UNITED STATES PATENT OFFICE.

CYRUS C. PRATT, OF PORTLAND, OREGON.
COMBINED ORE CRUSHER AND PULVERIZER.

934,694.
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To all whom it may concern:

Be it known that I, CYRUS C. PRATT, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Combined Ore Crushers and Pulverizers, of which the following is a specification.

The invention relates to an improvement in ore crushers and pulverizers wherein the material is reduced to the desired degree of fineness by the minimum of expenditure of power and labor.

The main object of the present invention is the provision of a crusher and pulverizer in which the material is fed to the machine as required, the parts being adjustable to permit control of the degree of pulverization.

The invention will first be described in connection with the accompanying drawings, the particularly novel features of the construction being pointed out in the appended claims.

In the drawings, Figure 1 is an elevation, partly in section, of a crusher and pulverizer constructed in accordance with my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a plan of the same. Fig. 4 is a vertical section of the armor cylinder. Fig. 5 is a vertical section of the cone. Fig. 6 is a plan of the same. Fig. 7 is a detail view illustrating the means for adjusting the cone relative to the armor cylinder.

Referring particularly to the drawings, my improved crusher and pulverizer comprises a frame 1 including standards 2 and cross braces or collar timbers 3. The frame is preferably square in cross section, and the collar timbers are arranged in spaced parallel relation between the standards, thereby providing upper and lower sets of collar timbers. Mounted upon each set of collar timbers is a collar 4, which includes a horizontally-disposed flange to overlie and bear upon the upper surfaces of the timbers, as at 5, bolts 6 serving to secure the collars in place. The collars are formed with depending flanges 7 resting against the relatively inner surface of the collar timbers and carrying ball ledges which are circular in plan, as at 8, and arranged to receive and support balls 9. The collars 4 are arranged to rotatably support what I call the armor cylinder 10, so termed by reason of the fact that the inner wearing portion thereof is preferably constructed of manganese steel, comprising a cylindrical shell 11 formed with projections 12 to overlie the ledges 8 of the collars, said projections being suitably grooved to cooperate with the balls on the collars.

Within the cylinder 11 is arranged the armor cylinder proper 13, preferably of slightly increasing diameter upwardly throughout its length and interiorly formed with a series of inclined breakers 14, which preferably extend at an inclination to the longitudinal axis of the cylinder, as shown. The cylinder 13 is formed in a number of sections, preferably three, as clearly shown in Fig. 4, whereby any one or more sections may be conveniently replaced by new sections without loss of time or disturbance of any other part of the mill. The sections are formed at their contacting ends in any usual or appropriate manner to provide for an interlocking, whereby, when assembled, the sections are practically secured together for simultaneous rotation.

Supported in bearings 14 and 15, at the respective ends of the main frame, is arranged a cone shaft 16. A cone 17 is keyed upon this shaft and formed on its surface with a series of breakers 18 to cooperate with the breakers in the armor cylinder 13. The cone is also of sectional formation in correspondence with that of the armor cylinder, and for the same purpose. A power shaft 19 is revoluely supported in the lower portion of the framework and actuated through the medium of belt pulleys 20. A bevel gear 21 is fixed on this shaft and arranged to mesh with a bevel gear 22 carried on the cylinder drive shaft 23, the upper end of which shaft is provided with a gear 24 arranged to mesh with a circumferentially-arranged rack 25 integrally formed with the shell 11. By this construction revolution of the power shaft imparts motion to the armor cylinder. A gear 26 is also carried on the power shaft and meshes with a bevel gear 27 carried upon the cone drive shaft 28, upon which shaft is arranged a gear 29 continually in mesh with a gear 30 fixed upon the cone shaft 17.

As the degree of fineness to which the material is ground depends upon the relative position of the breakers 14 and 18, I have provided means for adjusting the position of the cone to increase or decrease the distance between the breakers. To this end
a worm gear 31 is arranged upon the cone shaft in a suitable housing, with which worm gear a worm pinion 32 is arranged to mesh. The pinion 32 is fixed upon a shaft 33 supported in suitable bearings, which shaft carries a bevel pinion 34 arranged in mesh with a bevel pinion 35 mounted upon a shaft 36 supported in the frame. The shaft 35 is in turn driven by meshing pinions carried on it and on a manually-operated shaft 37 projecting beyond the edge of the frame and having a hand wheel 38. A discharge pan 39 is arranged beneath the armor cylinder, the latter projecting below the edge of the cone and into the pan.

