May 14, 1940. L. G. HAWKINS 2,200,576

CRUSHING AND GRINDING MACHINE

Filed Dec. 1, 1938 2 Sheets-Sheet 1

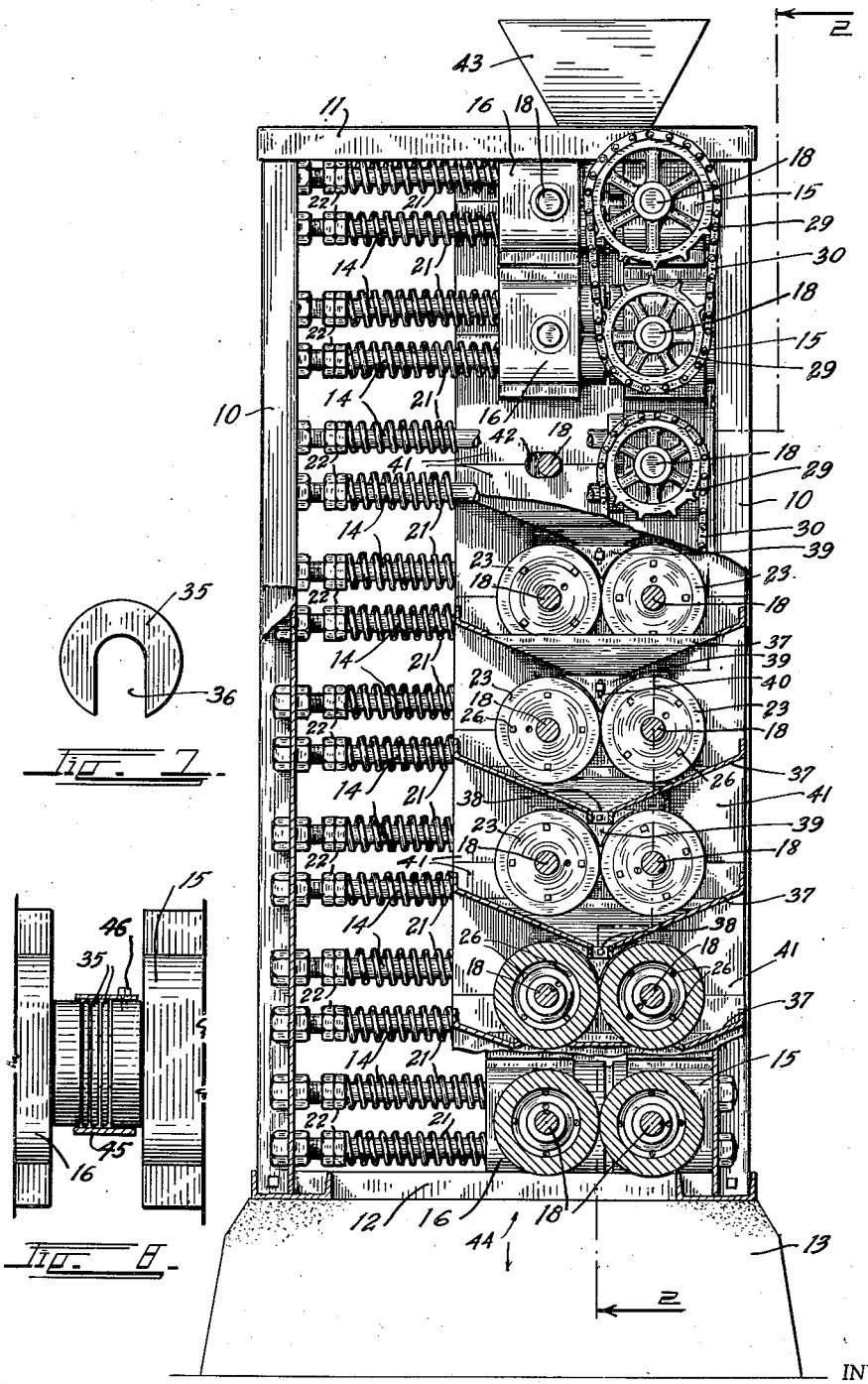


Fig. 1.

