Sept. 4, 1928. 1,683,304

E. T. ROEBKE

PULVERIZING MACHINE

Filed March 12, 1927

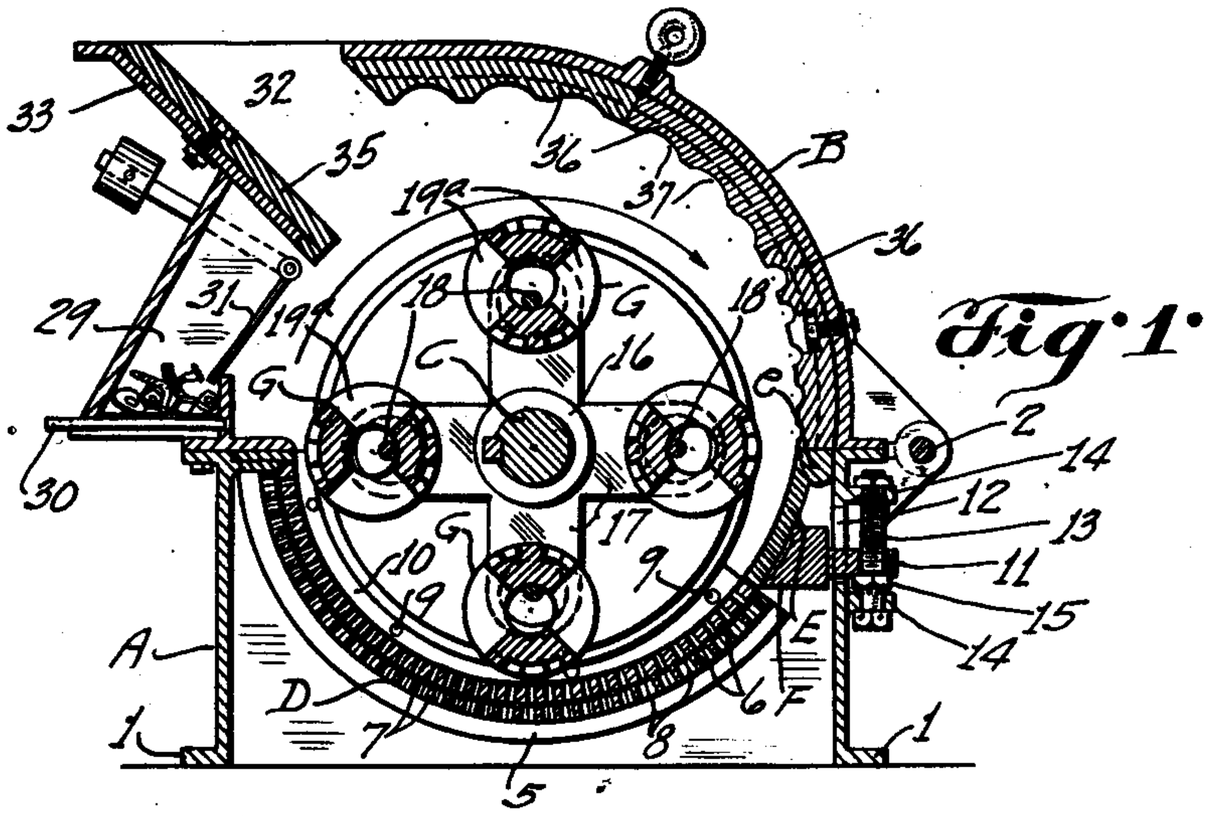

Fig. 1.

