J. C. TATMAN.

ORE GRINDING MACHINE.

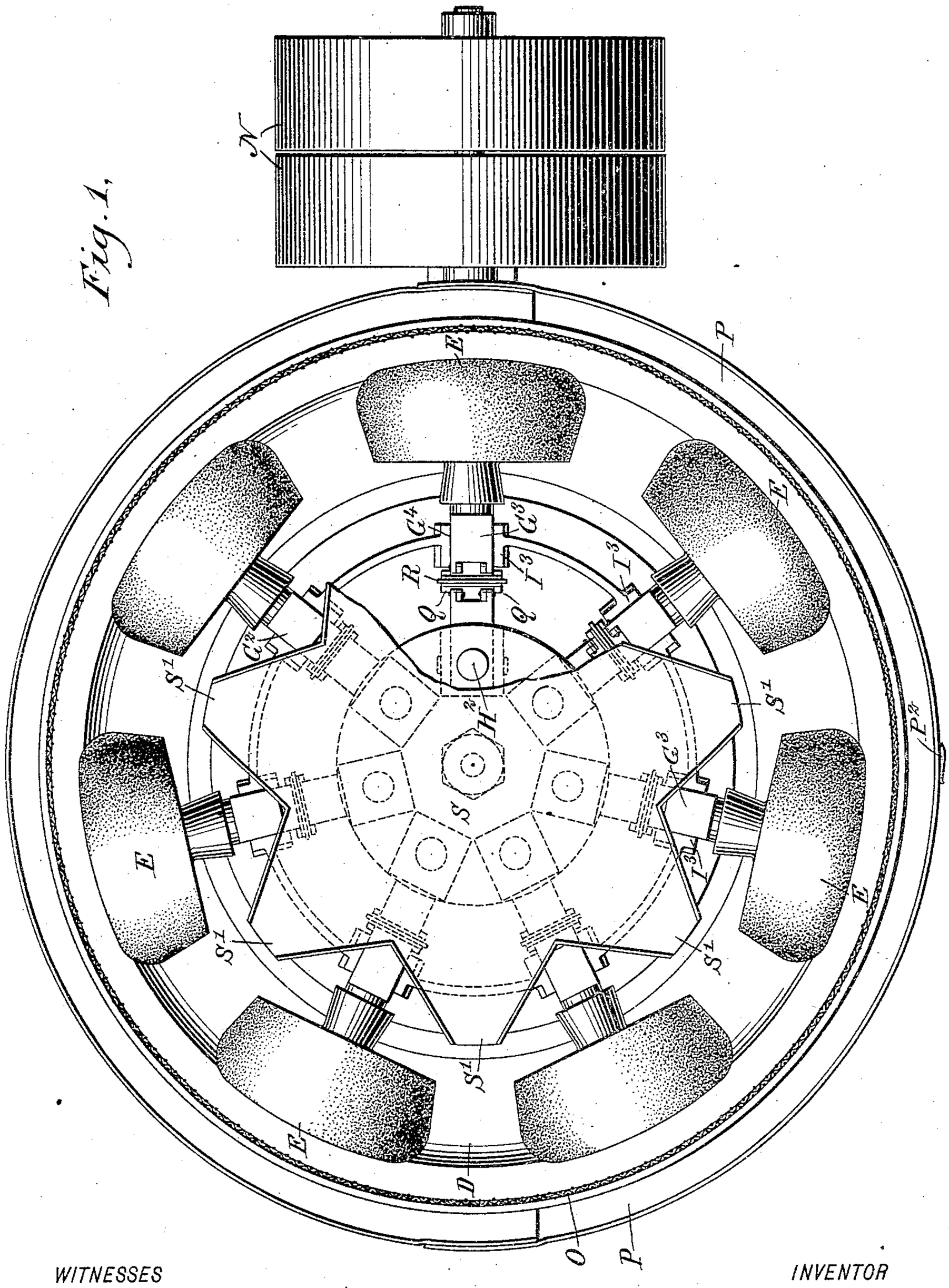
APPLICATION FILED JAN. 28, 1908.