Fig. 7.

Fig. 8.

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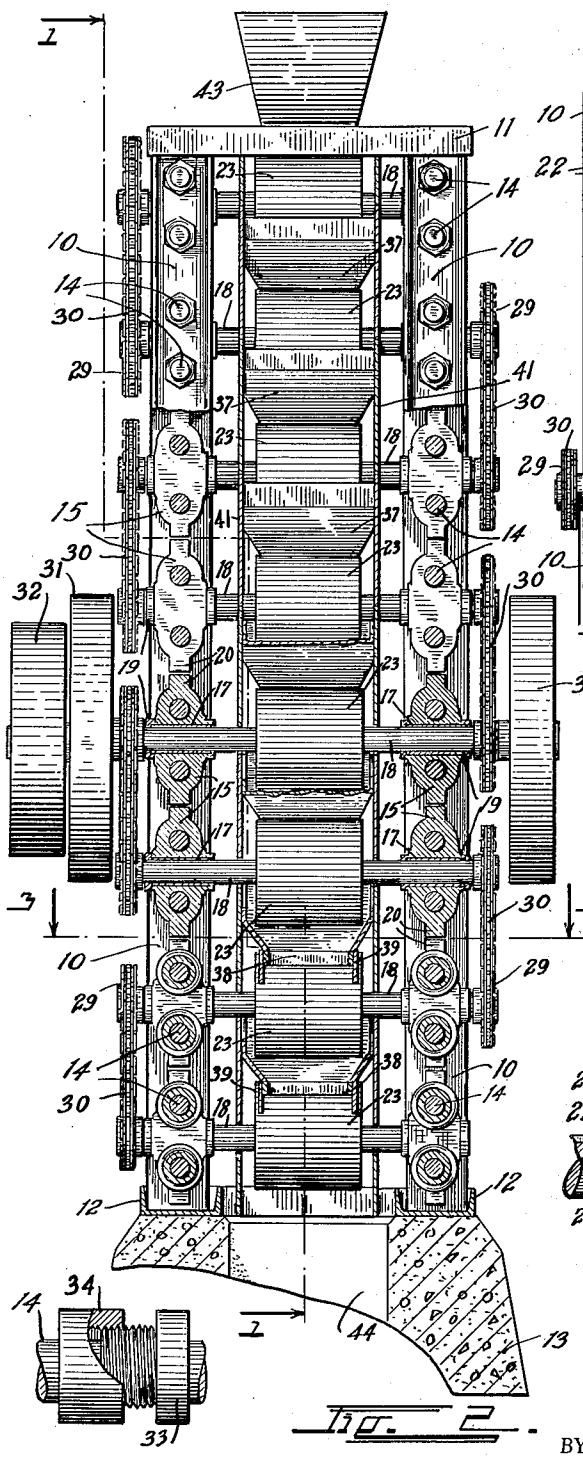


Fig. 2.

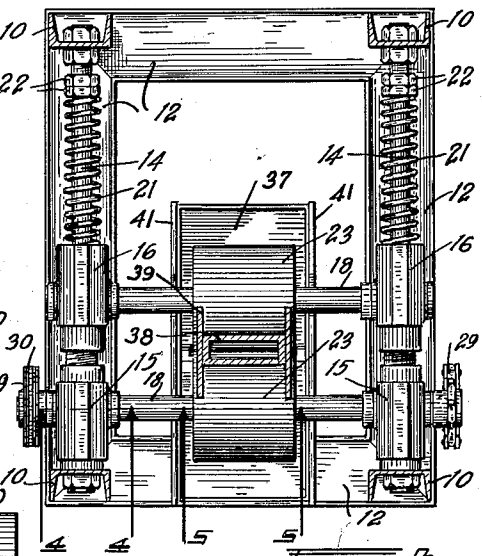


Fig. 3.

