J. R. BALL.

BALL MILL.

APPLICATION FILED SEPT. 5, 1918.

1,307,951.

Patented June 24, 1919.

4 SHEETS—SHEET 1.

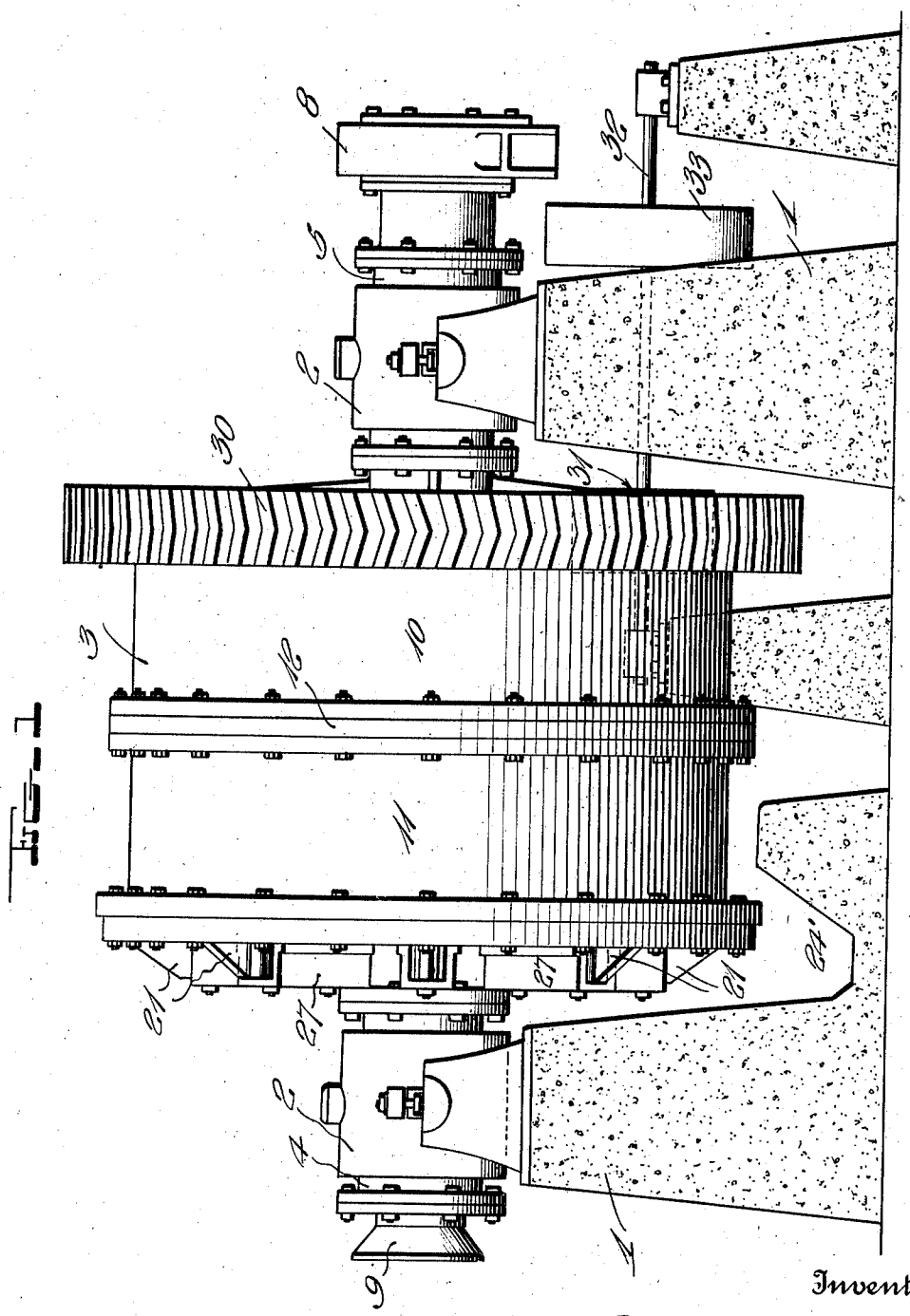


Fig. 1.

Witness

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4 SHEETS—SHEET 2.

