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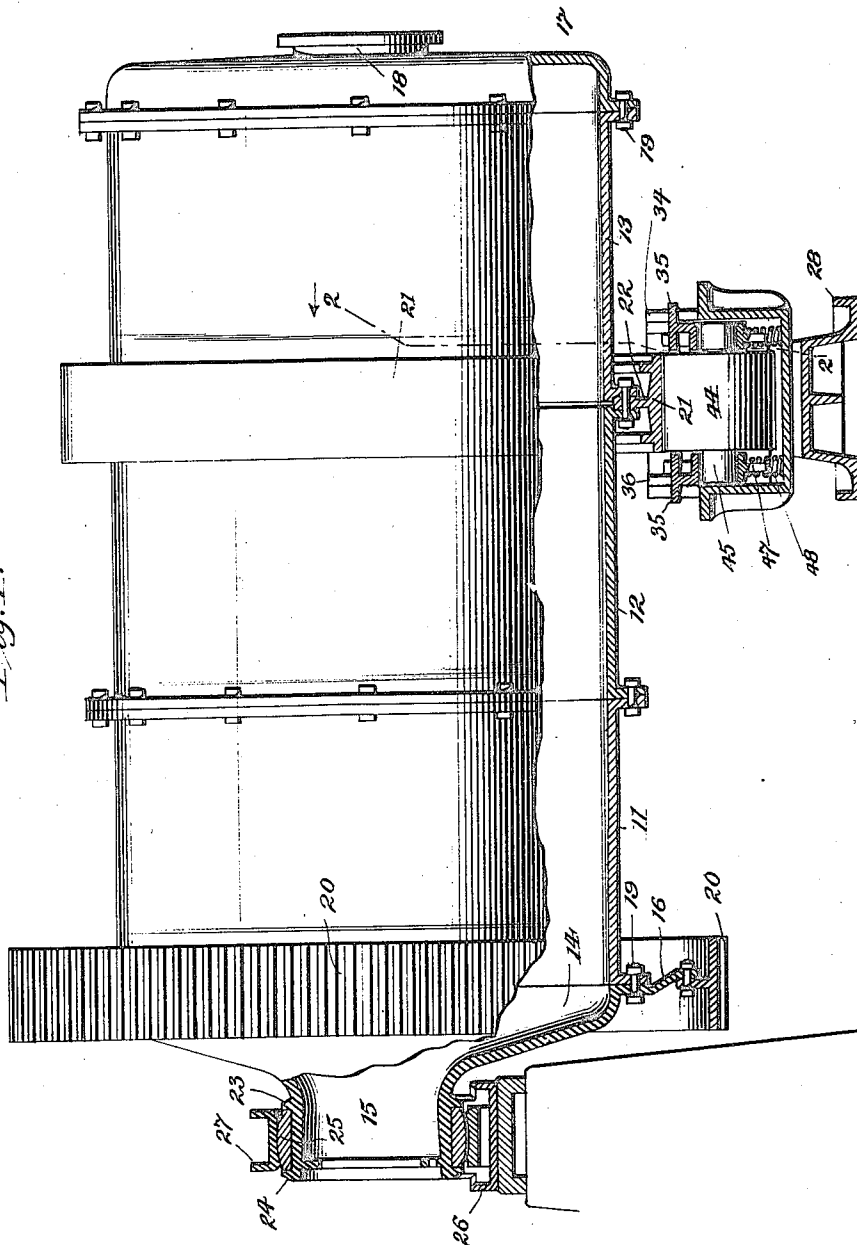
D. COLE ET AL

GRINDING MILL

Filed April 6, 1922

3 Sheets-Sheet 1

Fig. 1.