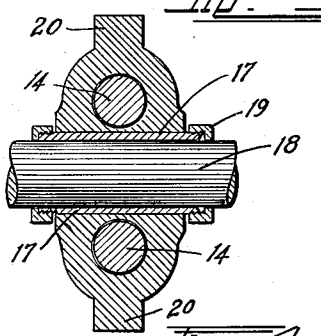


Fig. 4.

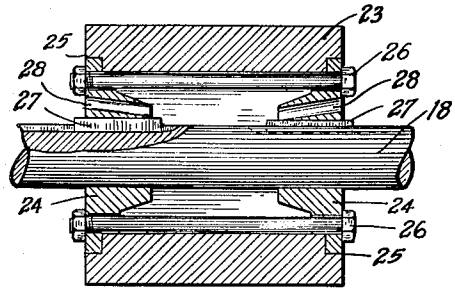


Fig. 5.

Fig. 6.

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CRUSHING AND GRINDING MACHINE

Leon G. Hawkins, Denver, Colo.

Application December 1, 1938, Serial No. 243,338

1 Claim. (Cl. 83—12)

This invention relates to a crushing and grinding machine more particularly for grinding ores for the separation of the mineral values therefrom.

The principal object of the invention is to provide a continuous grinding machine through which the ores can be continuously passed and which will, in a single passage through the machine, reduce material from an exceedingly coarse, bulk condition to a finely divided powder with a minimum consumption of power.

Other objects of the invention are to construct the machine so that the crushing rolls do not contact each other at any time so that the machine may be started before the material to be crushed is fed therein with a minimum of power; to provide means which will allow the rolls to automatically separate should hard, uncrushable material be encountered; to provide a series of rolls with a surface speed increasing in direct proportion to the increasing fineness and bulk of the material; and to provide rolls of a construction in which the grinding surface thereof can be quickly and easily removed and renewed without discarding the complete roll structure.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

Fig. 1 is a side elevation partially broken away to show the interior construction. The broken away portion of this view is taken on the line 1—1, Fig. 2.

Fig. 2 is an end elevation partially in section, the sectional portion being taken on the line 2—2, Fig. 1.

Fig. 3 is a horizontal section taken on the line 3—3, Fig. 2.

Fig. 4 is a detail section through a typical roll bearing block.

Fig. 5 is a detail longitudinal section through one of the crushing rolls.

Fig. 6 is a detail view illustrating one form of roll separator.

Fig. 7 illustrates an alternate form of roll separator.

Fig. 8 is a detail view illustrating the latter form in place.

The invention employs a vertical frame consisting principally of four vertical channel bars 10 secured in fixed rectangular relation by means of top and bottom frame 11 and 12, respectively. The entire structure may be supported upon any suitable foundation 13.

At each side of the frame a series of pairs of slide bars 14 extend between the channel bars 10. A stationary roll bearing block 15 and a movable roll bearing block 16 are supported on each pair of slide bars. Each of the bearing blocks contains two parallel bores for receiving the slide rods 14 and between these two bores, and at right angles thereto, the journal blocks are drilled to receive a bearing bushing 17 which forms a bearing for a roll shaft 18.

The bushings 17 are sealed at their extremities by means of packing nuts 19 to prevent grit from entering the bearings. Each of the bearing blocks is formed with slide bosses 20 at its top and bottom which contact with the bosses of the next adjacent bearing blocks to form sliding supports therefor. The movable bearing blocks are constantly urged toward the fixed blocks by means of compression springs 21 which surround the slide rods 14. The compression in the springs can be adjusted by means of set nuts 22.

Each of the roll shafts 18 carries a crushing roll 23. The crushing rolls 23 are formed of relatively thick hollow cylinders supported upon hubs 24. The hubs 24 engage annular shouldered recesses 25 in the ends of the rolls 23 and the two hubs are clamped toward each other and into the recesses by means of clamping bolts 26. The two hubs 24 are each keyed to the roll shaft 18 by means of suitable keys 27 and each is provided with a drive opening 28 through which a punch may be inserted to drive the key from the opposite hub member should it be desired to remove the roll from the shaft.

