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T. R. GOTH.

CRUSHING AND PULVERIZING MACHINERY.

(Application filed May 31, 1899.)

(No Model.)

Fig. 1.

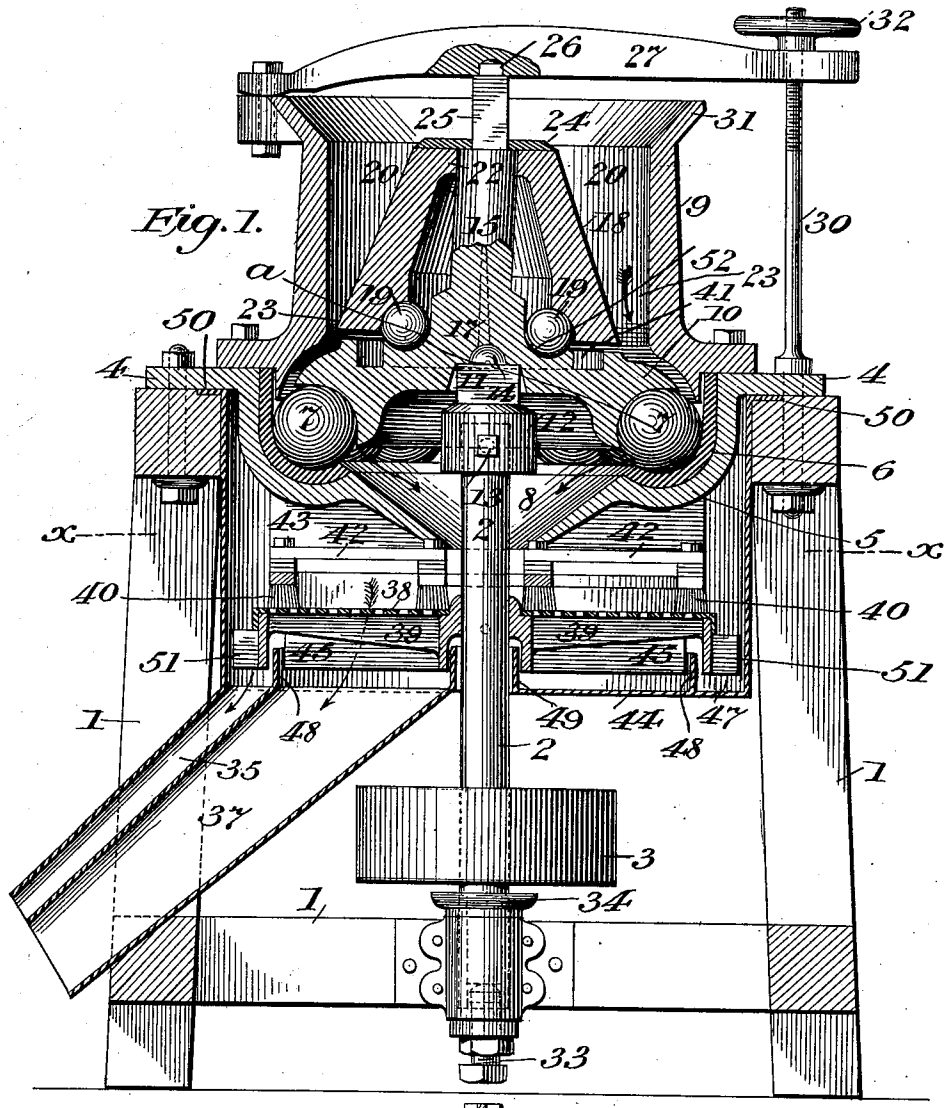
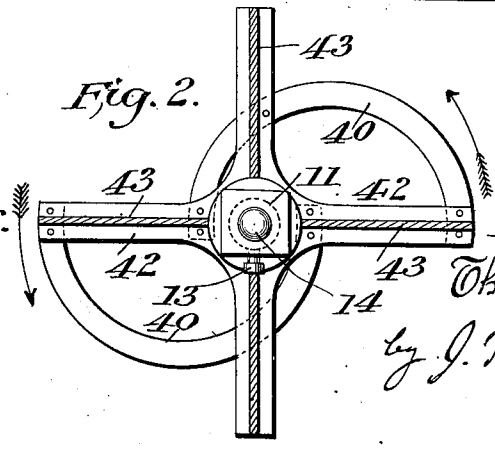


Fig. 2.



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UNITED STATES PATENT OFFICE.

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CRUSHING AND PULVERIZING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 657,933, dated September 18, 1900.

Application filed May 31, 1899. Serial No. 718,860. (No model.)

To all whom it may concern:

Be it known that I, THOMAS R. GOTH, a citizen of Canada, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Crushing and Pulverizing Machinery; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to machines for crushing and pulverizing mineral substances and to certain improvements therein.

My improvements consist in the combination of gyratory crushing devices combined with pulverizing apparatus having various novel features in the manner of their operation and construction, hereinafter fully pointed out and explained in connection with drawings that form a part of this specification.