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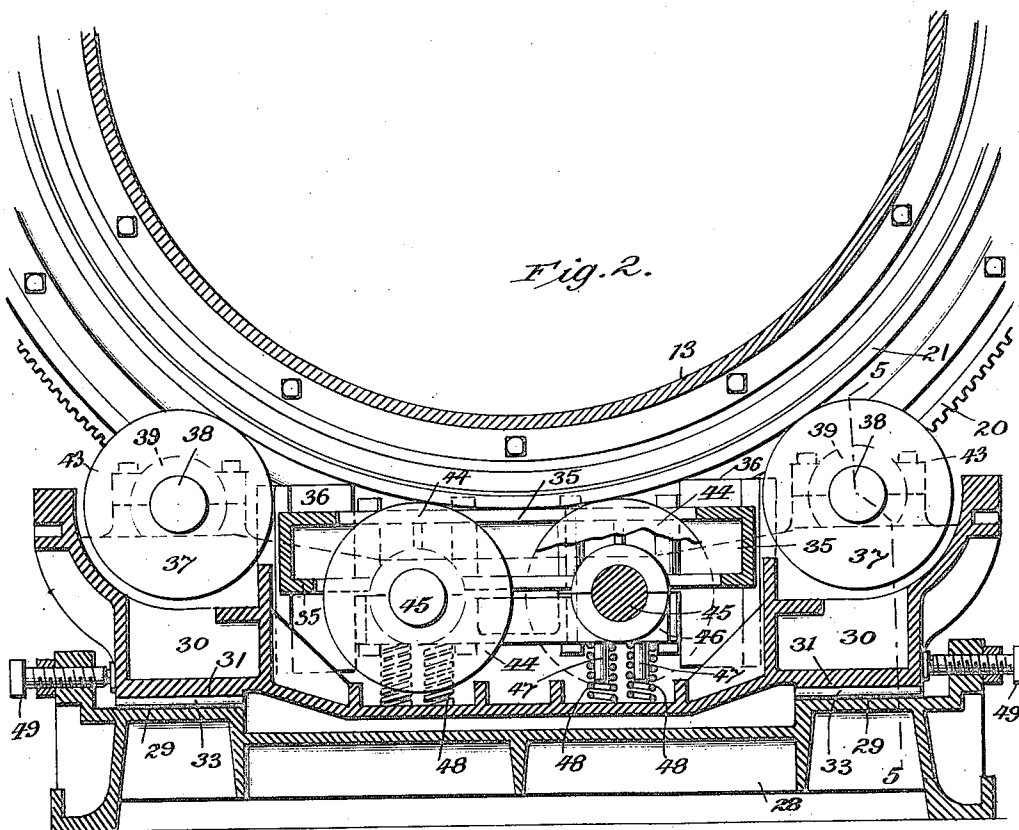
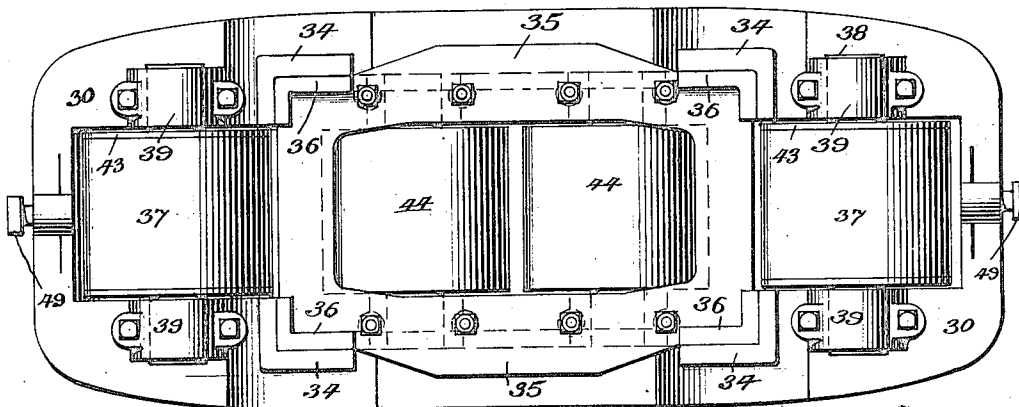


Fig. 3.

