March 8, 1927.

G. W. MORTHLAND

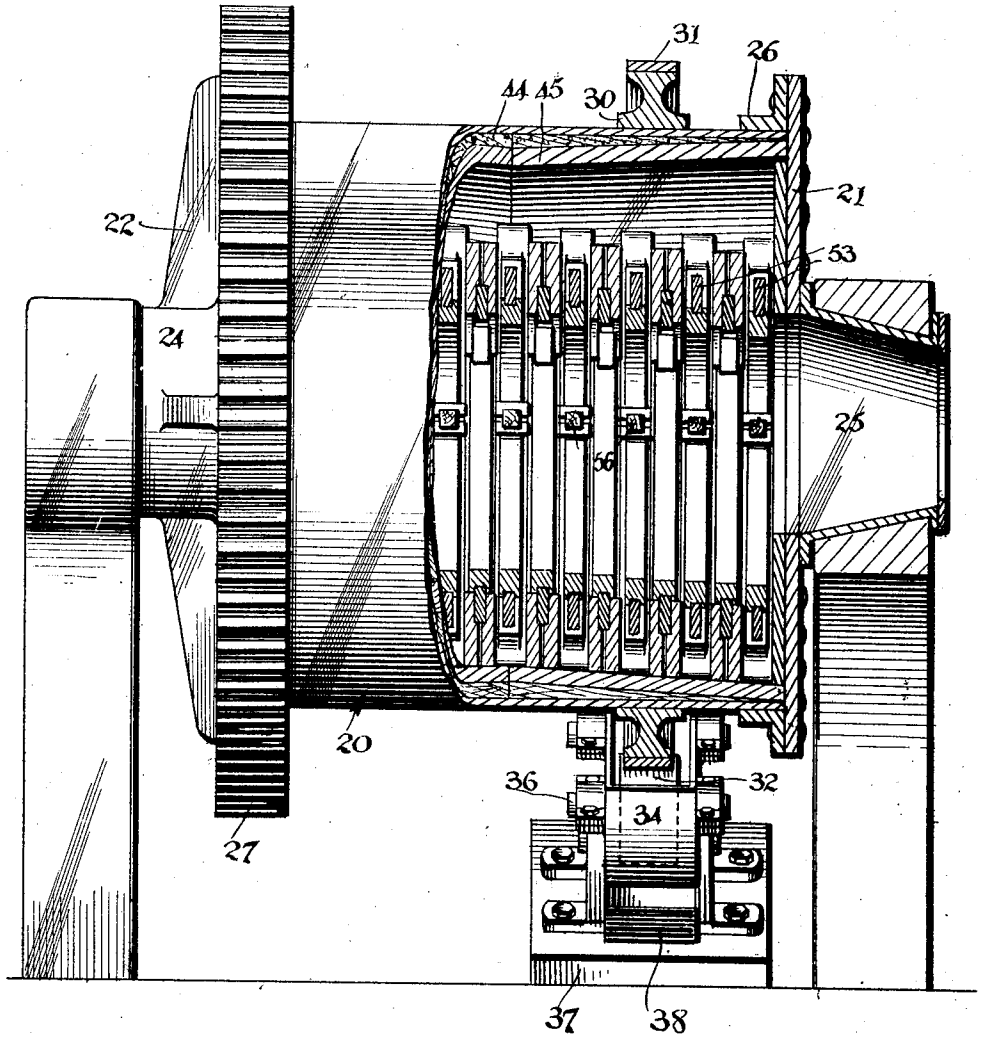
1,620,276

ORE GRINDING MACHINE

Filed May 10, 1921

4 Sheets-Sheet 1

Fig. 1.



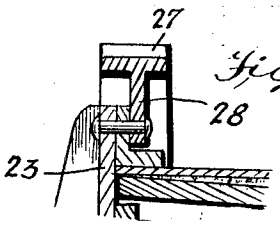


Fig. 2.

WITNESSES

S. R. Rousseau

INVENTOR

G. W. Morthland,

BY

Munn & Co.