A feed box, as 40, is movably supported at the upper end of the frame through the medium of slings 41 depending from hangers 42 secured to the frame. The feed box contains the usual false bottom and screen incident to such structures, the slime finding its way through the screen 43 being discharged through the conveyer 44. The inner or discharge end of the feed box overlies the open end of the armor cylinder, and is actuated to impart motion to the material within the box through the medium of a rod 45 connected to the discharge end of the box and depending to a position adjacent the power shaft. The lower end of the rod 45 is of hollow formation, as at 46, to receive the upper end of a rod 47 connected at its lower end with an eccentric 48 fixed on the power shaft. By operation of the eccentric causes a continual reciprocation of the feed box with the effect to discharge the material into the armor cylinder for crushing. To control the degree of movement of the feed box I provide the bar 45 intermediate its ends with a segmental plate 49 in which is formed an arcuate slot 50. A lever 51 arranged for hand operation and held in adjusted position through the medium of the dog and rack 52 is provided with a pin 53 fitting within the slot 50. By operation of the lever the degree of agitation of the feed box is controlled in an obvious manner.

The rise and fall of the cone shaft 16 is controlled through the medium of the worm gear 31 being screw-threaded in its bore and adapted to impart vertical motion to a screw-threaded stub-shaft 16', keyed near its lower end to prevent rotary motion thereof and provided in its head with an end thrust roller bearing (not shown), of any desired type, to support the cone shaft, motion being transmitted to the worm gear by means of shafts 33 and 36 and their respective pinions, as before described.

The construction described provides a combined pulverizer and crusher in which the material can be reduced to any degree of fineness, thereby performing the work of an ordinary crusher and stamp mill.

All essential bearings are ball bearings, eliminating friction to a material extent and reducing the amount of power required to perform a given amount of work.

The feed is an essential part of the present invention, particularly in the means whereby the throw of the feed box is adjusted.

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

1. A combined ore crusher and pulverizer, comprising a frame, a cylinder mounted in the frame, upper and lower bearings carried by the frame and supporting the cylinder, cylinder operating means arranged between the bearings, a cone mounted within the cylinder, cone operating means arranged below the cylinder, a single shaft, and independent driving means for the cylinder and cone operating means arranged within the frame and connected to the shaft.

2. A combined ore crusher and pulverizer comprising a frame, a cylinder mounted in the frame, upper and lower bearings carried by the frame and supporting the cylinder, cylinder operating means arranged between the bearings, a cone mounted within the cylinder, cone operating means arranged below the cylinder, a single shaft, and independent driving means for the cylinder and cone operating means arranged within the frame and connected to the shaft.

3. A combined ore crusher and pulverizer including a rectangular framework, two annular bearing plates secured thereto, a cylinder, bearing offsets formed on the cylinder and each arranged above and supported by one of the bearing plates, whereby the load of the cylinder is divided between said bearing plates, and a gear carried by the cylinder intermediate the offsets.

4. A combined ore crusher and pulverizer including a frame, a cylinder mounted within and operatively supported at spaced points in the frame, a gear carried by the cylinder, a cylinder-operating shaft engaging the cylinder, a cone operating the cone, a cone-operating shaft engaging the cone gear, a drive shaft arranged between the cylinder-operating shaft and the gear-operating shaft, and independent means carried by the drive shaft for operating the cylinder-operating shaft and cone-operating shaft respectively.

5. A combined ore crusher and pulverizer including a frame, a cylinder mounted within and operatively supported at spaced points in the frame, a gear carried by the cylinder, a cylinder-operating shaft engaging the cylinder, a cone operating the cone, a cone-operating shaft engaging the cone gear, a drive shaft arranged between the cylinder-operating shaft and the gear-operating shaft, and independent means carried by the drive shaft for operating the cylinder-operating shaft.
shaft and cone-operating shaft respectively, said cylinder-operating shaft and cone-operating shaft being mounted respectively on opposite sides of the frame, whereby to balance the strain on the drive shaft.

6. A combined ore crusher and pulverizer including a cylinder, a cone, cylinder-operating means arranged at one side of the cylinder, cone-operating means arranged below the cone, a shaft arranged below the cone and cylinder, and independent means for separately engaging and actuating the respective operating means, said independent means being arranged beyond and adjacent diametrically-opposite points of the cylinder.

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

CYRUS C. PRATT.

Witnesses:
R. W. Pratt,
W. P. Bennett.