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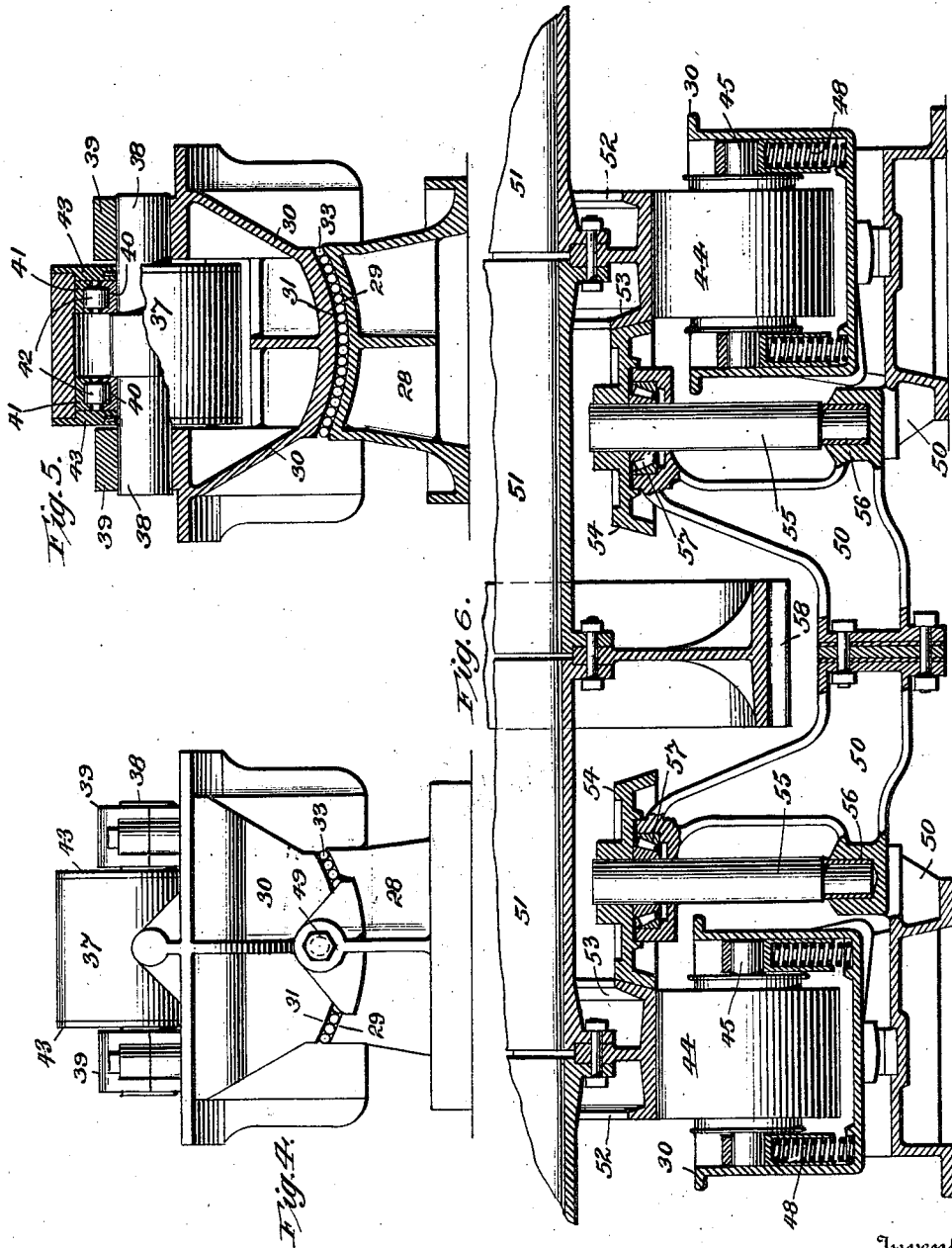
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

DAVID COLE AND JULIUS G. BERGMAN, OF EL PASO, TEXAS.

GRINDING MILL.

Application filed April 6, 1922. Serial No. 550,017.

To all whom it may concern:

Be it known that we, DAVID COLE, a citizen of the United States, and JULIUS G. BERGMAN, a subject of the King of Sweden, residing at El Paso, in the county of El Paso and State of Texas, have invented certain new and useful Improvements in Grinding Mills, of which the following is a specification.