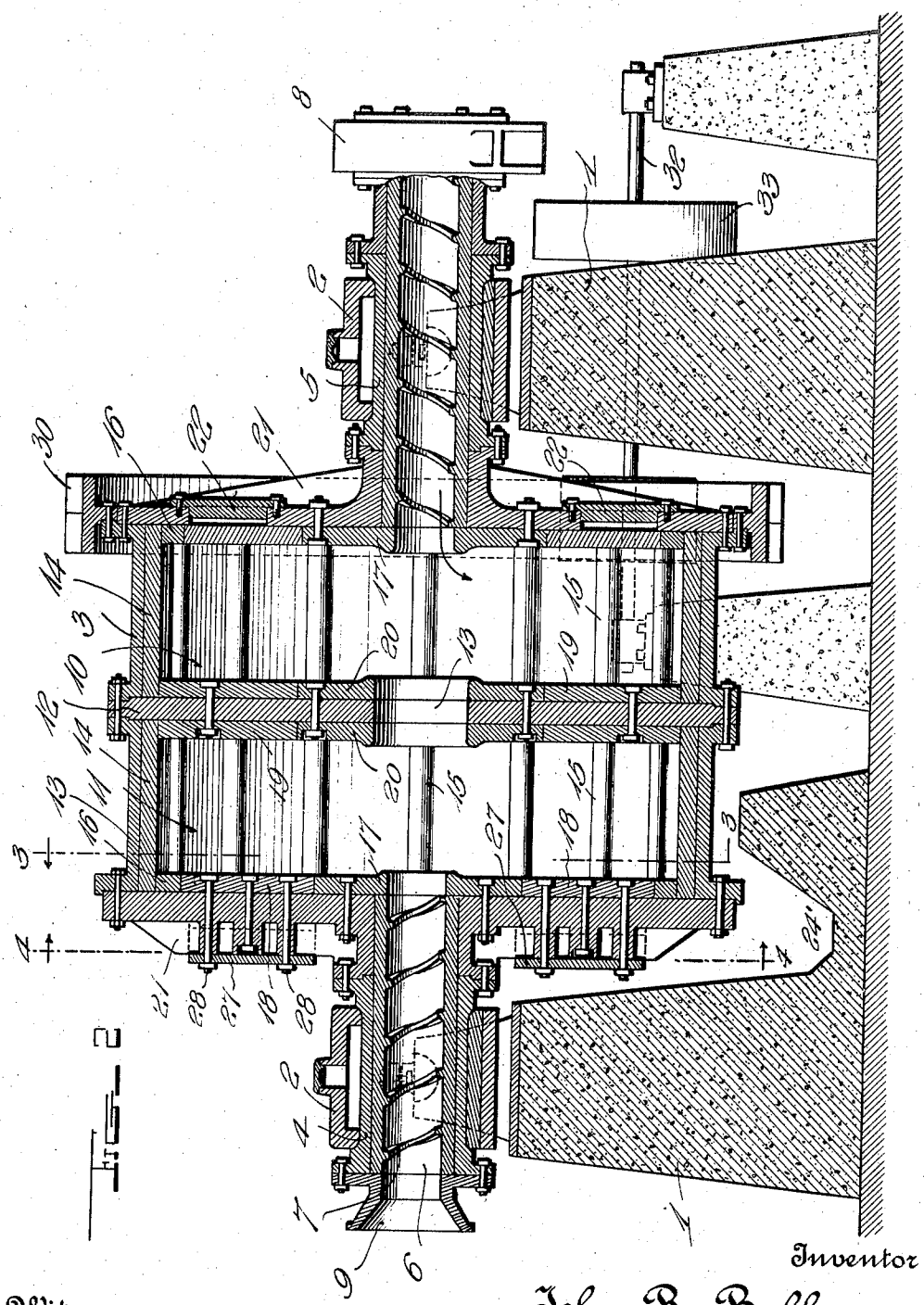


Fig. 2

Witness

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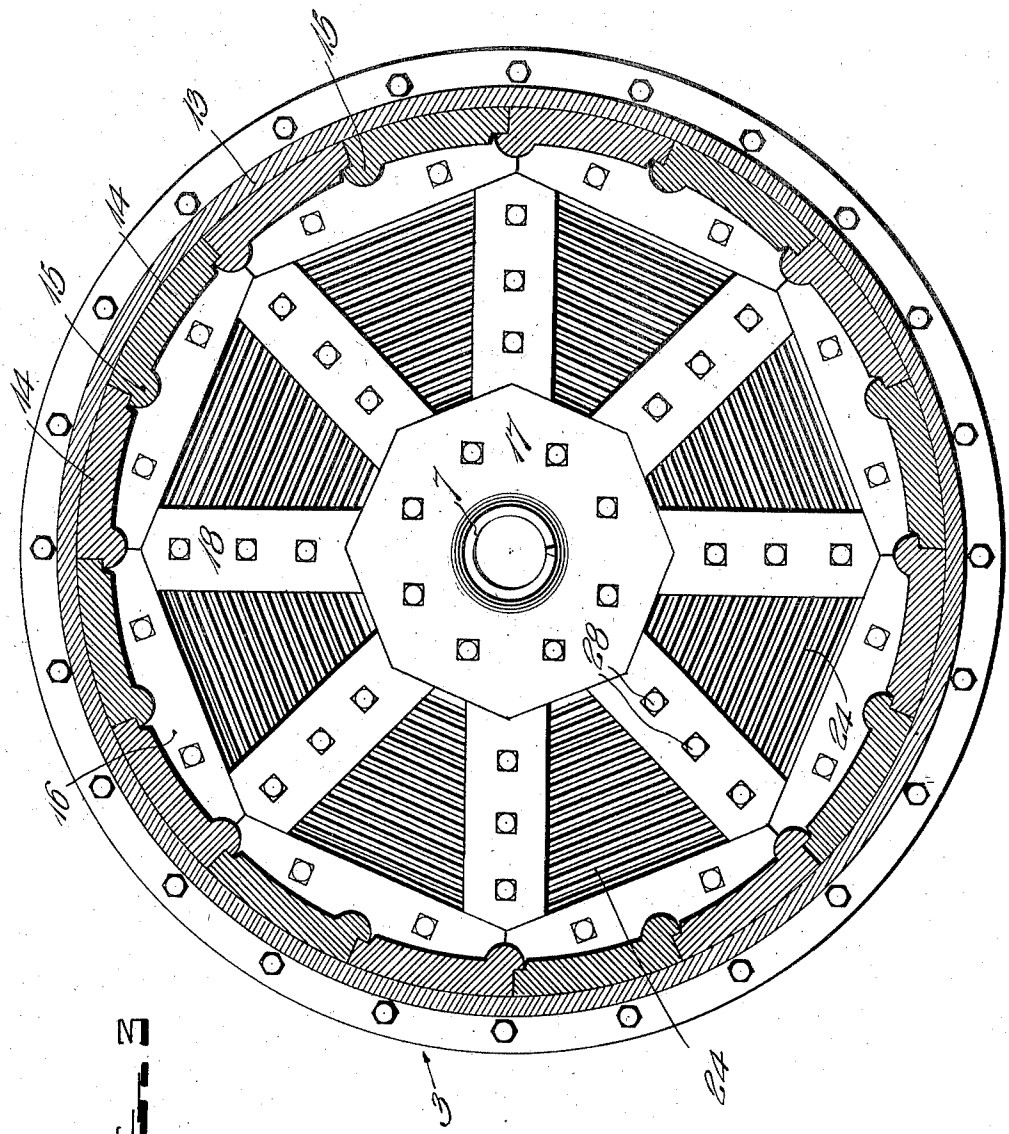
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4 SHEETS—SHEET 3.





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4 SHEETS—SHEET 4.