943,486.

Patented Dec. 14, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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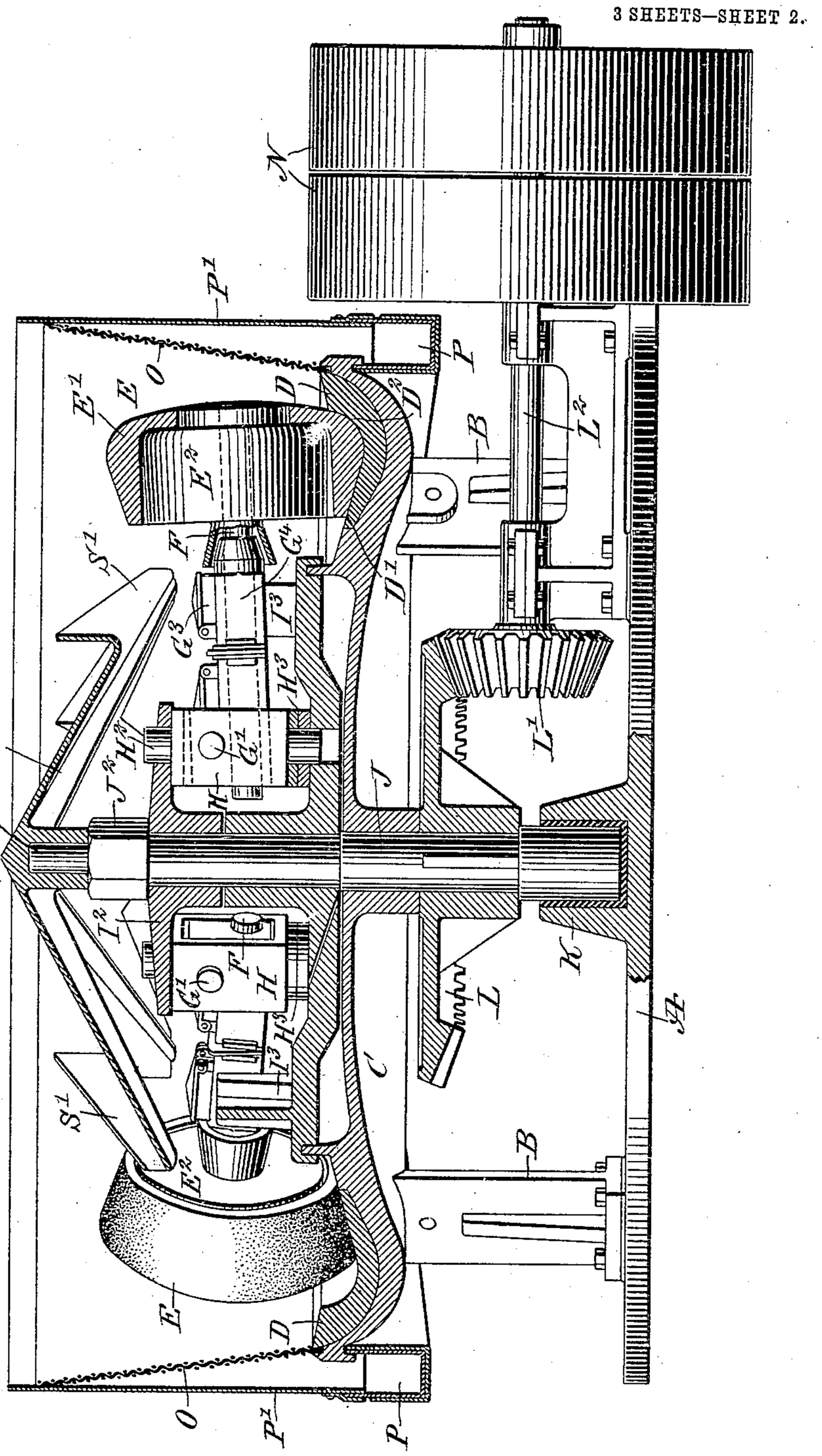
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3,

