Dec. 29, 1936. J. J. MORCH 2,065,821

CRUSHING AND GRINDING MILL

Filed Nov. 28, 1932 2 Sheets-Sheet 1

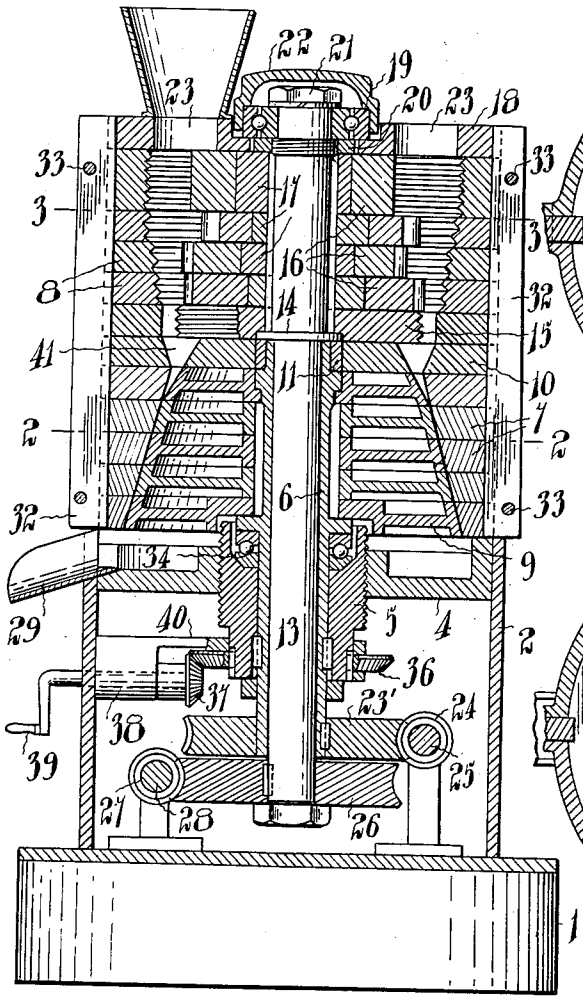


Fig. 1.

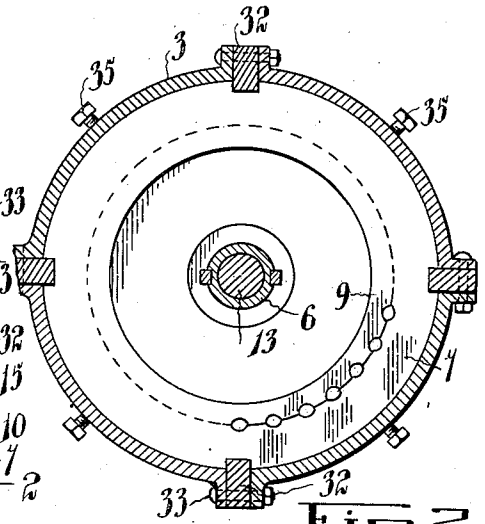


Fig. 2.

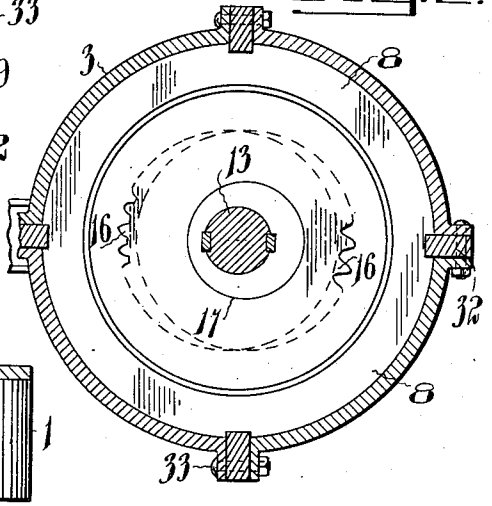


Fig. 3.