ATTORNEYS

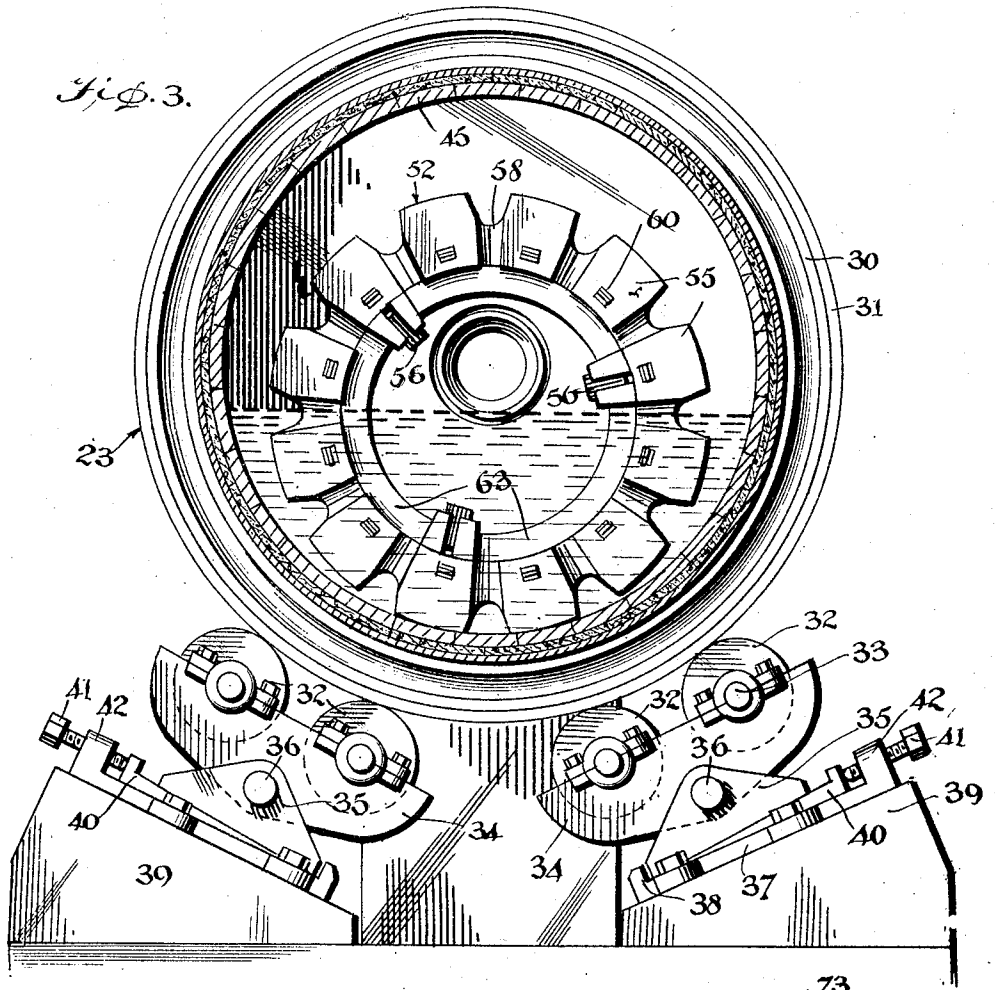
March 8, 1927. 1,620,276

G. W. MORTHLAND

ORE GRINDING MACHINE

Filed May 10, 1921 4 Sheets-Sheet 2

Fig. 3.



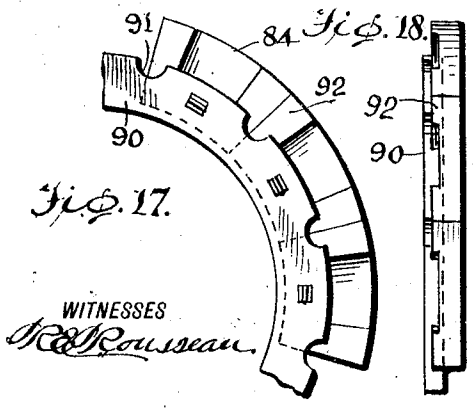
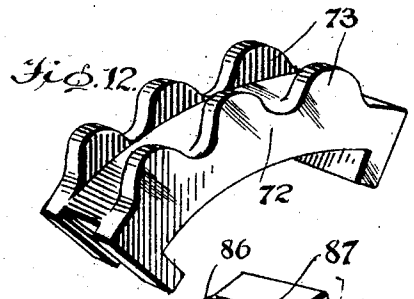


Fig. 17.