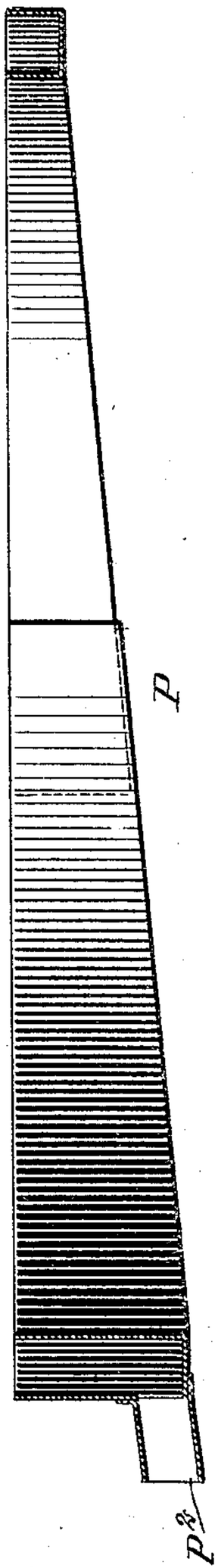


Fig. 5,

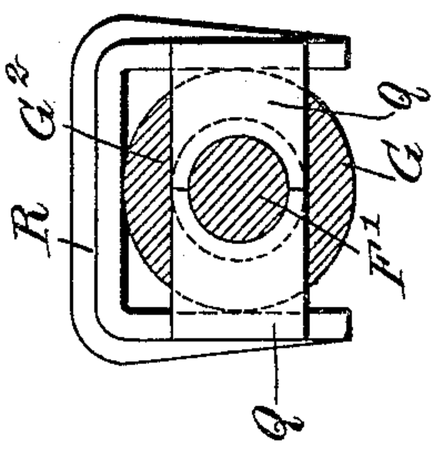


Fig. 6.

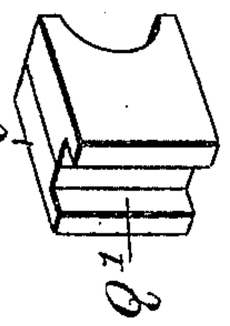
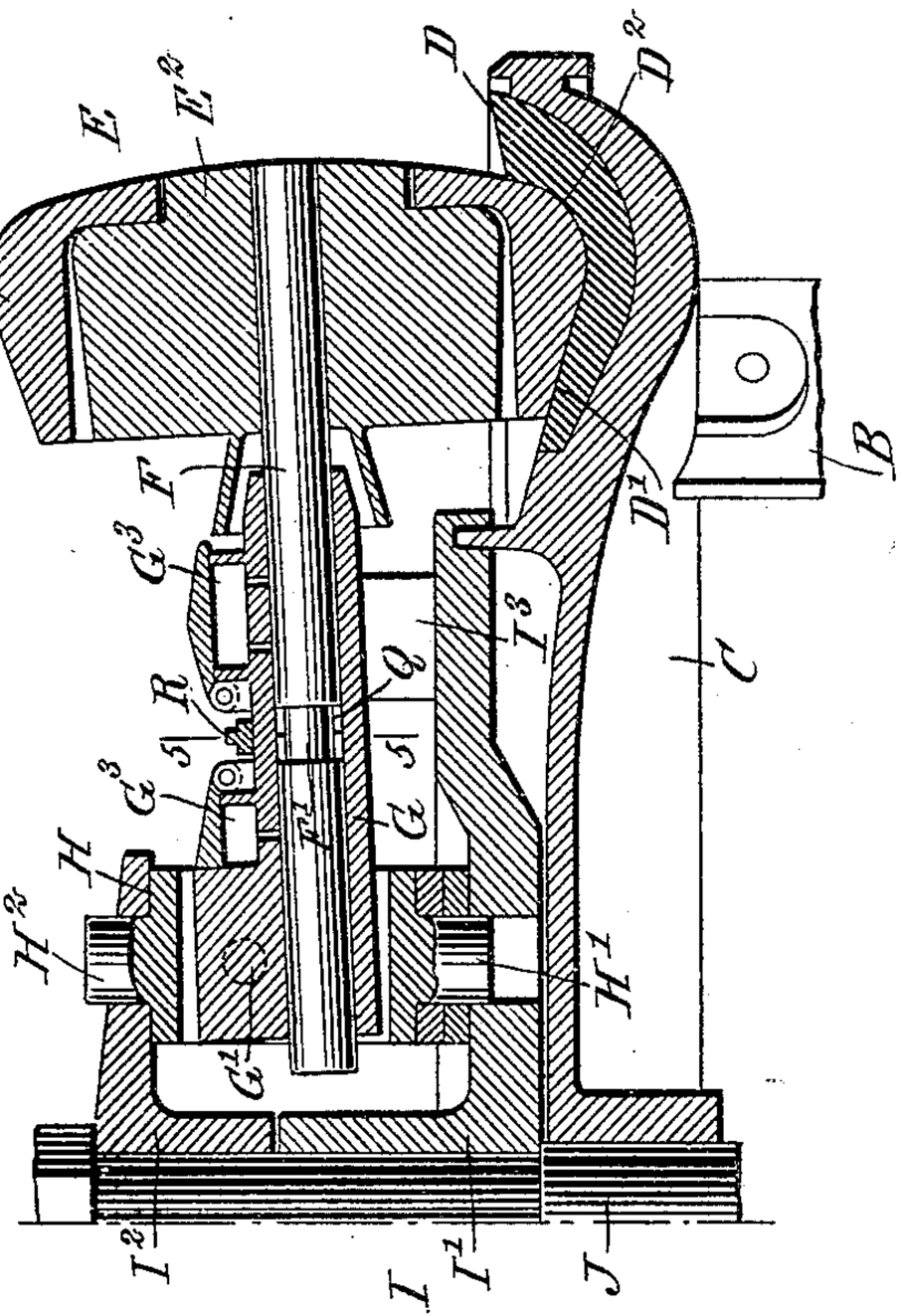