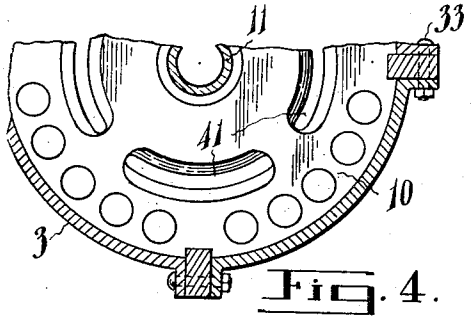


Fig. 4.

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Dec. 29, 1936. J. J. MORCH 2,065,821

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Filed Nov. 28, 1932 2 Sheets-Sheet 2

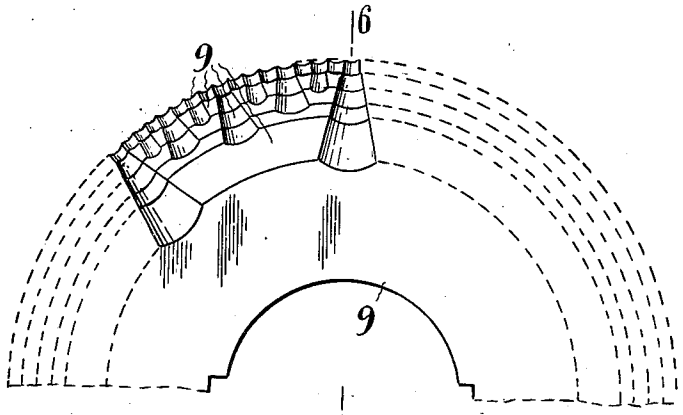


Fig. 5.

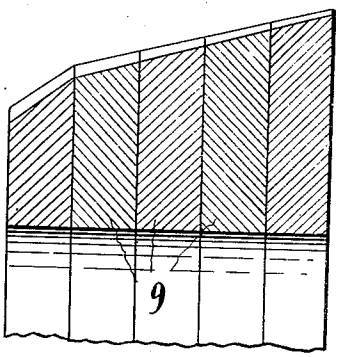


Fig. 6.

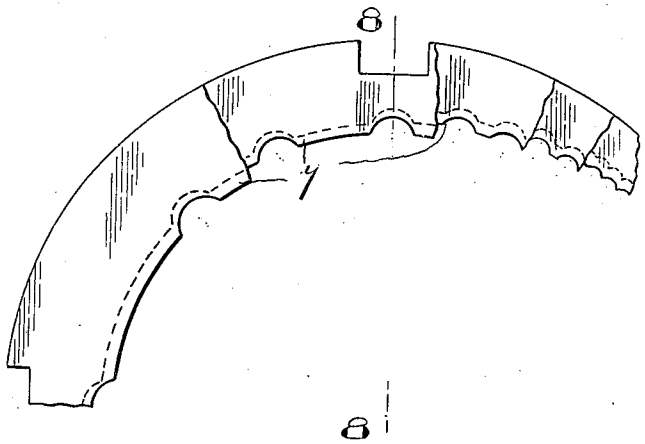


Fig. 7.

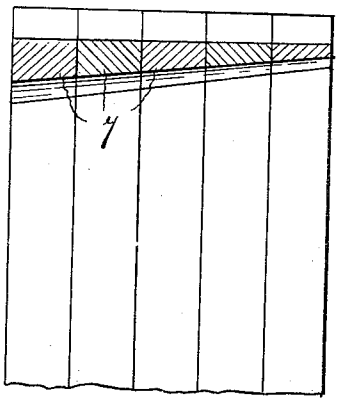


Fig. 8.

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CRUSHING AND GRINDING MILL

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Application November 28, 1932, Serial No. 644,717

3 Claims. (Cl. 83—10)

This invention relates to apparatus for crushing and grinding ore or other material, and the object of the present invention is to devise a mill by means of which the ore will be broken up in a substantially continuous process, which will be very effective in its crushing and grinding action throughout its length, in which the mill is arranged so that there will be no overloading or crowding at any stage in the breaking up process, and which may be readily disassembled and assembled when it is desired to transport the apparatus from place to place.

