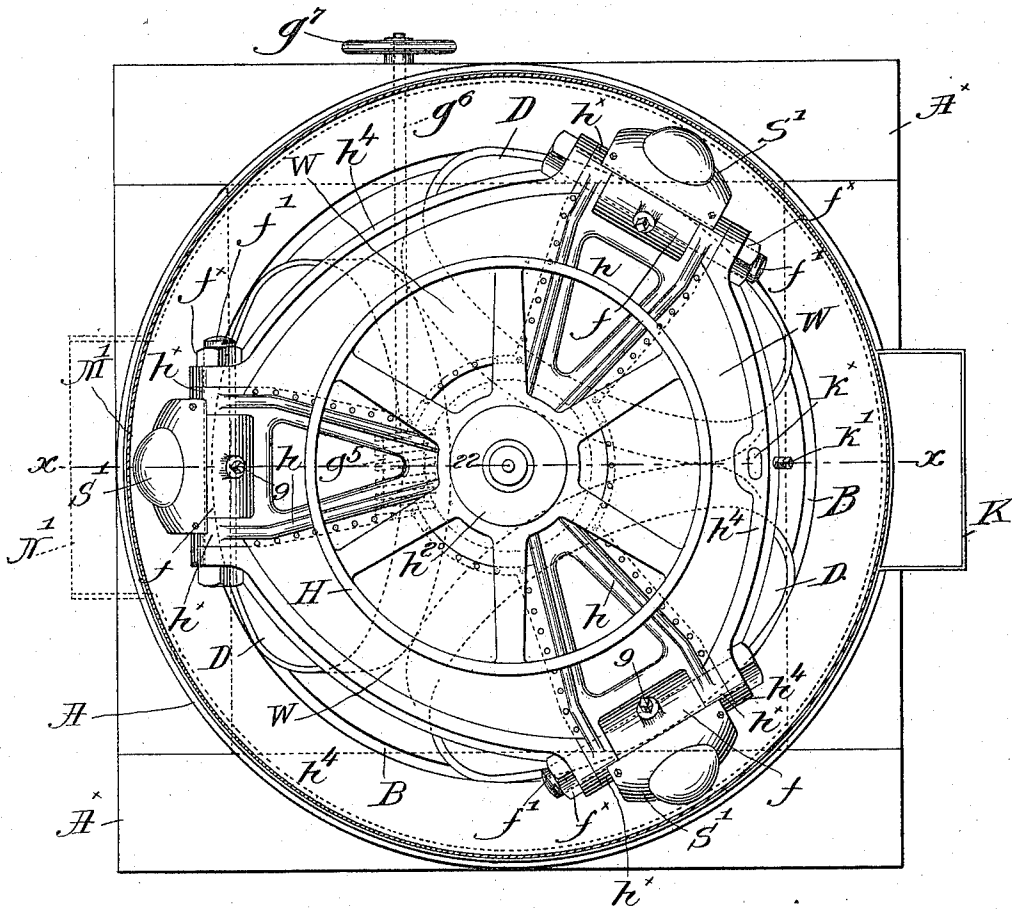


2 Sheets—Sheet 1.

No. 579,230.

Patented Mar. 23, 1897.

Fig:1.



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(No Model.)

2 Sheets—Sheet 2.

E. C. GRIFFIN.
CRUSHING OR PULVERIZING MILL.

No. 579,230.

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Fig. 2.