Fig. 4,



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UNITED STATES PATENT OFFICE.

JOHN COSGROVE TATMAN, OF DENVER, COLORADO.

ORE-GRINDING MACHINE.

943,486. Specification of Letters Patent. **Patented Dec. 14, 1909.**

Application filed January 28, 1908. Serial No. 412,964.

To all whom it may concern:

Be it known that I, JOHN COSGROVE TATMAN, a citizen of the United States, and a resident of Denver, in the county of Denver and State of Colorado, have invented a new and Improved Ore-Grinding Machine, of which the following is a full, clear, and exact description.

The invention relates to wet process grinding mills having a circular grinding channel in which travel revolving mullers, the ground material being thrown through a surrounding screen by the centrifugal force of the mullers.

The object of the invention is to provide a new and improved ore grinding machine of the class described, and arranged to provide a revolving velocity of the grinding wheels or mullers sufficiently high to take up and throw the wet ore particles at a tangent against the enveloping screen and to render the machine non-sliming.

The invention consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of the improvement, part of the cone feed being broken out; Fig. 2 is a sectional side elevation of the same; Fig. 3 is a transverse section of the annular discharge trough; Fig. 4 is an enlarged sectional side elevation of the improvement; Fig. 5 is a transverse section of the same on the line 5—5 of Fig. 4, and Fig. 6 is a perspective view of a pair of wearing blocks for the muller shaft.

On the base A of the machine are secured standards B supporting the bed C, provided in its outer portion with an annular die D, in which travel the revoluble grinding wheels or mullers E, having their shafts F extending inwardly and downwardly, the shafts being journaled in bearings G provided with transverse trunnions G′ journaled in blocks H having vertically-extending trunnions H′, H² journaled in the bottom and top sections I′ and I², of a revoluble carrier I, secured on the upper end of a shaft J journaled centrally in the bed C and having its lower end mounted in a step K carried by the base A. On the shaft J is secured a bevel gear wheel L in mesh with a pinion L′, secured on the inner end of a driving shaft L², journaled in suitable bearings arranged on the base A, and the outer end of the said shaft L² is provided with fast and loose pulleys N, connected by a belt with other machinery, for imparting a rotary motion to the shaft L². The rotary motion of the shaft L² is transmitted by the pinion L′ and the gear wheel L to the carrier shaft J, whereby the carrier I is caused to carry the shafts F around, thus causing the mullers E to travel around in the annular die D.