10 This invention relates to grinding mills and particularly to supporting bearings for mills of the type requiring one end head to be readily removable, such for example as the so-called "rod mills."

15 In a rod grinding mill the grinding elements are heavy steel rods substantially as long as the internal length of the drum. These rods, wear more rapidly at the feed end of the mill and hence must be periodically turned end for end to equalize the wear. The rods must be inspected from time to time, so that badly worn rods may be removed before they bend and snarl. Otherwise the grinding efficiency of the mill suffers, and the work of removing the bent rods consumes much valuable time.

25 These conditions require that the removal of the head be a simple operation and the drum be so supported that it can be slowly rotated while the head is removed, so that all the rods can be inspected without removal. These requirements have heretofore been met by supporting the mill on one trunnion bearing, and one riding ring, but the heavy weight of the loaded drum has imposed very severe duty on the bearings, and the structures heretofore used have developed difficulties arising from excessive loads in journals, and mis-alinement of the bearings. The heavy loads met in this service require the distribution of the load over several supporting rollers, and unless close alinement and reasonably close equalization of load on the various rollers and their bearings are maintained, destructive wear occurs before the faulty conditions are detected.

45 A simple rugged construction is essential from the cost and operation standpoint. The present invention meets these conflicting requirements and offers a practical solution of past difficulties.

No attempt at perfect equalization of the

load on the bearings is made, but a sufficiently close approximation is secured by supporting certain of the bearings on properly designed springs, which cause them to assume their share of the load. The various rollers which support the riding ring are so mounted and guided as to maintain alinement with each other and no means is provided by which this alinement can be changed. The design is purposely made such as to facilitate accuracy in manufacture, and permit the elimination of field adjustments.

55 The entire bearing structure for the riding ring is however transversely adjustable as a whole to permit the bearing to be alined properly with the axis of the drum, and the trunnion bearing is formed with a spherical seat to permit the drum to move in response to such movements of the riding ring bearing structure.

60 Furthermore the entire bearing structure for the riding ring is mounted so as to be capable of rocking slightly in order to equalize the supporting roller pressure over the whole width of the riding ring. When the pressure is equalized the parts are in stable equilibrium.

80 The rugged nature of the supporting bearings for the riding ring and the provision for securing and maintaining alinement permit such location of the riding ring as will cause it to support more than half the load, preferably about two thirds of the load. This permits the use of a short trunnion bearing and facilities feeding, the feed, as is usual in such mills, being passed through the trunnion. The resulting structure has few small parts and is capable of economical accurate manufacture. The component parts of the riding ring bearing will maintain alinement. Only one field adjustment is possible and this secures alinement of the entire bearing structure. When this adjustment is correctly made the drum will have no endwise creep, so that correct adjustment is easily recognized. The adjustment once made is easily maintained.

100 Preferred embodiments of the invention are shown in the accompanying drawings, in which:—

Fig. 1 is a view, partly in elevation and

partly in longitudinal section, showing the shell of a grinding drum supported by one trunnion bearing and one riding ring.

Fig. 2 is a section on the line 2—2 of Fig. 1, on an enlarged scale.

Fig. 3 is a plan view of the supporting roller structure shown in Fig. 2.

Fig. 4 is an end elevation of the roller structure.

Fig. 5 is a section on the line 5—5 of Fig. 2.

Fig. 6 illustrates a modified construction in which no trunnion bearing is used and in which the drum is supported on two riding rings and two supporting roller structures.

The grinding drum is made up of a plurality of flanged cylindrical sections 11, 12 and 13. It is closed at the feed end by a head 14 formed with a hollow trunnion 15 and a peripheral flange or web 16, and is closed at the discharge end by a head 17 having a central discharge opening 18. The heads and cylindrical sections are connected together by bolts 19.

A driving ring gear 20 is bolted to the flange 16 on head 14, and a riding ring 21 having an inwardly extending web 22 surrounds the drum. The web 22 extends between the flanges of sections 12 and 13 and is connected with such flanges by the bolts 19.