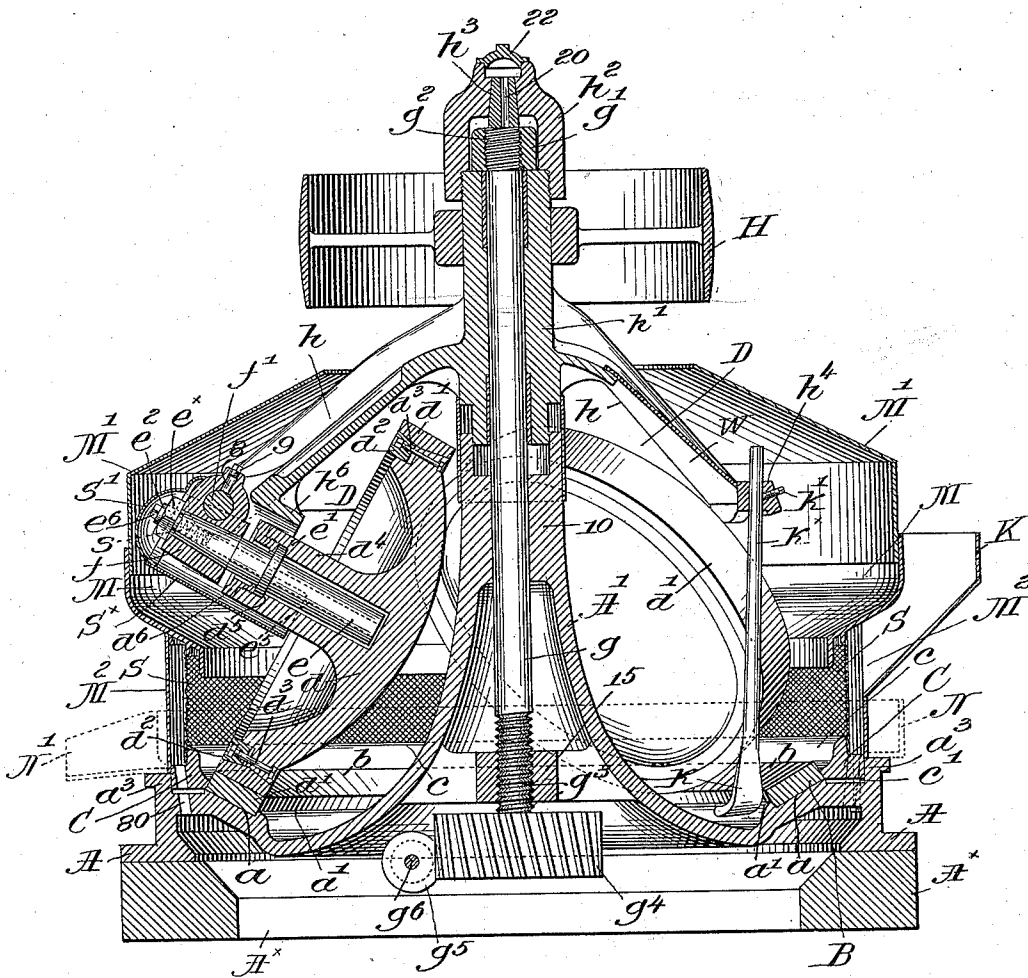
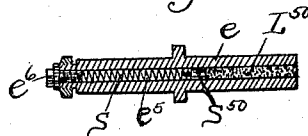


Fig. 3.



Witnesses.
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UNITED STATES PATENT OFFICE.

EDWIN C. GRIFFIN, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO THE
BRADLEY PULVERIZER COMPANY, OF MAINE.

CRUSHING OR PULVERIZING MILL.

SPECIFICATION forming part of Letters Patent No. 579,230, dated March 23, 1897.

Application filed September 25, 1895. Renewed February 19, 1897. Serial No. 624,199. (No model.)

To all whom it may concern:

Be it known that I, EDWIN C. GRIFFIN, a subject of the Queen of Great Britain, residing at West Newton, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Crushing or Pulverizing Mills, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to that class of crushing or pulverizing mills wherein the material is crushed by the impact of one or more rolls traveling upon an annular die or ring, the roll having an axial rotation as well as a rotation about the vertical axis of the ring or die. In some instances the crushing effect is due entirely to the weight of the roll, which travels over a substantially horizontal wearing-face of the die or ring, and in other instances the crushing is effected by the centrifugal force developed by rotation of the roll or rolls within the ring or die.

This invention has for its object the production of a crushing-mill wherein advantage is taken of the weight of the roll and also of the centrifugal force developed by its rotation, whereby the crushing effect due to the full weight of the roll or rolls is very materially increased by the centrifugal force developed thereby.

While it is preferable to use three rolls, as shown in the drawings, as thereby a better balancing and more even operation of the mill are attained, it will be obvious that I may employ more than three rolls, if desired, or I may use a less number, without departing from the spirit and scope of my invention.

Figure 1 is a top or plan view of a crushing or pulverizing mill embodying my invention, the greater portion of three rolls being shown in dotted lines, the upper part of the surrounding casing being omitted. Fig. 2 is a vertical sectional view thereof, taken on the line $x x$, Fig. 1; and Fig. 3 is a sectional detail showing the lubricating device for the roll-supporting spindle.

The circular pan or mortar A, having an upturned substantially conical center A', is secured in suitable manner to a base or foundation A^x, said pan or mortar having an annular inwardly-inclined face a , shouldered at

its inner lower circumference at a' to form a seat for the annular die or ring B, which may be either continuous or in section. Between the ring or die and the circular wall a^3 of the pan a continuous or sectional wedge portion C is inserted, upturned at c to form a curb and secured by suitable bolts c' to the pan, rigidly retaining the ring or die B in its place on the seat a .

The upper or wearing face b of the ring or die B is inclined inwardly and downwardly, as shown in Fig. 2, and forms a track for one or more crushing-rolls D, three such rolls being shown in Fig. 1.