Fig. 18.

Fig. 12.



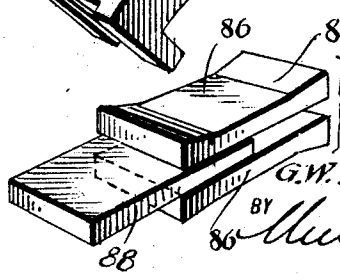


Fig. 16.

WITNESSES

INVENTOR

G. W. Morthland,

BY

ATTORNEYS

March 8, 1927. 1,620,276

G. W. MORTHLAND

ORE GRINDING MACHINE

Filed May 10, 1921 4 Sheets-Sheet 3

Fig. 4.

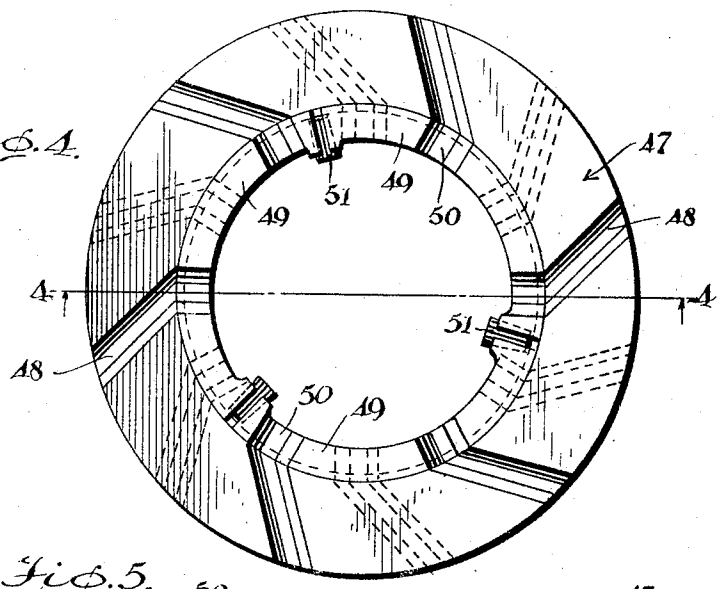


Fig. 5.

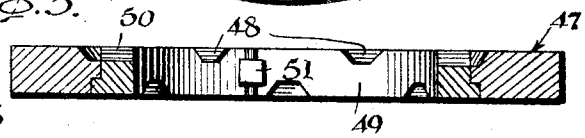


Fig. 8.

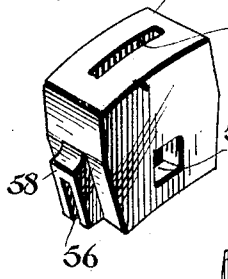


Fig. 6.

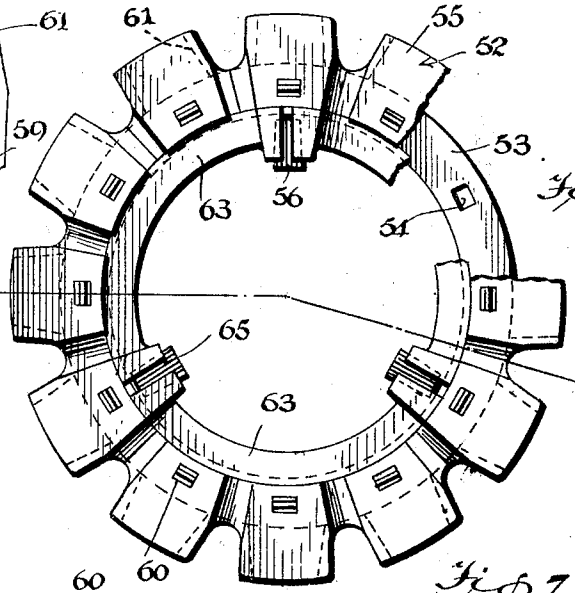
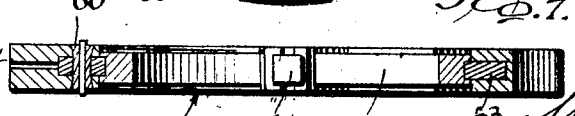


Fig. 7.