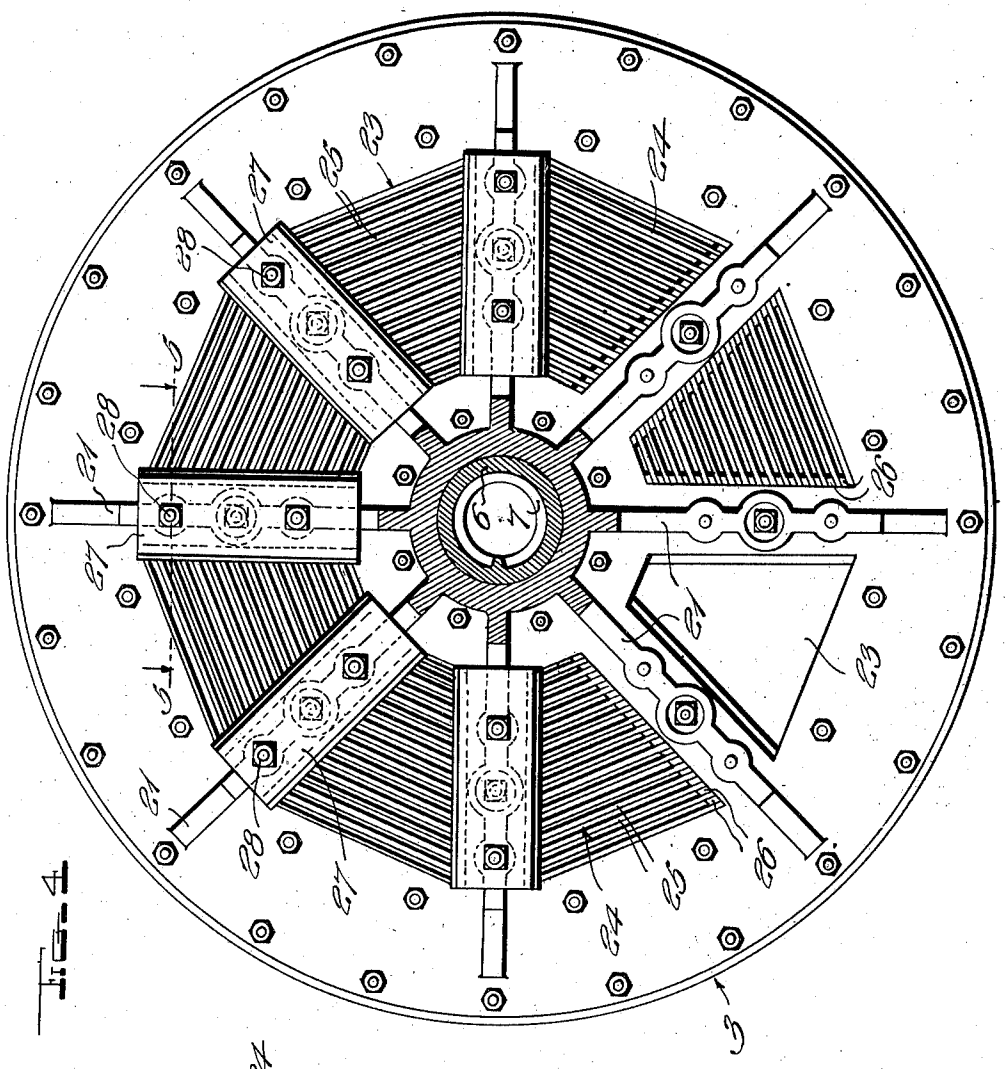


Fig. 4

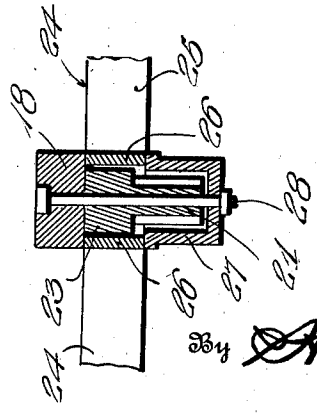


Fig. 5

Witness

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UNITED STATES PATENT OFFICE.

JOHN R. BALL, OF DURANGO, COLORADO.

BALL-MILL.

1,307,951. Specification of Letters Patent. Patented June 24, 1919.

Application filed September 5, 1918. Serial No. 252,743.

To all whom it may concern:

Be it known that I, JOHN R. BALL, a citizen of the United States, residing at Durango, in the county of La Plata and State of Colorado, have invented certain new and useful Improvements in Ball-Mills; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in mills of the type in which a plurality of balls are located in a grinding cylinder to crush the ore or other material fed into said cylinder to the desired mesh, the object of the invention being to provide a novel type of discharge screen.

Still another object is to devise novel and effective means for detachably securing the discharge screens in the end of the cylinder and to construct these screens in a manner to permit the spaces between the screen bars to be varied.

With the foregoing objects in view, the invention resides in the novel association of parts and in the unique construction hereinafter fully described and claimed, and illustrated in the accompanying drawings.

Figure 1 is a side elevation of the mill.

Fig. 2 is a central vertical longitudinal section thereof with parts in elevation.

Figs. 3 and 4 are vertical transverse sections on the planes indicated by the lines 3—3 and 4—4 respectively of Fig. 2.

Fig. 5 is a detail section on the plane of the line 5—5 of Fig. 4, showing more particularly the manner in which the screens are clamped in place.

In the drawings above briefly described, the numerals 1 designate suitable supports upon which appropriate bearings 2 are mounted, the grinding cylinder 3 being located between said bearings and having hollow trunnions 4 and 5 rotatable therein. Each trunnion is provided with a tubular lining 6 having a helical internal rib 7 for feeding the material therethrough into the grinding cylinder, the trunnion 5 being provided with a spiral collecting head 8 for feeding the ore or the like into said trunnion from suitable supply means, while the outer end of the trunnion 4 is provided with a flared extension 9 into which any material sufficiently fine to require only a small amount of crushing may be fed. It is through the trunnion 5 however that the greater part of the ore passes into the cylinder 3 to be initially ground in a preliminary grinding chamber 10 from which it is discharged into a final grinding chamber 11, said cylinder being divided into the two chambers 10 and 11 by a transverse partition 12 suitably secured in place, said partition having a central opening 13 through which the partly ground material is fed into the final chamber 11 from the preliminary chamber 10.

