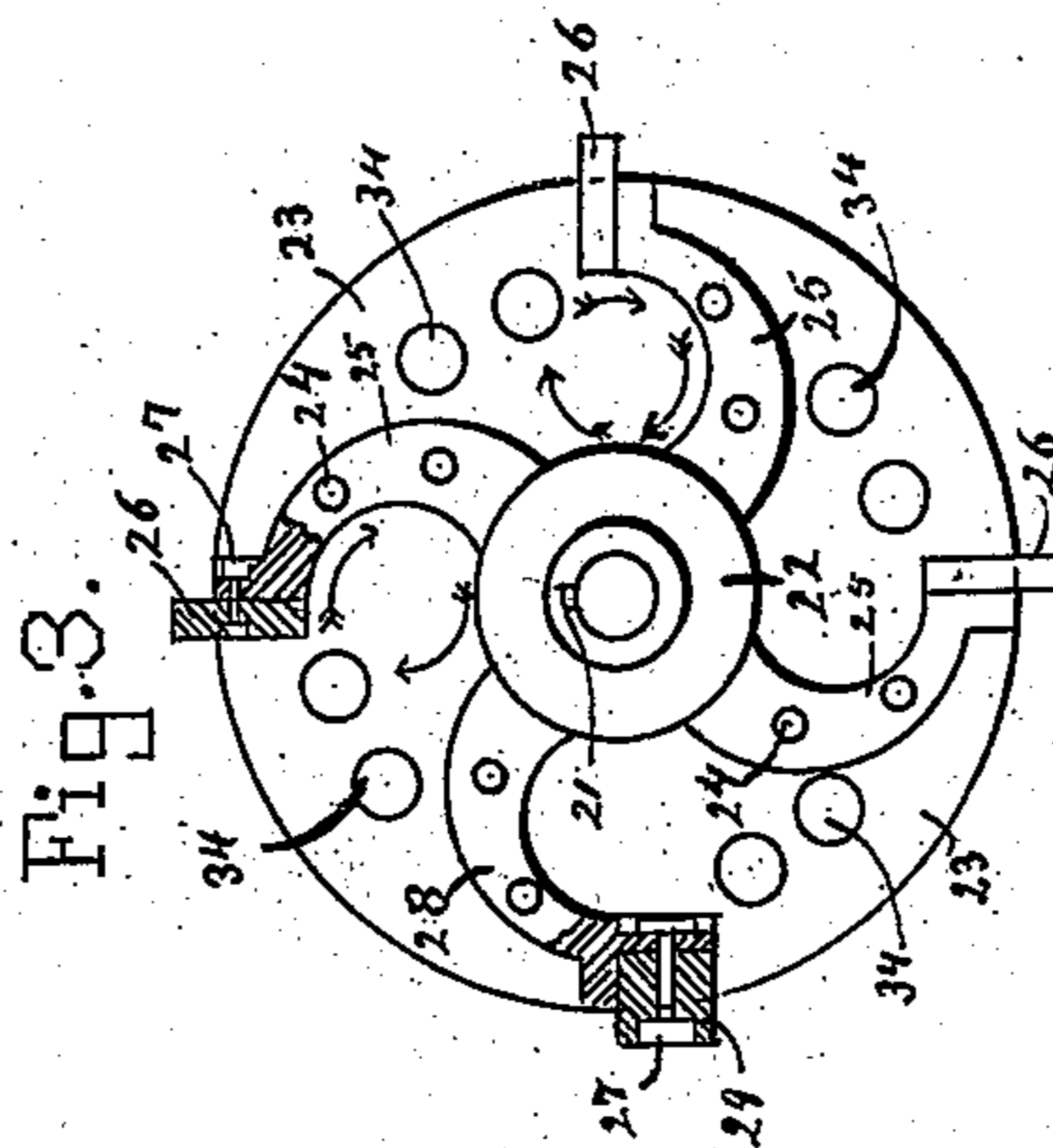