WITNESSES

R. E. Rousseau

L. G. Quesada

INVENTOR

G. W. Morthland

Munn & Co.

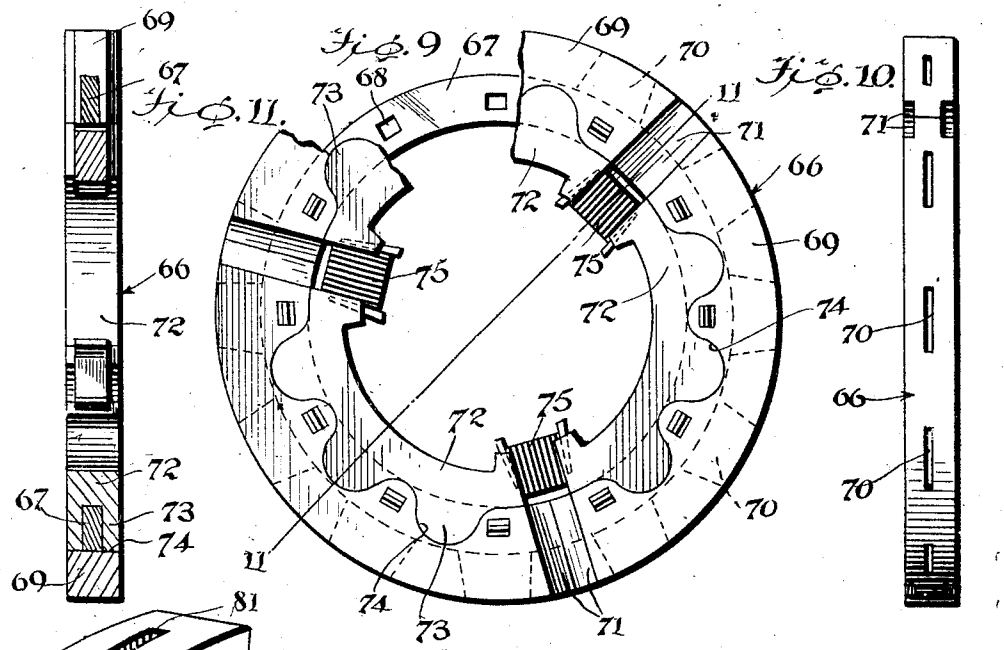
ATTORNEYS

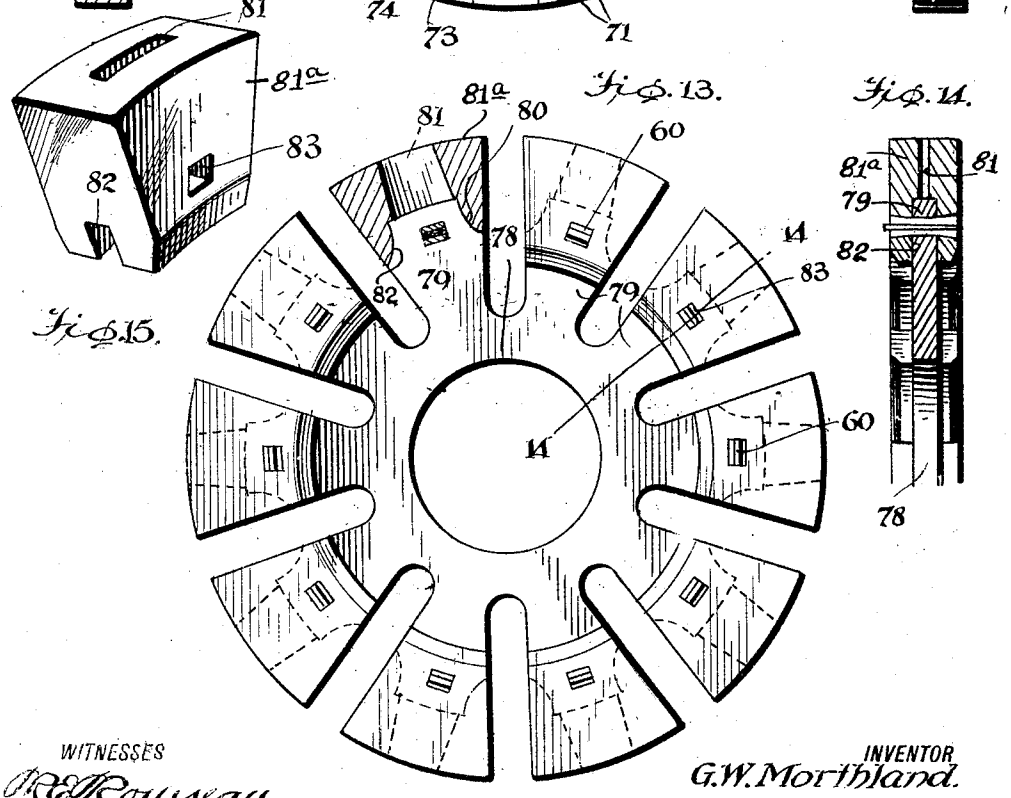
March 8, 1927. 1,620,276

G. W. MORTHLAND

ORE GRINDING MACHINE

Filed May 10, 1921 4 Sheets-Sheet 4





WITNESSES

R. E. Rousseau

A. G. Quesada

INVENTOR

G. W. Morthland.

BY Munn & Co.

ATTORNEYS

Patented Mar. 8, 1927. 1,620,276

UNITED STATES PATENT OFFICE.

GEORGE W. MORTHLAND, OF LEAD, SOUTH DAKOTA.

ORE-GRINDING MACHINE.

Application filed May 10, 1921. Serial No. 468,360.

This invention relates to improvements in ore grinding machines of the tube mill type.

An important object of this invention is to provide an ore grinding machine of the character described which is supported for rotation at one end by means of pairs of swingingly supported rollers engaged with a tire or band surrounding the casing in such a manner that wear on the tire is reduced to a minimum.

A further object of the invention is to provide an ore grinding machine having a casing which is interiorly enlarged toward its ends so as to permit the ore upon being crushed to gravitate freely toward the discharge end of the mill and so as to prevent accumulation of the larger and uncrushed material at the head of the mill.

Further by gradually and uniformly enlarging the mill toward its ends a more uniform sizing and shifting out of the finished products is secured.

The invention forming the subject matter of this application further resides in the formation of the crusher rings as will be more fully hereinafter pointed out.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a vertical sectional view through the improved ore grinding machine.

Figure 2 is a detail sectional view of the rotating ring of the mill.

Figure 3 is a vertical transverse sectional view through the improved ore grinding machine.

Figure 4 is a side elevation of one form of ore crushing ring.

Figure 5 is a transverse sectional view taken on line 4—4 of Figure 4.

Figure 6 is a fragmentary side elevation of a further modification of the crusher ring.