An annular screen O extends from the top outer portion of the die D in an upward and outward direction, and outside of the bed C is arranged and secured to the bed an annular trough P, having its outer wall P′ extended upward, to meet the upper end of the screen O. Thus when the machine is in use and the material is thrown against the screen and through the meshes thereof, as hereinafter more fully explained, then such material is deflected downward by the wall P′ into the trough P, which has its bottom inclined in opposite directions from one point, the lower portion leading to a chute P² for carrying the material to a suitable place of discharge.

The die D is provided on its upper surface with a channel having its inner portion D′ inclined outwardly and downwardly, and having its outer portion D² curved sharply upward and slightly outward, as plainly indicated in Figs. 2 and 4, and the tread E′ of each muller E is shaped correspondingly to the cross section of the said channel, as shown and described, the muller having its faces inclined to the vertical and its axis and that of its shaft F inclined inwardly and downwardly. Thus the peripheral face of the muller E is in the form of the frustum of a cone rounded off at the base, so that the outer or base end travels faster in the die D and thus throws the material up and under the whole extent of the muller tread, minimizes the end thrust and prevents twisting or producing undue friction at the bottom.

The tread E′ is secured to a body E², attached to the shaft F, and the latter is provided within each bearing G with a reduced portion F′ engaged by wearing blocks Q, extending through transverse slots G² formed in the bearing G, as plainly indi-

cated in Fig. 5, the said wearing blocks Q being provided at their outer ends with grooves Q′, engaged by the vertical members of a yoke R, straddling the bearing G. Thus by the arrangement described the shaft F is held by the wearing blocks Q against outward movement in the bearing G, and the said blocks can be conveniently removed when worn out, and replaced by new ones whenever necessary.

Each bearing G has flattened side portions G^4, fitting a vertical bearing I^3 formed on the lower section I′ of the carrier I, to allow the bearing up and down movement on the carrier I, it being understood that the inner end of the bearing is connected with the carrier I by a universal joint formed by the trunnion G′ and the trunnion block H. Each bearing G is also provided with the usual lubricating devices G^3, for lubricating the shaft F in the corresponding bearing, it being understood that by having the shaft inclined inwardly and downwardly, the lubricant travels in an inward direction on the shaft F, thus preventing the lubricant from passing to the material to be ground in the die D.

Material is supplied to the channel in the annular die D by a distributing cone S, held on the upper reduced end J′ of the shaft J, the cone resting on a nut J^2 screwing on the upper end of the shaft against the top section I^2 of the carrier I (see Fig. 2). The distributing cone S is provided near its lower end with chutes S′ delivering the material into the channel of the die D, between adjacent mullers E, as plainly indicated in Fig. 1, it being understood that the distributing cone S rotates with the shaft J and the carrier I employed for imparting a traveling motion to the mullers E.

The operation is as follows: When the main shaft L^2 is driven, the mullers E are caused to travel in the die D, and the material fed in a wet condition onto the apex of the distributing cone is delivered in uniformly divided quantities by the chutes S′ into the grinding channel of the die D. The shaft L^2 is driven at a high speed so that the mullers E are caused to revolve and travel with great velocity in the die D, thereby grinding the material contained therein, and, owing to the high velocity, the mullers E pick up and throw particles of the material at a tangent against the enveloping screen O. The coarse and fine particles of the wet material are picked up and thrown against the enveloping screen with such force and such quantity that whenever the particles are small enough they readily pass through the meshes of the screen and hence do not fall back into the channel of the die D, and are not subjected to a regrinding or sliming action. It will be noticed that if the particles are thrown against the screen with great force they readily pass through the screen and thus keep it clean at all times and with little danger of clogging it up.