The objects of my invention are to combine within small space sufficient pulverizing apparatus that will operate over the whole range from roughly-broken minerals to a finely-comminuted state of the same; also, to screen the same and select for further treatment such particles as are not reduced to the required degree of fineness; also, to so arrange the crushing and pulverizing parts that the force on these will react one upon the other and be absorbed without falling upon the driving-shafts or axial members of the machine.

To these ends I construct pulverizing-machines as illustrated in the drawings herewith, forming a part of this specification.

Figure I represents in sectional elevation a crushing and pulverizing machine made according to my invention; and Fig. II, a section, except as to the driving-shaft, through the main member or base of the machine on the line $x\ x$ in Fig. I.

Similar numerals of reference indicate corresponding parts in both figures of the drawings.

Referring to the drawings, 1 is the main frame, which can be constructed of metal or wood, the latter being chosen for the purpose, of illustration.

2 is the main driving shaft or spindle, shown with a pulley 3 to receive a band direct, a construction suitable for the smaller class of machines. In machines of larger size the power can be communicated by a horizontal shaft and bevel-gearing in the usual manner of driving machinery of this type.

4 is a main member constituting a base for the machine proper and is mounted on the top of the frame 1 high enough to permit the finished material to descend by gravity through chutes 35 37 to a place of storage or use. Integrally formed with this base or main chamber 4 is a concave seat or circular groove 5 for the pulverizing-balls 7, preferably provided with a removable lining 6, made of suitable material to resist as much as possible the abrasive wear. From this seat or groove 5 and integral therewith is a hopper-like extension 8, that collects and discharges the pulverized material around the shaft 2 at the center.

Superimposed on the member 4 and bolted thereto is a crushing cylinder or concave 9, made preferably with a parallel bore or so the muller 18 can be lifted out through the top when the lever 27 is removed. The top 31 of this cylinder 9 is made flaring in hopper form to receive the material to be crushed, as will be hereinafter explained.

The revoluble or operating member 10 is impelled by a squared extension 11 of a driving device 12, attached to the shaft 2 by a screw 13 or in any other suitable manner. At the top of the driver 12 is a spherical pivot 14, that sustains in part the weight of the member 10 and holds the parts in alinement. This member is provided at the top with an inclined and eccentric raceway 52 to receive the balls 19, which operate the muller 18, and on the bottom with a raceway of larger diameter to receive the pulverizing-balls 7, the relative position of these raceways producing the force to operate the muller 18 by a wedging action exerted on the line a. The thrust of balls 7 is conveyed to the muller on the line a and as nearly as possible to coincide with or balance the lateral crushing force on the muller 18; but in case this thrust is not balanced the muller 18 is given a short bearing at 22 on the stem 15, the latter being shown at an angle to coincide with this bearing at 22. The member 10 is in effect a cir-

cular wedge moving on balls between the crushing and pulverizing faces. It bears upon the pulverizing-balls 7 and is made with a strong stem 15, which is shown oblique to the axis of rotation, as indicated by dotted lines at 17. Around the base of this stem 15 is a circular concave inclined and eccentric raceway-seat 52 to receive a row of bearing-balls 19, that support the muller 18 and imparts to it the main crushing force, which, as may be seen, is reactive from and translated in a nearly-direct line to the opposite pulverizing-balls 7. The trough 52, as before explained, is eccentric to the axis of rotation and the plane of its base is slightly inclined to a horizontal. The muller 18 is conical in form, and being loosely mounted on the bearing-balls 19 it is evident that as soon as material passes into the crushing-space 20 it becomes wedged between the muller 18 and cylinder 9, and the muller 18 will not revolve with the stem and balls, but will be forced outward and upward at the bottom, according as it receives thrust from the balls 7 and 19, owing to the eccentricity and inclination of the raceway 52, this eccentric and upward and oblique motion crushing the material in the annular space 20 fine enough to pass down through the throat at 23 to the pulverizing-balls 7. This throat is shown exaggerated in size in Fig. I to more clearly illustrate the eccentricity of the muller 18. The crushing strain of the muller 18 and of the balls 19 are thus in opposite directions, reactive, and inherent in the machine, relieving the shaft 2 and stem 15 from lateral strain. At the top of the stem 15 is a plate or washer 24 to prevent grit from entering the top bearing 22 of the muller 18. A reduced extension 25 of the stem 15 extends upward to receive the lever 27. This lever is to exert pressure on the top of the stem 15 and through this and the member 10 to regulate the pulverizing pressure on the balls 7. Adjustable pressure is exerted on this lever by means of the hand-wheel 32 and screw 30. In this manner the balls 7 are pressed into their seat or upon the material by the weight of the member 10 and its connected parts by the lever 27, also by the oblique crushing strain upon the muller 18, the member 10 being, however, free to rise within limits from the pivot 14 and have an upward or oscillatory movement to accommodate the varying size of the material operated upon by the balls 7. To keep the spherical pivot 14 in contact and maintain alinement of the parts, a thrust-screw 33 is provided to raise the step 34 and the shaft 2, which is supported therein. The same means can be employed to oppose the action of the screw 30 and the pulverizing-balls be then set clear of their seat to do coarse work should that be required. The material after being pulverized by the balls 7 descends by the hopper 8 and falls on a revolving screen 38, attached to a frame 39, fastened to the shaft 2, and is moved outward on this screen by centrifugal force and by the action of the curved brushes 40, that are set eccentrically, as shown in Fig. II. These brushes are fastened to the ledges 42, cast on the ribs 43, extending downward from the main member 4, and by their rubbing action force the fine material through screen 38, from where it falls into the pan 44 and is swept into the chute 37 by the vanes 45, cast on the bottom of the revolving frame 40. Coarse material that will not pass through the screen 38 is swept over the periphery of the screen 38 and falls into the channel 47, around the pan 44, formed by the rim 48, and is swept into the chute 35 by the vanes 51 and is collected to be again passed through the machine. The circular pan 44 has a central nipple 49 to prevent fine material from escaping around the shaft 2 and is made to surround the operating parts of the machine up to the top of the frame 1, where it is held by a flange 50, as shown in Fig. I.