The peripheral wall of each of the grinding chambers is provided with a lining formed of a plurality of sections 14 which abut each other on lines transverse to the direction of rotation of the cylinder 3, one edge of each section 14 being provided with a rib 15 on its inner side, the several ribs extending a suitable distance beyond the edges of the sections to overlap the adjacent edges of the other sections as shown most clearly in Fig. 3. The usual grinding balls are placed in the two chambers 10 and 11, comparatively large balls in chamber 10 and smaller ones in the other, and the coaction between the balls and ribs produces highly effective work. The ends of the lining sections 14, at the ends of the cylinder 3, rest upon outer lining rings 16 secured to the inner sides of the cylinder ends, said rings being by preference formed of a plurality of sections abutting each other as shown in Fig. 3. An inner lining ring 17 is secured to each cylinder end at its center, and lining plates 18 extend between the rings 16 and 17 as shown also in Fig. 3, said plates being suitably secured in place. The inner ends of the lining sections 14 are held against the peripheral walls of the cylinder 3 by lining plates 19 secured to the opposite sides of the partition 12, said lining plates extending outwardly from lining rings 20 secured to the aforesaid partition adjacent its center.

By lining the cylinder 3 in the manner shown and described, such lining may be removed and replaced whenever necessary, due to wear, breakage of parts, etc.; and it will be seen that in addition to coöperating with the grinding balls, the ribs 15 reinforce the abutting edges of the lining sections 14 and prevent chipping thereof.

The ends of the cylinder 3 are reinforced on their outer sides by radial ribs 21, and

between these ribs, one of the ends is provided with manholes equipped with suitable covers 22, while discharge openings, 23 for the final grinding chamber 11, are formed between the ribs 21 and the other cylinder end. The edges of the radial plates 18 of the last named end of the cylinder, project beyond the edges of the openings 23 and the screens 24 which are received in said openings bear against said projecting edges. Each screen is formed of a plurality of parallel bars 25 having their ends spaced apart by suitable spacing blocks 26 as seen clearly in Figs. 4 and 5. By using spacers 26 of different thicknesses, the distances between the bars 25 may be varied and consequently the material may be ground to a finer or coarser mesh before discharge, as occasion may demand. To retain the screens in place, channel-shaped radial bars 27 straddle the ribs 21 of the adjacent end plate and bear against the outer sides of said screens, that is against the outer edges of the bars 25 and the spacers 26. Bolts or the like 28 are employed to secure the channel bars 27 in place, and these bolts preferably extend entirely through the end of the cylinder and through the plates 18 as featured in Fig. 5.

By constructing the screens 24 in the manner shown and securing them in place by the bars 27, the mesh of the screens may not only be varied at will, but injured or broken parts may be quickly and easily removed and replaced.

In operation, the ore is fed to the spiral collecting head 8, and the latter picks up such ore and discharges it into the tubular trunnion 5, the helical rib 7 of such trunnion serving to feed the material into the preliminary grinding chamber 10 as indicated by the arrow in Fig. 2. In this chamber, the large balls act upon the ore or the like and the partly ground product is discharged through the opening 13 into the final grinding chamber 11. In this chamber, the smaller balls complete the grinding operation and when the material has been reduced to the proper mesh, it is discharged through the screens 24 into the trough 24' or into any other preferred receptacle. Whenever the ore or the like is sufficiently fine not to require preliminary grinding in the chamber 10, it may be fed directly into chamber 11 through the hollow trunnion 4.

Any preferred means may be employed for driving the cylinder 3, but for illustrative purposes, I have shown said cylinder provided with a gear 30 meshing with a pinion 31 on a countershaft 32 which may be provided with a pulley or the like 33 driven in any preferred manner.

I claim:

1. In a screen, the combination with a cylinder having radial reinforcing ribs on the outer side of one of its end walls and discharge openings between said ribs; of screens in said openings, radially disposed channel bars whose side flanges straddle said ribs and bear against said screens to hold them in place, and means for securing said bars to said cylinder end.

2. In a screen, the combination with a cylinder having external radial reinforcing ribs on one of its ends and discharge openings between said ribs having their edges parallel thereto; of radial bars on the inner side of said cylinder end located opposite said ribs with their edges extending beyond the edges of said openings, screens in said openings in contact with the outer sides of said projecting bar edges, channel bars radially disposed on the exterior of the cylinder with their flanges straddling said ribs and contacting with the outer sides of said screens to hold the latter in place, and bolts passing through said first and last named bars and through the intervening ribs and cylinder end to secure all parts in position.

In testimony whereof I have hereunto set my hand.

JOHN R. BALL.