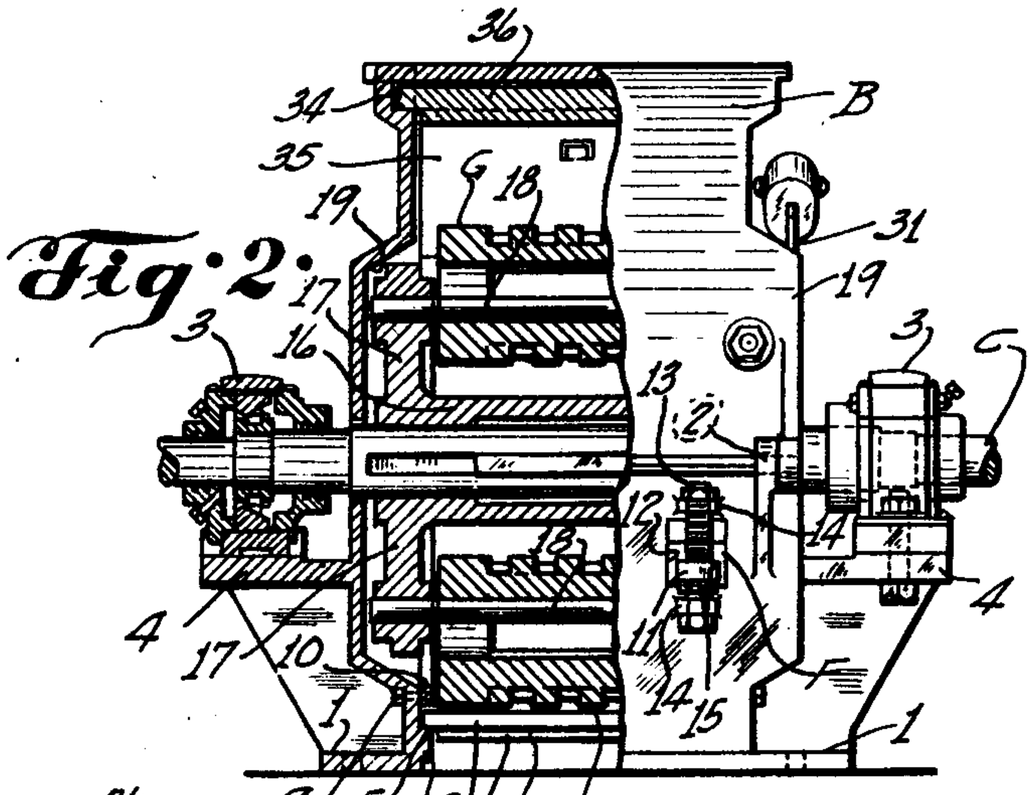

Fig. 2.

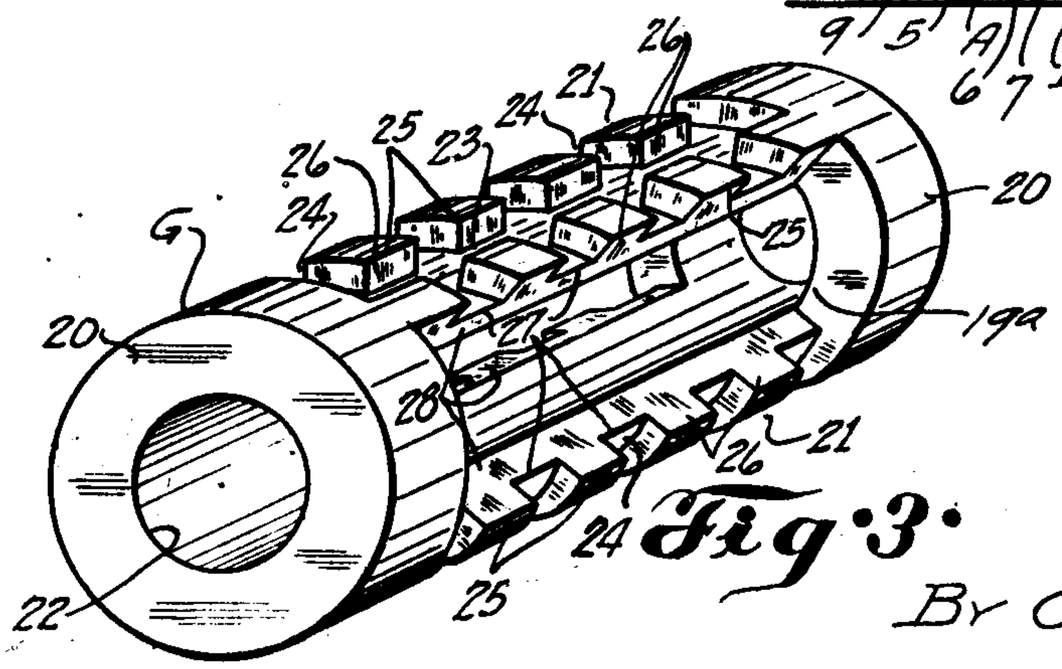

Fig. 3.