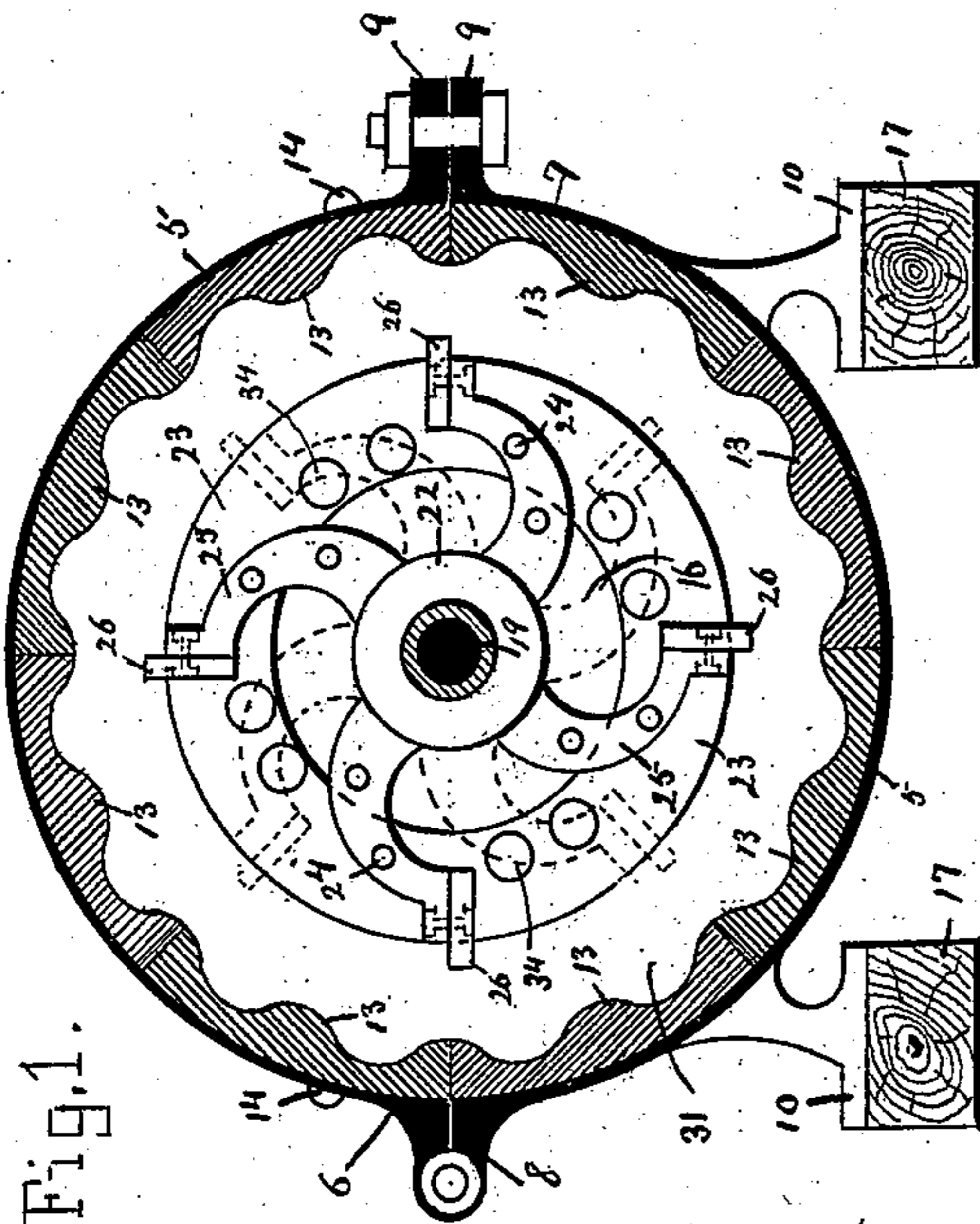