The trunnion 15 is formed with a journal between the flanges 23, 24 and this turns in a bearing 25 which has a spherical external surface and is mounted in a spherical seat in the bearing box composed of the base casting 26 and cap 27. The base casting 26 is mounted on any suitable fixed support.

It will be observed that the riding ring 21 is so placed as to take the majority of the load, an arrangement which permits reduction of the length of the bearing 25 surrounding trunnion 15, and thus facilitates feeding material to the drum.

The bearing structure which supports the riding ring 21 is carried by a base casting 28 formed near its outer ends with two aligned arcuate seats 29. The centers of the arcs of seats 29 are in the plane of the axes of rollers 37 hereafter described.

A unitary housing 30, preferably formed as an integral casting is supported on the arcuate seats 29 of base 27 by means of arcuate pads 31, and two series of anti-friction rollers 33. One series of rollers 33 is interposed between each seat 29 and the corresponding pad 31. This construction permits a rocking movement of the housing 30 on an axis at right angles to the axis of the drum, and insures uniform bearing pressure throughout the length of the supporting rollers.

The housing 30 is formed at its center with a well or depression which is defined at its corners by four parallel vertical guides 34. Mounted in the guide 34 is a frame or

yoke 35 generally rectangular in form and provided with integral guides 36 at its corners. Each guide 36 coacts with a corresponding guide 34, and the two sets of guides serve to constrain the frame 35 to right line movement up and down in housing 30.

Mounted near the ends of housing 30 are supporting rollers 37 upon which the riding ring 21 runs. Each roller 37 turns freely in a fixed shaft 38 clamped by means of caps 39 in seats near the ends of the housing 30. As shown in Fig. 5 antifriction bearings may be used and for purposes of illustration a cylindrical roll type of bearing is shown. The inner race is shown at 40, the outer race at 41, the interposed rollers at 42, and a combined retaining ring and dust guard at 43. Various commercial types of ball or roller bearings may be substituted.

The two rollers 37 and their bearings are so designed that they may, within a reasonable factor of safety, alone sustain the load imposed through the riding ring. To relieve them of part, and preferably approximately half of the load, additional supporting rollers are provided.

These are the rollers 44 which are freely rotatable on fixed shafts 45 which are clamped in seats on the under side of frame 35 by means of the inverted caps 46. The bearing structure is preferably identical with that used for rollers 37.

Each cap 46 is provided with two downward projecting lugs 47 on which are seated the springs 48 whose lower ends bear on the bottom of the well or depression in housing 30. (See Fig. 2.) The yoke or frame 35 is thus supported by eight springs 48 and these springs are so designed that the eight will support approximately half the total load. In other words the rollers 44 relieve the rollers 37 of approximately half the load they would otherwise be called upon to bear. Screws 49 with suitable check nuts permit the housing 30 to be adjusted in the direction of its length. This is the only field adjustment provided.

Fig. 6 shows the use of two riding-rings and two riding-ring supporting bearings to permit the elimination of the trunnion bearing.

A cast base frame 50 takes the place of casting 27, and supports by means of rollers similar to the rollers 33 (not shown in Fig. 6) two housings 30 identical in all essential respects with the housing 30 of Figs. 1-5, and equipped with essentially the same adjusting screws 49, rolls 37, 44, guides 34, 36, frame 35, and supporting springs 48 as is the supporting bearing structure fully shown in Figs. 1 to 5, and already described. These parts, or such of them as are visible are indicated in Fig. 6 by the same reference numerals used to indicate them on Figs. 1 to 5. Details of construction are slightly

varied in the structure of Fig. 6, but essentially it involves the use of two riding rings and bearings of the type already described instead of one.

5 The shell of the grinding drum is indicated at 51 and may be made in sections. It is provided with two riding rings 52 which run on the rolls 37, 44 and have beveled flanges 53. The flanges 53 run against beveled guide wheels 54, one for each riding ring. The wheels 54 are fast on vertical shafts 55 and the wheels and shaft turn in on step bearing 56 and an antifriction bearing 57.