INVENTOR
Ernest T. Roebke.
BY Raymond Irwin
ATTORNEY

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UNITED STATES PATENT OFFICE.

ERNEST T. ROEBKE, OF ST. LOUIS, MISSOURI, ASSIGNOR TO AMERICAN PULVERIZER COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

PULVERIZING MACHINE.

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This invention relates generally to pulverizing machines. More particularly, my invention relates to a certain new and useful improvement in machines especially adapted for reducing material by pulverizing, grinding, crushing, and the like.

My invention has for its chief object the provision in a machine of the class stated of so-called hammer means comprising a series of hammers of cylindrical bar-ring form each both rotatable with, and at the same time axially rotatable and laterally shiftable relatively to, their carrier, each hammer being also of sufficient weight and, through body-interruption, cutting-away, and notching, equipped with a plurality of material-engaging faces and edges for efficient and rapid co-operation with the grinding concave or concaves of the machine.

My invention has for a further object the improvement generally of machines of the class stated, and with such objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts hereinafter described and pointed out in the claims.

In the accompanying drawing,

Figure 1 is a transverse sectional view of a pulverizing machine equipped with bar-ring hammers of my invention;

Figure 2 is a view, partly in elevation and partly in longitudinal section, of the machine; and

Figure 3 is a perspective view of one of the bar-ring hammers.

Referring now more in detail and by reference characters to the drawing, which illustrates a preferred embodiment of my invention, the machine proper preferably includes a base A adapted to rest, as a 1, 1, upon a floor, foundation, or other place of support. Pivotally fastened, as at 2, to base A for relative hinged or swinging movement, is a complementing or upper casing-section B.

C designates the main shaft of the machine, which is disposed longitudinally between the casing members A and B and is journaled for rotation on boxes 3 preferably adjustably arranged on brackets 4 projecting outwardly of, and preferably integral with or otherwise rigidly fixed to, the base A.

The side walls of base A are formed with opposed inwardly presented flanges 5 concentric with shaft C, and seated on flanges 5, is a grinding surface or grate D comprising a series of bars 6 having depending tongues 7 and retained in suitably spaced relation as by lugs or blocks 8 preferably formed integrally on the bars 6. Bolted, as at 9, or otherwise detachably secured to the base side walls over the ends of the series of bars 6, are arcuate-members or strips 10 for removably retaining the bars 6 upon their seat. Forming a continuation of the grate D and suitably pivotally mounted, as at *e*, on base A, as seen in Figures 1 and 2, is a grinding-plate or concave E adapted for swingable adjustment by means of a wedge-member F having a tongue or lug 11 fitting for movement in a slot 12 of the casing A and engaged by a bolt 13 having, in turn, engagement with spaced lugs 14, 14, on the base A and carrying a nut 15.

Mounted on and keyed to the shaft C, is a carrier comprising a suitably elongated hub 16, and integral with, or otherwise rigidly fixed to, the ends of the hub 16 and disposed for rotation in opposed recesses 19 formed in the opposite side walls of the casing-sections A and B, as best seen in Figure 2, are end-spiders 17, 17, connected together adjacent the free ends of the several arms thereof by an annular series of longitudinally disposed rods 18. Disposed on the respective rods 18, are bar ring hammers G, each of which is generally of cylindrical or tubular form and preferably of a length to extend from one end-spider 17 to the other, as seen in Figure 2, and each of which intermediate its ends is longitudinally interrupted or cut away upon diametrically opposite sides, as at 19^a, 19^a, whereby each bar-ring G includes end annuli 20 connected integrally together by preferably diametrically opposite and correspondingly annularly or circumferentially spaced arc-