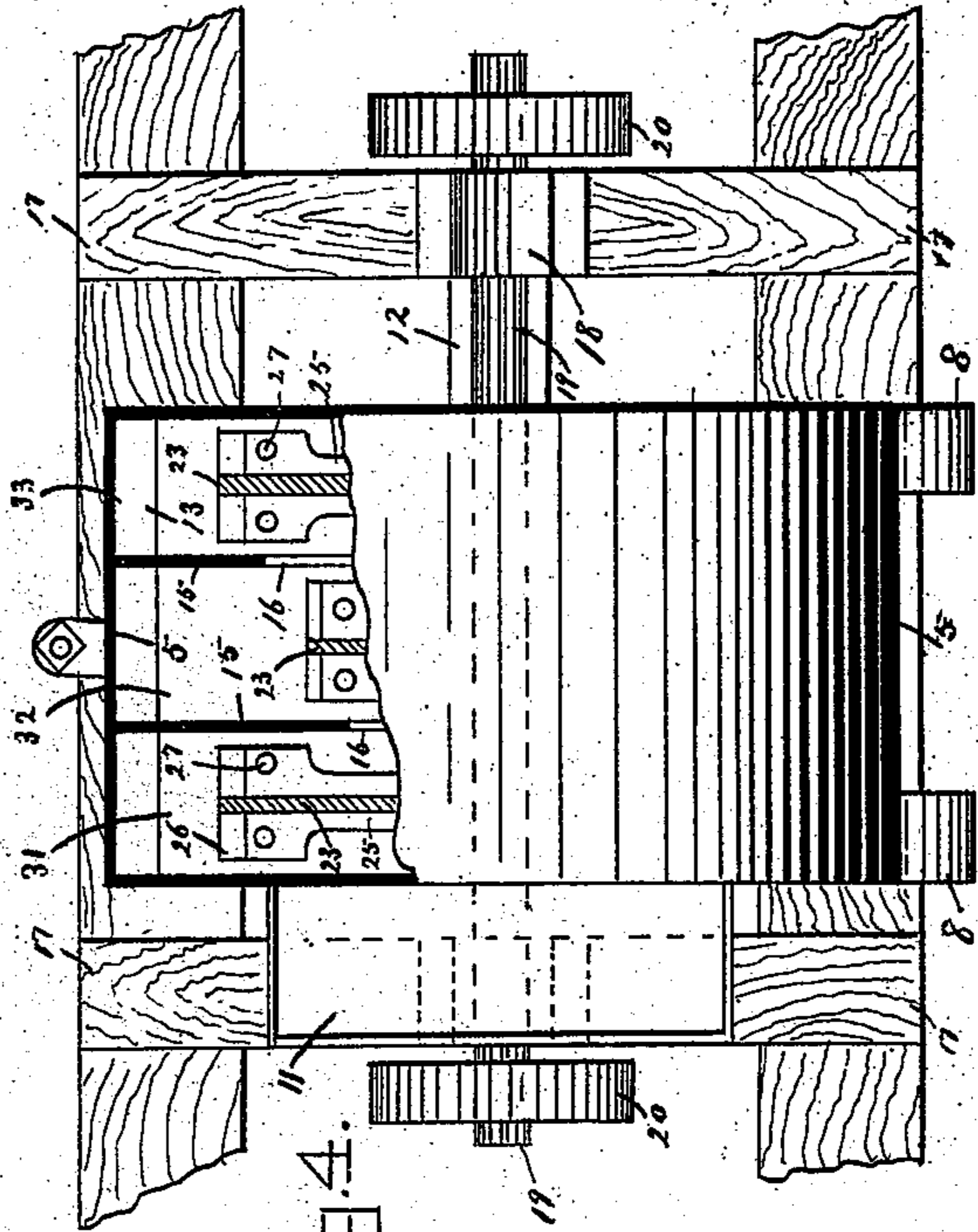