I attain my object by forming the mill in two main sections, a crushing section and a grinding section, in the crushing section of which the crushing is effected by a series of crushing members operated preferably in the horizontal plane by eccentrics carried by the main drive shaft, and in which the grinding section comprises a series of grinding members rotated by a drive shaft, the peripheries of which grinding members co-act with the inside of the main housing to effect the breaking up of the material.

The construction is hereinafter more specifically described and is illustrated in the accompanying drawings in which

Fig. 1 is a vertical section of the improved apparatus;

Fig. 2 a section on the line 2—2 of Fig. 1;

Fig. 3 a section on the line 3—3 in Fig. 1;

Fig. 4 a plan view of the divider ring or plate between the crushing and grinding sections of the apparatus;

Fig. 5 a partial plane view of the rotary grinding stack;

Fig. 6 a section on the line 6—6 in Fig. 5;

Fig. 7 a plan view of the stationary grinding ring stack;

Fig. 8 a section on the line 8—8 in Fig. 7.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

On a suitable base 1 is mounted a casing, preferably in superposed parts 2 and 3. The part 3 of the casing is preferably divided vertically on a plurality of lines, and at the points of division members 32 are provided to which the edges of the casing parts are bolted, the casing parts being provided with outwardly directed flanges through which the securing bolts 33 pass.

About the top of the lower part 2 is mounted a bottom trough 4, which is provided with a central hole in which is positioned a bearing 5 in which is mounted a vertically arranged tubular shaft 6. This trough is provided at one side with a discharge spout 29 extending through the side of the casing 2.

Supported by the rim of the bottom trough 4 are a plurality of outer ring members 7, which are of gradually decreased internal diameter from bottom to top. On the upper ring member 7 is a divider plate 10, and on this divider plate is superposed a second series of ring members 8, the internal diameter of which increase from bottom to top.

The rings 7 and 8 are notched as shown in Figs. 2 and 3 to receive the bars 32 whereby the rings are held from rotating.

Supported within the bearing 5 is a bearing 34, preferably of the ball type, on which are supported a series of grinding rings 9 which rotate with the tubular shaft 6. These grinding rings 9 co-operate with the outer ring members 7 to form the grinding portion of the mill. The members 9, particularly the lower ones, are a substantially tight fit within the members 7, and their co-operating surfaces are preferably vertically grooved, the grooves in a lower ring being smaller in size, but greater in number than those in a ring above, as will be seen clearly from Figs. 5 and 6 of the drawings. As stated above the members 9 are substantially a tight fit within the members 7 and therefore all the material being ground must pass down the co-operating grooves in said members, and the breaking up of the material is thus accomplished by a shearing action rather than a crushing action as is ordinarily the case in grinding machines. As the material in the larger grooves in the upper grinding members is sheared off, the pieces drop down into the smaller grooves in the lower members, where shearing is again effected and so on down to the final stage. As it is quite important that the material delivered into the trough 4 be of substantially the same size, I provide means for centering the outer rings 7 relative to the members 9, which means comprise screws 35 extending through the wall of the containers 3 and by adjusting the screws the rings 7 may be positioned relative to the co-acting members 9.

As in some cases it is not necessary to have such a fine grinding, I provide means for raising and lowering the grinding unit as a whole. The bearing 5 is therefore provided with a threaded connection with the trough 4, so that by rotating the bearing, the bearing with the hollow shaft 6 and the parts mounted thereon may be lowered or raised to increase or decrease the space between the membrs 7 and 9. For the purpose of rotating the bearing 5, I provide on a downward

extension of it a bevel gear 36 which meshes with a pinion 37 on a shaft 38, the end of which is provided with an operating handle 39. The bevel gear is preferably slidable on the bearing 5 but is held from rotation by means of a key. A bracket 40 extending over the bevel gear 36 holds it in mesh with the pinion 37.

The member 10 is provided with a central bearing 11 for the upper end of the tubular shaft 6 and also with arc-shaped slots 41 for the passage of the crushed material to the grinding portion of the apparatus.