As shown in Fig. 2, each roll is composed of a heavy substantially concavo-convex casting d , to the periphery of which a removable tire d' is secured by a retaining-ring d^2 and bolts d^3 , though the rolls may be made of a solid casting, if more convenient. The convex side of the central portion d of the roll is turned inward, and the roll as a whole is inclined toward the vertical axis of the ring or die, as clearly shown in Fig. 2, the form shown for the interior of the roll being adopted to bring the center of gravity thereof as near the center of the mill as possible.

It is obvious that the nearer the center of gravity of the roll is brought to the center of the mill and the lower down such center of gravity is located the greater will be the force required to hold the roll erect, and consequently the mill can be run at a higher speed than would be otherwise possible, and more of the centrifugal force can be utilized in grinding. This high speed is attained before there is any material pressure due to centrifugal force brought upon the roll-carrier, and up to this point all the centrifugal force can be utilized in crushing.

Each roll is provided with an outwardly-extended boss or hub d^4 to receive a shaft or spindle e , upon which the roll rotates, the shaft having a collar e' to rest on the internal shoulder d^5 in the hub, while a ring d^6 , shown in Fig. 2 as screwed to the hub outside of the collar, retains the roll in position on the shaft when the mill is at rest or running slowly.

The outer end of the shaft or spindle e is extended into and through a rocking head f and reduced and threaded at e^2 to receive a nut e^x , which holds the shaft firmly in the

head, and through the latter is passed a transverse trunnion-pin f' , having bearings h^x for its projecting ends in the bifurcated end of a radial arm h , oil-ducts 8 being provided, closed by suitable screw-plugs 9, Fig. 2.

The trunnion-pin f' is preferably at right angles to the shaft or spindle e , and in Fig. 1 is shown as headed at one end and threaded at the other to receive a retaining-nut f^x , and the roll, shaft, and head f can rock bodily on the trunnion-pin f' as a fulcrum.

The inclined position of the rolls toward the vertical axis of the mill renders them much more easily operated than would be the case if they were mounted on horizontal or vertical shafts, and the centrifugal force developed by the rotation of the rolls increases the pressure exerted upon the ring or die B, instead of being wasted in friction, as in the ordinary edge runner or Chilian mill.

Referring to Fig. 2, the central portion A' of the pan A has mounted therein, in a long bearing 10 and a threaded bearing 15, a vertical standard or post g , extended through a rotatable hub h' , provided with one or more radial arms h , to each of which a roll is pivotally connected or jointed, as has been described. At its lower end the hub h' is shouldered to engage the top of the bearing 10, and a stirrup h^2 , shown in Fig. 2 as screwed upon the upper end of the hub, has mounted therein a step h^3 , which rests upon the top of the post g and sustains the hub and its attached parts, forming an end bearing. To prevent the hub and its attached parts from rising, a collar g' is screwed upon the threaded end g^2 of the post g , and a lubricant may be admitted to the step-bearing by a suitable passage or duct 20 in the step h^3 , protected by a cap 22.

Forged iron bars or links h^4 are shown in Fig. 1 as interposed between the arms h and held in place by the trunnion-pins f' to give the necessary strength and rigidity to the revolving roll-carrier, comprising the hub h' and its roll-carrying arms h .

A sheet-iron web W is secured to the carrier-arms, inclosing the upper portion of the rolls and serving as a hood to prevent the material from being thrown out of the mill.

It is desirable to adjust on account of wear and to retain the rolls at about the same angle when in operation, so that they will track or travel in the same path on the die B, and herein I have accomplished this by raising or lowering the roll-carrier.

The post g is threaded at g^3 to engage the threaded bearing 15, and a worm-wheel g^4 is secured to the post in mesh with a worm g^5 on a shaft g^6 , provided with a suitable hand-wheel g^7 , Fig. 1. By turning the shaft g^6 the post g will be raised or lowered the required amount and the carrier will be thereby adjusted as desired.

I have shown one of the links or bars h^4 as provided with an opening to receive the shank k^x of a depending plow k , held in place by a suitable set-screw k' , the plow or stirrer act-

ing to throw the material up onto the die B as it rotates above the bottom of the pan A and within the die.

Obviously a plow or stirrer could be attached to each link or to any other part of the roll-carrier, or the plow or plows may be dispensed with altogether.

A perforated screen S surrounds the mill, extending upwardly from the curb c to the inclined casing M, which supports a suitable shield M' of any usual or suitable construction, and outside of and a short distance from the screen S an imperforate casing M² surrounds the mill.

A feed-chute K opens into the interior of the mill, the screen S and shield M² being brought up to the chute at each side and suitably secured. The material to be crushed is fed through the chute and falls upon the die B, around which it is distributed by the action of the rolls and by the plows, if used.