The eccentricity and inclination of the raceway 52 and the lateral range of the muller 18 are in different machines adapted to the material operated upon and the fineness required. The groove or channel 41 in the top of the member 10 is to catch any oil that may drain down from the bearings of the muller 18 and prevent the oil from passing with the material to the pulverizing apparatus below.

I do not confine myself to the precise construction shown. In various parts of the machine modified mechanism can be substituted—as, for example, cones or a sliding bearing can be substituted for the balls 19, and other details are susceptible of modification without departing from the essential features of my invention.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a combined crushing and pulverizing machine, a superimposed crushing-muller and a cylinder or casing therefor, a train of balls to operate the muller rolling in a revoluble inclined raceway set eccentric to the axis of revolution and inclined to the plane of its orbit to produce a gyratory movement of the muller and apply an oblique force thereto, substantially as specified.

2. In a combined crushing and pulverizing machine, the revoluble member 10 having on its top an inclined and eccentric raceway for a series of bearing-balls and a gyratory muller mounted thereon, a larger guide or way on the bottom to receive a train of pulverizing-balls that oppose their pressure obliquely to the upper train of balls and to the gyratory muller, substantially as specified.

3. In a combined crushing and pulverizing machine, a non-revoluble muller resting upon and actuated by a series of balls, a revoluble raceway for these balls set eccentric to a shaft by which the raceway is driven and at an inclination from a horizontal plane and means to revolve the raceway, substantially as shown and specified.

4. In a combined crushing and pulverizing machine, a superimposed gyratory muller supported on and actuated by rolling balls, mounted in a revoluble member having an inclined and eccentric raceway on the top and a concentric groove or guide for pulverizing-balls on the bottom, these race or guide ways of different radius to give the upper and lower balls an oblique position in the line of pressure and in respect to the axis of revolution, the two sets of balls therein opposing each other and exerting an oblique force on the gyrating muller, as specified.

5. The revoluble member 10 having an inclined and eccentric raceway on its top for the balls 19, a concentric way or groove on its bottom to receive the pulverizing-balls 7, the stem 15 and adjustable means for applying pressure on this stem and thereby to the pulverizing-balls 7, substantially as specified.

6. In a combined crushing and pulverizing machine a ball pulverizing apparatus, a superimposed crushing apparatus, a rotative bearing member resting on the pulverizing-balls provided with an upward-projecting stem set eccentric at the base and oblique to the axis of rotation, a tapering muller mounted on the stem resting on a ball-bearing at its base and an embracing crushing-cylinder around the muller so disposed and made that the muller can pass out of the top of the cylinder substantially as specified.

7. In a combined crushing and pulverizing machine, the revoluble member 10 pivotally supported on a main driving-shaft and provided with an inclined and eccentric raceway on its top, a series of balls therein, a superimposed muller resting on these balls and deriving an angular or upward and lateral thrust therefrom, substantially as specified.

8. In a combined crushing and pulverizing machine, a frame, a vertical driving shaft or spindle, a circular concave seat, with balls therein, heavy member 10, centrally mounted on the spindle, inclined stem 15, conical gyratory muller 18, with ball-supports, and surrounding cylinder 9, having flaring mouth 31, substantially as specified.

9. The combination of vertically-adjustable driving-shaft 2, concave seat 5, balls 7, heavy member 10, inclined stem 15, conical muller 18, cylinder 9, lever 27, and means to apply pressure through said lever to the pulverizing-balls 7, substantially as specified.

10. In a combined crushing and pulverizing machine, an eccentric non-revoluble crushing-muller, an eccentric and inclined revolving raceway and guide with rolling balls to actuate the muller, a hopper below the pulverizing parts to discharge centrally around the driving-shaft, and a revoluble screen in combination therewith attached to the driving-shaft below the pulverizing apparatus, substantially in the manner shown and described.

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