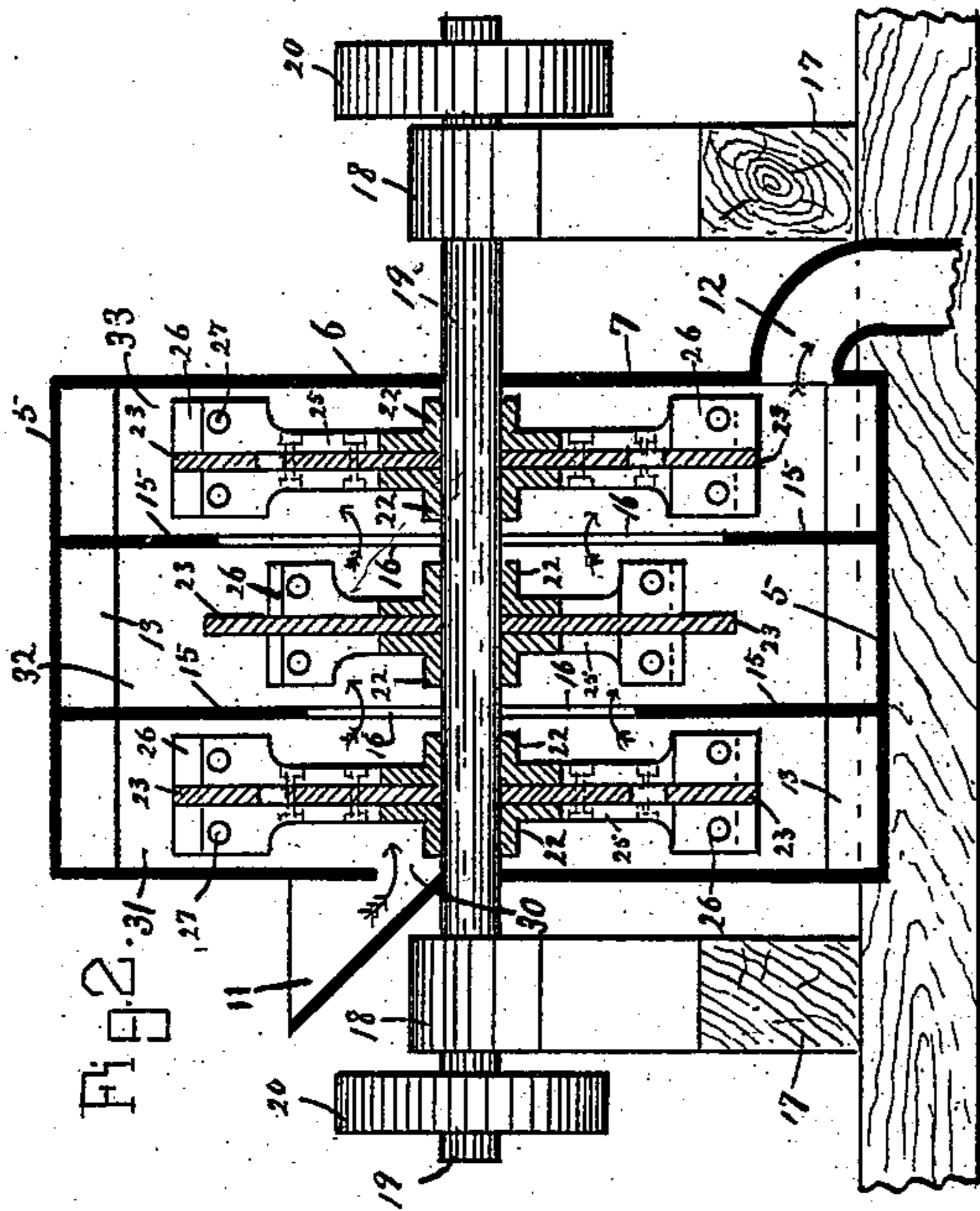