Figure 7 is a horizontal sectional view taken on line 7—7 of Figure 6.

Figure 8 is a perspective of one of the crushing shoes detached.

Figure 9 is a side elevation of a still further modified form of ore crushing ring, parts being broken away.

Figure 10 is an edge elevation of the ore crushing ring illustrated in Figure 9.

Figure 11 is a vertical transverse sectional view taken on line 11—11 of Figure 9.

Figure 12 is a perspective of one of the pressure weights embodied in the form of the invention illustrated in Figures 9 to 11 inclusive.

Figure 13 is a side elevation of a still further modified form of ore crushing ring, parts being shown in section.

Figure 14 is a detail transverse sectional view taken on line 14—14 of Figure 13.

Figure 15 is a perspective of an ore crushing shoe illustrated in Figure 13.

Figure 16 is a group perspectve of a key or fastening device embodied in the invention.

Figure 17 is a fragmentary side elevation through a further modification of the crushing roller.

Figure 18 is a fragmentary edge elevation of the crushing member illustrated in Figure 17.

In the drawings wherein for the purpose of illustration is shown several preferred embodiments of the invention, the numeral 20 generally designates a casing having end walls 21 and 22 in the form of disks. The end walls 21 and 22 may correspond to the construction of the end wall shown in my United States Patent 1,363,999 and are provided with tubular trunnions 24 and 25 through which a quantity of liquid is supplied. The ore upon being crushed within the casing is, of course, carried off through the outlet trunnion 25 and is subsequently separated from the liquid in any desired manner. The end plates 21 and 22 are secured to the casing by means of retaining rings 26 which as illustrated in Figure 1 have flanges contacting with the end plates and surrounding and secured to the casing. The radially projecting flanges of the retaining rings 26 may be secured to the edge portions of the end plates 21 and 22 by rivets or other suitable means.