The roll-carrier is provided with a driving-pulley H, secured to the hub h' , to which rotation is communicated by a belt (not shown) from a suitable source of power, the carrier moving the rolls about the vertical axis of the mill while the rolls rotate on their own shafts or spindles e . The material is crushed upon the die by the weight of the rolls and also by the centrifugal force developed thereby, the jointed connections between the rolls and roll-carrier permitting the variation in inclination due to inequalities in the grinding-path.

The whole mass of material in the pan partakes of the rotary motion generated by the rolls and is thrown outwardly against the screen S, through which those particles sufficiently fine will pass, and if worked dry the screened material will pass through openings 80, Fig. 2, into a pit or receptacle below the mill, the shield M² preventing the escape of dust, &c.

If water is used, the pulverized material which passes through the screen S will be caught in the surrounding trough N (see dotted lines, Fig. 2) and led away through a suitable discharge-spout N'. In the latter case the shield M² is omitted and the openings 80 may or may not be closed, as desired.

Whether the wet or dry process be used the particles of material too coarse to pass through the screen S will fall back into the mill, to be again acted upon by the rolls.

The arms h are provided each with a flange or shed h^6 above and within the trunnions f' to protect the latter from water or dirt which might run down upon the inner side of the hood or web W.

In order to protect the head f and the parts adjacent thereto from flying material or water, it is surrounded by a curved shield S^x, extending around the sides of and beneath the head f and inclosing the outer end of the hub d^4 , while an end cap S' engages the outer end of the shield and rests its upper edge on the head, permitting the latter to rock freely, the shield S^x being attached to the arm h . If

the cap S' be removed, a current of air will be drawn in at the outer end or opening of the shield S^x.

It is necessary to lubricate the roll shafts or spindles *e*, and in Fig. 2 I have shown in dotted lines a convenient mode of supplying lubricant, the spindle *e* being bored throughout its length at *e*⁵, into which a solid lubricant in stick form is inserted, the lubricant being pressed toward the inner end of the spindle by a spring *s*. A screw-plug *e*⁶ in the outer end of the spindle maintains the spring in place, and as the lubricant melts little by little the expansion of the spring *s* continually urges it forward.

Other means for lubrication may be employed, if desired; but I have found that the means herein shown and described are very efficacious and avoid waste of lubricating material.

I claim—

1. In a crushing-mill, a rotatable carrier having a radial arm, a rocking head mounted therein, a spindle extended inwardly from the head, a curved shield extending around the sides of and beneath the head, a removable end cap mounted on the end of the shield, and inclosing the outer portion of the head, permitting the latter to rock, a roll on the spindle, and an annular die upon which the roll travels, substantially as described.

2. In a crushing-mill, a rotatable carrier, a rocking head mounted thereon, a spindle secured to the head and having a longitudinal bore to receive lubricant, means to force the lubricant toward the inner end of the spindle, and a roll mounted rotatably on the spindle, substantially as described.

3. In a crushing-mill, an annular die, one or more rolls adapted to rest and travel thereupon, and a rotatable carrier for the rolls having mounted fixedly thereupon a conical closed portion extending outside of the rolls and toward the ends of the axes thereof, to prevent scattering of the material during the operation of the mill, substantially as described.

4. In a crushing-mill, a rotatable carrier

having a radial arm, a spindle pivotally connected at its outer end with said arm, a roll rotatable on the spindle, an annular die upon which the roll travels, and a curved shield extending beneath the spindle between the roll and the arm and attached to the latter, the rotation of the carrier and the roll inducing a current of air through the shield, to keep the working parts free from dust, substantially as described.

5. In a crushing-mill, an annular die having an inwardly and downwardly inclined upper face, a roll inclined toward the center of the mill and adapted to rest and travel upon said face, and having its inner side convex to thereby bring the center of gravity of the roll low down and near the center of the mill, to relieve the strain upon the roll-support and increase the pressure upon the die, and means to support the roll and carry it around the die, substantially as described.

6. In a crushing or pulverizing mill, a rotatable carrier having a radial arm, a rocking head mounted in said arm, a spindle extended inward from the head, a protective shield for said head and spindle, and rigidly attached to the arm, the shield surrounding said head and spindle, a roll rotatable about the spindle, means to retain the roll thereon, and an annular die upon which the roll rests and is adapted to travel, substantially as described.

7. In a crushing-mill, an annular die having an inclined upper face, a roll adapted to rest and travel upon said face, the body portion of the roll being concavo-convex, the convex side being inward and inclined toward the center of the mill, to bring the center of gravity of the roll low down and near the center of the mill, and means to support the roll and carry it around the die, substantially as described.

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

EDWIN C. GRIFFIN.

Witnesses:

JOHN C. EDWARDS,
AUGUSTA E. DEAN.