(No Model.)

H. H. EAMES.
ORE PULVERIZER.

No. 379,943.

Patented Mar. 27, 1888.



Witnesses:
Geo. W. Gastrow.
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UNITED STATES PATENT OFFICE.

HENRY H. EAMES, OF COLUMBIA, VIRGINIA, ASSIGNOR TO JOHN J. KELLY,
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ORE-PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 379,943, dated March 27, 1888.

Application filed June 7, 1887. Serial No. 240,561. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. EAMES, a citizen of the United States, residing at Columbia, in the county of Fluvanna and State of Virginia, have invented certain new and useful Improvements in Ore-Pulverizers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in machinery for pulverizing the various ores, and is of that class wherein centrifugal force is employed to produce the necessary abrasion and grinding; and it consists of a pulverizer with two or more compartments therein and specially-designed mechanism employed, whereby the ground particles are caused to pass from one compartment to the other, and in these other compartments subjected to additional abrasion and grinding, and, finally, those particles which have reached the necessary degree of pulverization are carried to the last compartment, from where they are discharged into the receptacle for the completed material.

In the further description of my invention reference is had to the accompanying drawings, in which—

Figure 1 is a cross-section in a plane at right angles to the line of the shaft through the middle of the central compartment, showing flanged hubs, disks, arms, and beaters in full. Fig. 2 is a longitudinal section through the device. Fig. 3 is a detail view of rotating disk and arms, partly in section, showing the manner of construction. Fig. 4 is a plan of the device, partly in section.

The same figures refer to the same or similar parts throughout the several views.

The figure 5 denotes the cylinder which forms the casing of the pulverizer, and is made in the two half-sections 6 and 7, which are held together on one side by the hinges 8, whereby the casing may be opened for access to the interior for necessary adjustment or repairs to the mechanism therein, the other side being

provided with the lugs 9, one on each half-section of the casing, for the purpose of securely clamping and locking the said two half-sections together, the lower half-section, 7, being provided with the feet or lugs 10 for properly securing the device to its foundation.

In Fig. 2 is represented the hopper 11, which is attached to the side of the upper half-section, 6, of the casing and communicates with the interior of the pulverizer for supplying the material thereto, the discharge-opening 12 being placed on the side of the lower half-section, 7, of the casing, opposite the hopper 11, through which the ground material passes when the operation of grinding is completed.

In order that the particles may be deflected at different angles when thrown out by centrifugal force against the inner surface of the cylinder 5, the said inner surface is lined with the corrugated segments 13, four of which are placed in the lower half-section, 7, and held therein by gravity, the four other segments being placed in the upper half-section, 6, and held therein by securing the lower segments to the casing by means of the bolts 14, the upper segments being supported thereupon by their arched form. To divide the pulverizer into compartments the annular division-plates 15 are provided, which are made in two halves in order that the casing 5 may be opened, and may be made integral with the casing 5, or be constructed of several pieces and held in position by the corrugated segments 13. These division-plates 15 are constructed each with the opening 16 therein, each of different size, in order that a free escape for the ground material will be permitted from one compartment to the other as the process of grinding approaches completion through the different compartments.

Resting upon the foundation-blocks 17 are the bearings 18, which support the shaft 19 at each end, this shaft passing longitudinally through the center of the casing 5 and being provided with the pulleys 20, which are driven in the usual manner by belting. Secured to the shaft 19 by means of a key, 21, each in their respective compartments, are the flanged hubs 22, which hold securely between the flanges thereof, by means of through-bolts,

the disk 23, which is constructed of steel and made in this form to insure the greatest strength, this disk 23 being provided with the perforations 34, in order that the finer particles of material may more readily pass from one side of the said disk to the other. Bolted to this disk 23 are the arms 25, which are placed opposite each other, one on each side of the disk, the bolts 24 passing through the three parts and being pocketed in the arms to prevent abrasion in the process of grinding, these arms 25 being of the curved form represented in Figs. 1 and 3, for the purpose of causing the finer particles to pass from one compartment to the other, in a manner which will be described in the description of operation. Secured to the ends of the arms 25, so that the faces thereof will receive the impact of the material to be ground, are the hammers or beaters 26, which are constructed of the hardest material and are held in position by the pocketed bolt 27. (Represented in Fig. 3.)

A modification is represented in Fig. 3, where one arm, 28, is made with the offset in the arm thereof, and whereto the square hammer 29 may be secured by means of a pocketed bolt, this modification possessing the advantage of being able to utilize the four sides of the hammer by turning as the surface becomes worn and exposing new surfaces for action.