uate bar-portions 21, 21, whose outer peripheral surface coincides with or is disposed in the circumferential plane of the annuli 20. In turn, the bar-ring G has a longitudinal bore 22 considerably greater in diameter than the diameter of the respective rods 18, whereby the several hammers G are not only rotatable about the casing with the shaft C, but also and at the same time are each independently both axially rotatable about and laterally shiftable or yieldable relatively to its respective supporting axis or rod 18 for efficient grinding, crushing, and pulverizing co-operation with the concaves E and D; and to increase the material cutting, breaking, and crushing efficiency of the several hammers G, the arcuate bar-portions 21 thereof are formed or provided by circumferentially spaced longitudinal surface grooves 23 and longitudinally spaced circumferential surface grooves 24 with circumferential series of preferably staggered cutting-edges 25 and hammer-faces 26, such cutting-edges 25 and hammer-faces 26, as well as also the edges 27 and side-faces 28 of the bar-portions 21, functioning in the operations of the machine and in co-operation with the concaves D and E as material cutting or shredding and breaking and crushing surfaces, while the remaining peripheral surfaces of the bar-portions 21 and the peripheral surfaces of the annuli 20 function more directly as grinding or pulverizing surfaces for the so broken, crushed, or shredded material.

Provided in the upper casing-section B and disposed preferably to one side of the shaft C and its associated barring hammers, G, is a suitable feed-opening, as at 32, one or the lower wall 33 of which is disposed obliquely inwardly and downwardly toward the hammers G and, as best seen in Figure 1, is preferably flatwise equipped with a renewable wear-plate 35, and provided in the casing-section B adjacent and under the feed-opening wall 33, for purposes short ly appearing, is a chamber or receptacle 29 normally closed at its lower end by a slide-door 30, the chamber 29 being also separated from the interior of the hammer-casing by means of a gravity-closed counterweighted door 31.

Preferably also the arcuate wall of casing-section B, is provided on its inner face with opposed ways or grooves, as at 34, to slidably receive one or more impact-plates 36, 36, formed longitudinally with a series of transverse corrugations or depressions, as at 37, for material breaking and crushing co-operation with the hammers G, the depressions or corrugations 37 preferably progressively decreasing in depth and width from the region of the feed-opening 32 to the lower end of the plate 36, which end, as best seen in Figure 1, is preferably concentrically disposed immediately above the upper end of the concave E in approximately the plane of the axis of rotation of the main shaft C.

In use and operation, the shaft C and consequently also the several hammers G are caused to revolve at the desired speed by any convenient driving means, not shown. The material to be crushed, pulverized, or otherwise acted upon is introduced into the machine through the feed-opening 32 and is delivered to the more or less rapidly revolving hammers G over the wear-plate 34. The several hammers G then function in co-operation with the concaves D and E and the plate or plates 36 to break up and reduce the material, in such action the various faces and edges of the several bar-rings G efficiently increasing the action of the hammers, as I have before described. In such crushing, breaking, or other such operations, any tramp iron or foreign unbreakable material will be automatically thrown by the several hammers G into the receptacle 29, the gravity-door 31 yielding under the impact of the thrown material, and from such receptacle such tramp iron or other foreign material may be readily removed through the opening normally closed by the slide 30. It will also be evident that, by actuation of the nut 15, the concave E may be pivotally shifted or adjusted relatively to the hammers G as may be desired in the particular operations being carried on.

My new machine as a whole, and especially the bar-ring hammers G, which are preferably integrally cast or otherwise constructed and are of proper and sufficient weight, in co-operation with the grinding concaves, are exceedingly efficient in the performance of their intended functions. The hammers G may be readily manufactured and are conveniently renewably mounted upon the spiders 17 and rods 18, and it will be evident that, by reversing the position of the hammers G upon the rods 18, the opposed cutting-edges 25, 27, and faces 26, 28 of the arcuate ring-bars 21 may be interchangeably utilized and the usable life of the bar-ring hammer G correspondingly prolonged or lengthened. Preferably and as shown, the point of jointure of the base-section A and upper section B coincides approximately with the center or axial line of shaft C, so that, should repair or replacement of the shaft C or any of its associate parts disposed within the casing become necessary, convenient access is afforded by a mere swinging back of the upper casing-section B.

I am aware that changes in the form, construction, arrangement, and combination of the several parts of my new machine may be made and substituted for those herein

shown and described without departing from the nature and principle of my invention.