A ring gear 27 is arranged about one end of the casing and is provided with an inwardly directed attaching flange 28 secured to the retaining ring 26 by means of the rivets which connect the retaining ring 26 to the end plate 22. The ring gear 27 is engaged by a beveled gear operated from any suitable source of power.

The casing is provided adjacent its other end with a rim 30 about which a metallic tire 31 is arranged and which is mounted

upon pairs of rollers 32. With reference to Figure 3 it will be observed that the rollers 32 which are arranged in pairs are provided with laterally projecting pins 33 connected to the sides of cradles 34 into which the rollers 32 extend. Each cradle 34 is connected intermediate its ends at a point adjacent its lower end or side with a pair of upstanding apertured ears 35 by means of trunnions 36. The ears 35 which are arranged on opposite sides of the cradles are of course provided with connecting plates mounted upon the base plates 37 and each having one end formed with an upstanding lug 38 which limits the sliding movement of the ears 35. The base plates 37, of which there are two, are secured on inclined supports 39 arranged on opposite sides of the vertical center of the casing. Wedges 40 are arranged between ears 35 and the base plates 37 and are forced beneath the ears 35 by means of set screws 41 having threaded engagement with the upstanding ears 42 formed at the upper ends of the base plates 37. By tightening the set screws 41 the wedges 40 may be forced beneath the supporting members 45 so that the cradles 34 will be elevated. As the rollers 32 may partake of a slight movement about the axis of each pair of trunnions 36 wear on the tire 31 and on the rollers is reduced to a minimum. Further, the specific supporting means employed for the casing permits shocks incident to the operation of the crushing disks to be absorbed without undue strain on the machine.

As illustrated in Figure 1, a lining of concrete 44 is arranged within the casing as is a lining 45 of hard iron or the like. The lining 45 has its internal diameter decreased gradually and uniformly toward the center of the casing so as to form what might be termed the rim at the center of the casing over which the bore passes when properly ground. The internal diameter of the casing is decreased toward its center or intermediate portion by decreasing the thickness of the concrete lining at the ends of the casing.

In my United States Patent #1,366,999 the casing was gradually reduced toward its discharge end so that the ore upon being crushed was forced to ascend rather than descend with the result that the larger particles of ore accumulated at the head of the machine. However, in accordance with the present invention the ore upon being properly crushed is permitted to freely gravitate toward the discharge end of the mill, since the mill is gradually and uniformly enlarged toward its discharge end.

However, since the mill is gradually decreased in its internal diameter from its inlet end, the larger particles of ore are retained within the enlarged end of the casing until ground by the action of the crushing members. By gradually increasing the internal diameter of the casing toward its ends, the accumulation of the heavier particles of ore at the head of the machine is prevented and more uniform sizing and sifting out of the finished product as adapted to the stream flowing through the mill is admitted.

A plurality of rotary crushing elements are arranged within the casing and have their opposed sides in contact so that as the casing is rotated by means of the ring gear 27 and the source of power connected to the same the ore will be engaged by the several crushing members upon moving outwardly and crushed or partially crushed to the desired fineness. The several crushing disks may decrease in thickness toward the discharge end of the mill so as to cause the disks to rotate with relation to each other whereby the ore positioned between the disks will be pulverized when the machine rotates.

The crushing members may be of the type ilustrated in Figures 4 and 5 wherein the disk is designated by the numeral 47 and is provided with a plurality of grooves 48 which extend obliquely with relation to the radius of the disk and out through the edges of the same to permit of the passage and crushing of the ore. As in the case in the aforesaid patent, the disks rotate with relation to each other and the ore received within the grooves is crushed by this rotation of the disks with relation to each other. However, by arranging the grooves 48 obliquely with relation to the radius of the disk, the material being crushed is not carried so high on the ascending side of the disk as it would be with radially extending grooves and the material is free to pass through the pocket on the descending side of the disks. By reason of this construction, less power is required to operate the mill and the crushing capacity of the same is substantially increased.