15 The bevels of the guide wheels and flanges are designed to give proper rolling contact and the wheels 54 prevent endwise creep of the drum. Of course, when the housings 30 are properly mounted parallel to each other, and so adjusted transversely to the axis of the drum by means of screws 49 as to bring the axis of the drum and the axis of the rollers parallel, there is no tendency to creep, and the duty on bevel wheels 54 is light. This, of course, is the normal condition.

The drum may be driven in any suitable manner and we show a ring gear 58.

It will be observed that in both embodiments of the invention herein illustrated the rollers automatically divide the load among themselves, and yet are compelled by a very simple mechanical construction to maintain alinement with each other. Furthermore the load is automatically equalized over the entire length of the supporting rollers. The design of all parts is such as to facilitate accurate manufacture, so that adjustments are unnecessary and are not provided for.

40 The invention is susceptible of various slightly different embodiments, and various modifications, all falling within the scope of the appended claims, are contemplated.

In both embodiments of the invention alinement of the axes of the supporting rollers with the axis of the drum is secured by transverse relative adjustment of two bearings. Relative adjustability of two bearings is the essential thing and one bearing might be adjustable as in Figs. 1 to 5 or both as in Fig. 6 without departing from the spirit of the invention. Where only one is adjustable it may obviously be either one.

What is claimed is:—

55 1. The combination of a drum provided with a riding ring; a housing provided with a pair of parallel rollers serving to support said ring; a frame movably mounted in said housing and positively guided thereby to move in a right line toward and from said riding ring; a roller rotatably mounted in said frame on an axis parallel to the axes of the first named rollers; and a spring structure urging said frame toward said riding ring.

2. The combination of a drum provided with a riding ring; a bearing structure including a frame and a plurality of rollers supported thereby and in rolling contact with said ring; and supporting means for said bearing structure serving to permit said structure to rock about an axis substantially at right angles to the axis of said drum.

3. The combination of a drum provided with a riding ring and a trunnion; a self alining bearing for said trunnion; a supporting bearing structure comprising a frame and a plurality of parallel rollers supported thereby and in rolling contact with said ring; and means for adjusting the position of said bearing structure relatively to said trunnion bearing in a direction transverse to the axis of said drum to establish parallelism between said rollers and the axis of said drum.

4. The combination of a drum provided with a riding ring; a housing provided with a pair of parallel rollers serving to support said ring; a support for said housing serving to permit the housing to rock about an axis at right angles to the axis of the drum whereby the pressure between said rollers and ring is equalized over the length of the rollers; a frame movably mounted in said housing and positively guided thereby to move in a right line toward and from said riding ring; a roller rotatably mounted in said frame on an axis parallel to the axes of the first named rollers; and a spring structure urging said frame toward said riding ring.

5. The combination of a drum provided with a riding ring and a trunnion; a self alining bearing for said trunnion; a housing provided with a pair of parallel rollers serving to support said ring; a frame movably mounted in said housing and positively guided thereby to move toward and from said riding ring; a roller rotatably mounted in said frame on an axis parallel to the axes of the first named rollers; a spring structure urging said frame toward said riding ring; and means for shifting the position of said housing relatively to said trunnion bearing in a direction transverse to the axis of said drum to establish parallelism between the axes of said rollers and the axis of said drum.

6. The combination of a drum provided with a riding ring and a trunnion; a self alining bearing for said trunnion; a housing provided with a pair of parallel rollers serving to support said ring; a support for said housing serving to permit the housing to rock about an axis at right angles to the axis of the drum whereby the pressure between said rollers and ring is equalized over the length of the rollers; a frame movably mounted in said housing and positively guided thereby to move toward and from

said riding ring; a roller rotatably mounted in said frame on an axis parallel to the axes of the first named rollers; a spring structure urging said frame toward said riding ring; and means for shifting the position of said housing relatively to said trunnion bearing in a direction transverse to the axis of said drum to establish parallelism between the axes of said rollers and the axis of said drum. In testimony whereof we have signed our names to this specification.

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JULIUS G. BERGMAN.