The roll shafts 18 in the fixed journal members 15, with the exception of the top-most and lower-most shafts, each carry a sprocket wheel 29 on each of its extremities. The top-most and lower-most shafts carry only one of the sprocket wheels 29. A series of drive chains 30 extend between the adjacent sprocket wheels 29 at alternate sides of the machine so that all of the roll shafts 18 in the fixed journal members are rotated in unison and in a common direction.

At a convenient height on the machine one of the roll shafts is extended outward at both

sides to support a pair of fly wheels 31 and a belt drive pulley 32.

It is desired to call attention to the fact that the sprocket wheels 29 successively decrease in diameter as the bottom of the machine is approached so that the rolls 23 are rotated at an increasing higher speed as the bottom of the machine is approached. In the actual construction, the ratio of the sprockets is such that the top-most roll rotates at 200 R. P. M. and the lower-most roll rotates at 425 R. P. M.

The initial static pressure of the rolls on the roll shafts 18, in the movable bearing blocks, against their adjacent rolls may be regulated by means of a separating device positioned on each of the slide rods between the two journal members. One such separating device is shown in Fig. 6 and comprises a male bushing 33 which is threaded into a female bushing 34. By threading these two bushings away from each other, a percentage of the pressure between the rolls may be absorbed. A second form of separating device is shown in Figs. 7 and 8 comprising a series of relatively thin shim washers 35 of various thicknesses which are notched, as shown at 36, so that they may be slipped over the slide rods between the bearing blocks, as shown in Fig. 8, to maintain any desired separation thereof. The initial or empty roll pressure may be regulated by adding to or subtracting from the number of shim washers. The shim washers are held in place by means of a slidable sleeve 45 locked in place by a set screw 46.

The material from each pair of rolls is guided to the next pair below by means of an elongated hopper 37, each of which terminates in an elongated throat member 38 positioned between the lower rolls. A curvated-triangular plate 39 is secured to each extremity of each throat member 38 to prevent material from falling from the extremities of the rolls. These plates are provided with slotted bolt openings 40 so that they may be raised or lowered to properly space them from the roll surface.

The hoppers 37 are supported from side plates 41 which rest upon each other throughout the entire heighth of the machine. The side plates 41 are notched, as shown at 42, for passage of the roll shafts. The material to be crushed is fed into the machine through an upper feed hopper 43 and exits through a discharge channel 44 in the foundation 13.

In the actual machine the rolls are 16 inches in diameter and 16 inches long. It was found impossible to start a machine of this size with the rolls in contact under the full spring pressure without a motor of impractical size. By placing the spacing devices between bearing blocks, however, so that the rolls contact with very little pressure, the frictional retarding action of the heavy springs 21 was so reduced that very little power was required for the initial start. As soon as the material to be crushed, however, enters between the rolls the bearing blocks move away from the separating devices and the full pressure of the springs is exerted thereon. The separators also serve to absorb the rebound of the rolls after they have passed over a rock or lump of material and prevent rolls from striking with sufficient force to indent or deform them.

It is desired to call attention to the fact that the rolls do not increase in size as the bottom is approached although the volume of material being ground does increase to more than twice the volume being fed into the feed hopper 43. This swell or expansion in the material as it is being comminuted is taken care of by the differential speed in the rolls for as the material becomes finer, it will be passed through the machine more rapidly.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claim, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

A crushing and grinding machine comprising: four upright members; a vertical series of pairs of parallel horizontal slide rods supported between said members at opposite sides of said machine; a stationary journal block mounted on each pair of rods, said stationary journal blocks being in vertical alignment at each side of said machine; a first series of horizontal crushing rolls journalled in said stationary journal blocks and extending across said machine at right angles to said rods; a movable journal block mounted on each pair of slide rods adjacent the stationary block thereon; a second series of horizontal crushing rolls journalled in said movable journal blocks and extending across said machine parallel to said first series of rolls; a compression spring surrounding each rod and acting to force the movable block thereon towards the stationary block thereon; and a slide surface on the top and bottom of each journal block, the top surfaces contacting the bottom surfaces of the next above block to vertically space the blocks and to lend additional support thereto.

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