Fitted within the tubular shaft 6 is a shaft 13, which extends above said tubular shaft and is provided with an annular shoulder 14 resting on the bearing 11. Carried by this shoulder 14 and keyed on the shaft 13 so as to rotate therewith is a lower crusher member 15 and on this crusher member are mounted in superposed relation a plurality of annular crusher members 16 adapted to co-operate with the rings 8. These crusher members are each mounted on an eccentric 17 keyed on the extending portion of the shaft 13, and the eccentrics are arranged in staggered relation to one another, from which it necessarily follows that the crusher members 16 are also in staggered relationship to one another. The annular crusher members do not necessarily rotate with the eccentrics, being quite free thereon.

The crusher members are provided with serrated working faces to facilitate the crushing of the material. These serrations on the crusher members 16 are preferably formed as vertical ribs, and the co-operating surfaces of the rings 8 are also serrated, being preferably formed with horizontal ribs, that is, the cooperating faces of the one set of members are provided with ribs at an angle to the ribs on the other members.

The crushing member 15 is concentric with its corresponding ring member 8, but has a ribbed periphery in the form of a screw thread as shown in Fig. 1, whereby material is worked down to the arc-shaped slots 41.

The casing is provided with a top 18, which top is provided with a central bearing 19, preferably of the ball type, for supporting the upper end of the shaft 13. A lock nut 20 is preferably interposed between the upper eccentric 17 and the bearing 19, and a lock nut 21 is screwed on the end of the shaft to hold the bearing in place. A cap 22 is positioned over the bearing to protect the latter.

The top 18 is provided with one or more openings 23 for the entry of the material to be operated upon.

The shafts 6 and 13 may be operated at the same or different speeds. The apparatus for driving these shafts may be of any suitable type. As one method, I show a worm gear 23' mounted on the lower end of the hollow shaft 6, which meshes with a worm 24 on a shaft 25.

To drive the shaft 13, a worm gear 26 is arranged thereon, which worm gear is driven by a worm 27 on a shaft 28. These shafts 25 and 28 may be driven in any suitable manner, and usually by means of an electric motor or motors, not shown, whereby the grinding section may be operated without the crusher section, and whereby the rates of drive of the sections may be regulated relative to each other to ensure that each section operates at full capacity without overloading the other section.

It will also be evident that the grinding members may, if desired, be arranged to be driven at different speeds relative to one another, and also that the crushing members may also be driven at different speeds.

The operation of the mill is as follows. The material to be operated on is inserted through the opening 23 and as the shaft 13 is rotated the crusher members 16 are moved laterally through the action of the eccentrics to crush the material against the rings 8. It will be noticed of course, that the space between the crusher members and rings 8 gradually decreased from top to bottom resulting in a finer and finer crushing of the material until it is sufficiently fine to pass between the member 15, and its cooperating ring, through the slots 41 into the grinding section of the apparatus, where it passes down the grooves between the grinding members, being broken up finer and finer during said passage downwardly until it finally reaches the trough 4 and passes out through the spout.

What I claim as my invention is:

1. In crushing and grinding apparatus, the combination of a casing; rotary grinding means positioned in the lower part of the casing; rotary crushing means positioned above the grinding means and co-axial therewith; a spacer separating the grinding and crushing means having openings therein for the passage of crushed material; and screw means rotatable with the crushing means for forcing the material from the crushing means through said openings.

2. In crushing and grinding apparatus, the combination of a casing having an interior crushing surface; a vertical shaft rotatable in the casing; a plurality of superimposed crushing members eccentrically mounted on and driven by the said shaft for co-operation with the aforesaid grinding surface, the eccentric throw of different members lying in different angular positions in the plane of rotation; and a concentric ring mounted on the vertical shaft below the eccentric members and provided with a screw-like rib on its periphery adapted to force downwardly the crushed material.

3. In crushing and grinding apparatus, the combination of a casing; rotary grinding means positioned in the lower part of the casing; rotary crushing means positioned above the grinding means; a spacer separating the grinding and crushing means having openings therein for the passage of crushed material; means for separately driving the crushing and grinding means; and screw means directly connected with one of the last mentioned means for forcing the material from the crushing means through said openings.

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