The manner of operating is as follows: The pulley 20 having been thrown in gear and motion being given to the shaft, the rotating movement of the inclosed disk 23, arms 25, and hammers 26 will cause a current of air to pass through the pulverizer, entering through the hopper 11, and passing out at the opening 6 in a manner similar to that produced in rotating blowers. When sufficiently high speed has been attained, the ore, having been previously broken into lumps of convenient size, is continuously fed into the hopper 11 by means of some suitable feeding device, from whence it drops through the opening 30 into the first compartment, 31, of the pulverizer, when, in consequence of the rapid rotating movement therein, the lumps will be thrown by centrifugal force against the corrugated surface forming the lining of the casing 5, rebounding therefrom at an angle dependent upon that portion of the curvature of the corrugation upon which it strikes, the different angles formed by the said curvature of the corrugation causing the particles to rebound, or be deflected at varying angles one from the other, and meeting with the new particles of ore which have just entered the pulverizer, causing by this diverse movement more frequent impact and greater abrasive result therefrom than if the inner surface of the casing 5 were of smooth cylindrical surface and the particles rebounded in radial lines. The hammers 26, which are placed on the ends of the arms 25, and consequently have the greatest circumferential movement, serve to throw the particles

with greater force against the sides of the casing 5, and meeting them on their return produces additional abrasion; hence the hammers 26 are made of the hardest material, and the bolts for securing them need be protected in the manner illustrated.

As previously described, the arms 25, which are secured to the disk 23, one on either side of the disk, are made in the curved form represented in Figs. 1 and 3, the inner or concave surfaces of which in their rotating movement, in consequence of their curved form, cause a slight inward or centripetal movement of air in their vicinity, and those particles of ore which have been ground sufficiently fine as to possess insufficient weight to be counteracted upon by the centrifugal force, when brought within the influence of this inward-moving current, or in contact with the convex surfaces of the said arms 25, will be carried toward the center and within the influence of the current of air which is caused to pass through the apparatus by the rotating movement therein, and thus carried into the next compartment through the opening 16 of the division-plate 15, where those particles which possess sufficient weight and have escaped from the first compartment will be subjected to further abrasion by the centrifugal force therein until such degree of fineness is reached, when, in the manner described, they will be carried by the curved arms 25 into the succeeding compartment, from whence, if this be the last compartment, in which is the discharge-opening 12, they will be discharged into the receptacle for the completed material. For convenience of manufacture, the compartments are all constructed alike, with the curved arms 25. These curved arms, however, are not necessary in the last compartment, which may be in this last compartment constructed of the common radial form, the process of grinding being complete when this compartment is reached, and whose duty is to discharge the completed material into the receiving-vessel. The perforations 34 are provided in the disks 23, in order that some of the finer particles of ore may find escape thereby from one compartment to the other when brought within the current of air which is passing therethrough.

The division-plates 15 are constructed with the central openings, 16, therein, of different areas, the first being the smaller and increasing gradually in area, the last being the larger, whereby, as the process of grinding through the different departments progresses, the escape of the finer particles becomes easier, the larger opening being in the last compartment, thus confining the larger particles of ore to the first compartment until a certain degree of fineness is assured.

Having described my invention and the manner of operating, what I claim, and desire to secure by United States Letters Patent, is—

1. In a machine for pulverizing ore, the combination of the casing 5, the shaft 19, the disk 23, the flanged hubs 22, by which the said disk

is secured to the shaft, arms secured to the said disk, and beaters attached to the ends of said arms, for the purpose set forth.

5 2. In a machine for pulverizing ore, the combination of the casing 5, the shaft 19, the disk 23, the flanged hubs 22, by which said disk is secured to the shaft, the arms 25, constructed in a curved or bent form, the said arms placed on each side of said disk and secured thereto, 10 the beater 26, attached to the end of said curved arms, and the division-plates 15, with the opening 16 therein, for the purpose set forth.

3. In a machine for pulverizing ore, the combination of a casing, 5, the shaft 19, the disk 23, having perforations 34, the flanged hubs 22, the arms 25, and the beaters 26, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. EAMES.

Witnesses:

WM. T. BAILIE,
JNO. T. MADDOX.