By constructing the carrier I, the mullers E and the die D in the manner described, the machine can be run at a very high speed, especially as the close fit of the peculiar tread of the muller in the die channel, tends to minimize the end thrust of the muller and maintains a large and uniform amount of grinding or contact surface, with the least tendency of the muller to creep outward and produce uneven wear.

By the arrangement shown and described, long life of the machine is insured and the machine can be run at a very high rate of speed.

By tilting the muller inwardly from the vertical, a considerable portion of its weight is transferred to the trunnion support, hence in rapid circular travel of the muller this portion of the weight transferred to the trunnion support must be overcome by centrifugal force, before there is any tendency of the muller to tilt outwardly, and end thrust is overcome to that degree. The centrifugal force is also utilized to increase the pressure of the muller upon the material. When the machine is first supplied the mullers are lifted still farther into the inclined position by the material, and a still greater portion of the centrifugal force is utilized, and at the time when such additional force is needed the most. It will be evident that when the muller is tilted inwardly from the vertical there are then two points of support for the same, one being the ring die and the other the trunnions.

The trunnions H′, H^2, permit some swinging of the muller when the axle boxings become worn, and in case of breakage of said boxings the muller would be permitted to swing freely, thus preventing breakage to the remainder of the machine.

It will be observed from an inspection of Figs. 2 and 4, that the carrier plate is provided with an annular rib and the lower section of the die plate with a groove in which the rib travels. The rib and the groove act as a guideway and a support for the bed.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An ore grinding machine, comprising an annular grinding die whose upper surface has an abrupt outer slope and a gradual inner slope, mullers mounted to travel in and shaped to fit the die, said mullers having a radial shaft inclined downwardly, bearings for the shafts, a rotatable carrier, a universal joint connection between the carrier and the shaft bearings, and means for limiting the movement of the bearings with respect to the carrier in a horizontal direction.

2. An ore grinding mill, comprising a fixed die, having an annular channel appearing in cross section, inclined downwardly and outwardly and sharply curved upwardly at the outer portion, the upper end of the outer portion rising above the inner end, revoluble mullers mounted to travel in the said channel and having their peripheral surface of the shape of a frustum of a cone, rounded at its base and fitting the said die, the radial shafts of the mullers being inclined downwardly and inwardly, a central revoluble carrier for the inner ends of the said shafts, an annular screen upwardly and outwardly inclined from the top of the outer portion of the die, and an annular receiving trough outside the channel and having its outer wall rising to meet the upper end of the said screen.

3. An ore grinding machine, comprising an annular die, a muller adapted to travel in the said die, a shaft for the said muller, and having a reduced portion between its ends, a bearing for the shaft and provided with slots, and wearing blocks extending through the said slots and engaging the reduced shaft portion.

4. An ore grinding machine, comprising an annular die, a muller adapted to travel in the said die, a shaft for the said muller and having a reduced portion between its ends, a bearing for the shaft and provided with slots, wearing blocks extending through the said slots and engaging the reduced shaft portion, and a yoke straddling the bearing and engaging the outer ends of the said wearing blocks.

5. An ore grinding machine, comprising an annular die, a muller adapted to travel in the said die, a shaft for the said muller, a revoluble carrier, a block having vertical trunnions journaled in the said carrier, and a bearing for the said muller shaft and having transverse trunnions journaled in the said block.

6. An ore grinding machine, comprising an annular die, a muller adapted to travel in the said die, a shaft for the said muller, a revoluble carrier, a block having vertical trunnions journaled in the said carrier, a bearing for the said muller shaft, and having transverse trunnions journaled in the said block, and washers at the lower trunnion of the said block and interposed between the carrier and the block.

7. An ore grinding machine, comprising a bed, a die on the said bed, a muller adapted to travel in the said die, a carrier having its vertical shaft journaled centrally in the said bed, the carrier being made in top and bottom sections, of which the bottom section is provided with an annular groove engaging an annular ridge on the said bed, a block trunnioned in the said carrier section, and a bearing for the muller shaft and trunnioned in the said block.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN COSGROVE TATMAN.

Witnesses:
E. N. JENNISON,
JAMES A. JONES.