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

1. In a machine of the class stated, in combination with a casing, an arcuate grinding surface within the casing, and a carrier mounted for rotation within the casing, of an annular series of cylindrical hammers supported by the carrier and rotatable both with and axially relatively to the carrier for co-operation with the grinding surface, each of said hammers including spaced annuli and arcuate circumferentially spaced bars disposed between and connecting the annuli and having their outer peripheral surface in the circumferential plane of the annuli.

2. In a machine of the class stated, in combination with a casing, an arcuate grinding surface within the casing, and a carrier mounted for rotation within the casing, of an annular series of cylindrical hammers supported by the carrier and rotatable both with and axially relatively to the carrier for co-operation with the grinding surface, each of said hammers including spaced annuli and arcuate circumferentially spaced bars disposed between and connecting the annuli, said bars having their outer peripheral surface in the circumferential plane of the annuli and each having a material-cutting edge and a radially disposed material-engaging face.

3. In a machine of the class stated, in combination with a casing and an arcuate grinding surface within the casing, of a carrier mounted for rotation within the casing and including an elongated hub, end spiders on the hub, and rods disposed longitudinally of the hub and having engagement at their ends with the arms of the spider, and cylindrical hammers loosely disposed axially on said rods and rotatable with the rods and also axially rotatable and bodily movable inwardly and outwardly relatively to said rods, each of said hammers having spaced annuli whose internal diameter is greater than the diameter of said rods, and arcuate circumferentially spaced bars disposed between and connecting the annuli, each of said bars having a plurality of material-cutting edges and a plurality of radially disposed material-engaging faces.

4. In a machine of the class stated, a casing, an annular series of hammers mounted for rotation within the casing, an arcuate grinding-plate pivotally supported at its upper end for adjustable co-operation with the hammers, and means for adjustably shifting said plate relatively to the hammers, said means including a wedge-member, lugs on the casing and on the wedge-member, a threaded bolt having engagement with the lugs of the casing, and a nut on the bolt having engagement with the wedge-member.

5. In a machine of the class stated, a tubular hammer including a plurality of parallel connected annularly spaced bars, each having a side face and an arcuate outer face, each said side face being radially disposed to each said outer face for material engagement and its outer extremity providing a peripherally disposed material-cutting edge.

6. In a machine of the class stated, a tubular hammer including a plurality of parallel connected annularly spaced bars each having opposite side faces and an arcuate outer face, said side faces being radially disposed to said outer faces for material engagement and their opposite outer extremities providing peripherally disposed material-cutting edges.

7. In a machine of the class stated, a tubular hammer including end annuli and a plurality of annularly spaced bars connecting the annuli, said bars having arcuate outer and inner faces and disposed with their outer faces in the circumferential plane of the annuli.

8. In a machine of the class stated, a tubular hammer including end annuli and a plurality of annularly spaced bars connecting the annuli, said bars having arcuate outer and inner faces and disposed with their outer faces in the circumferential plane of the annuli, the side walls of said bars connecting their said outer and inner faces providing radially disposed material-engaging faces and peripherally disposed material-cutting edges.

9. In a machine of the class stated, a tubular hammer including end annuli and a plurality of annularly spaced bars connecting the annuli, said bars having arcuate outer and inner faces and disposed with their outer faces in the circumferential plane of the annuli, each of said bars being upon its outer surface longitudinally and circumferentially grooved and thereby provided with a plurality of material-cutting edges and radially presented material-engaging faces.

10. In a machine of the class described, a tubular hammer including end annuli and a pair of diametrically opposite bars connecting the annuli, said bars having arcuate outer and inner faces and disposed with their outer faces in the peripheral plane of the annuli, each of said bars being upon its outer surface longitudinally and circumferentially grooved and thereby provided with a plurality of staggered material-cutting edges and staggered radially disposed material-engaging faces.

11. In a machine of the class stated, a reversible tubular hammer integrally includ-

ing end annuli and a pair of diametrically opposite bars connecting the annuli, said bars having arcuate outer and inner faces and disposed with their outer faces in the peripheral plane of the annuli, each of said bars being upon its outer surface longitudinally and circumferentially grooved and thereby provided with a plurality of staggered and opposed material-cutting edges and staggered and opposed radially presented material-engaging faces.

In testimony whereof, I have signed my name to this specification.

ERNEST T. ROEBKE.