A plurality of arcuate crushed weights 49 may be engaged with the inner edge of the disk 47 and are provided with radial grooves 50 registering with the obliquely extending grooves 48 to permit of passage of the ore. The ends of the arcuate sections 49 are enlarged and are formed with grooves to receive the wedges 51 which act as a means for holding the sections in their extended positions as indicated in Fig. 4.

In the form of the invention illustrated in Figures 6 to 8 inclusive the crushing member which is generally designated by the numeral 52 includes a master ring 53 of steel or the like and which is provided with an annular series of spaced openings 54. An annular series of crushing shoes 55 of approximately segmental formation are formed with slots 56 which snugly receive the master ring 53 and which have their edges formed with

spacing shoulders 58. The spacing shoulders 58 act as a means for spacing the outer portions of the shoes to form pockets in which ore is received. The shoulders 58 which are less in thickness than the thickness of the shoes also define radial grooves through which ore is passed when being crushed. The shoes 55 are provided on opposite sides of the slot 56 with openings 59 aligning with the openings 54 for the reception of a key or fastening device generally designated by the numeral 60. With reference to Figure 8 is will be noted that each shoe is provided with a radially extending slot 61 into which a quantity of ore is tightly packed during the operation of the machine so as to engage the outer edge of the master ring 53 and prevent the loosening of the shoe should the key generally designated by the numeral 60 become loose. In other words, the opening 61 communicates with the transverse slot 56 so that the ore packed within the opening 61 may contact directly with the outer edge of the master ring. The opening 61 in the shoe 55 also provides means whereby the shoes which are of steel may be properly tempered to withstand the friction incident to use.

The crusher illustrated in Figures 6 to 8 inclusive may be provided with an annular series of arcuate pressure weights 63 having grooves which receive the inner edge portions of the master ring and having their ends formed with transverse grooves for receiving retaining wedges 65.

In the form of the invention illustrated in Figures 9, 10, 11 and 12 the crusher member is generally designated by the numeral 66 and comprises a master ring 67 having a plurality of spaced openings 68 adapted for the reception of fastening devices 60 which are employed for securing arcuate shoes 69 in position. The arcuate sections 69 are formed with radial openings 70 which permit the material being crushed to engage the outer edge of the master ring 67 and thereby relieve the strain on the fastening devices 60. In other words the radial openings 70 communicate with the grooves which receive the master ring 67 and thereby permit the material packed within the opening to contact directly with the outer edge of the master ring and to cooperate with the fastening devices in holding the arcuate sections 69 against movement. The ends of the arcuate sections 69 are formed with reduced shoulders 71 which define radial grooves for the passage of the ore between the disks.

Pressure weights 72 of a material cheaper than the shoes 69 are arranged about the inner side of the master ring 67 and are formed with spaced lugs 73 which are received within the spaced notches 74 in the shoes whereby the pressure weights 72 are held against movement. By holding the pressure weights 72 against movement with relation to the shoes 69, the inner ends of the radial grooves formed by the shoulders 71 are never closed. It will be noted with reference to Figure 9 that the arcuate pressure weights 72 terminate at the ends of the shoes 69 and do not extend over the inner ends of the grooves whereby the grooves are entirely open. The ends of the pressure weights are, however, engaged by spacing wedges 75. The material necessary for the arcuate shoes 69 is considerably reduced since the lugs 73 extend for a substantial distance into the shoes and thereby take the place of non-wearing parts of the shoes.

In the form of the invention illustrated in Figures 13 and 14, the master ring or spider 78 is formed with an annular series of radial spokes 79 having their outer ends reduced to form shoulders 80. Substantially segmental shoes 81[a] are formed with radial openings 81, the inner end portions of which are enlarged to produce the sockets 82 which receive the reduced outer ends of the spokes 79 and have their end walls in contact with the shoulders 80 whereby the shoes are held against endwise movement. Fastening devices 60 are extended through transverse openings 83 in the shoes and through aligning openings in the outer portions of the spokes. The spokes 79 have their opposed edges spaced so that the shoes 81[a] are also spaced to define passages for the ore being crushed.

In the form of the invention illustrated in Figures 17 and 18 the master ring 90 is provided with a plurality of recesses 91 into which the laterally enlarged portions 92 of the crushing shoes 84 are received to prevent displacement of the crushing shoes when the same wear down to the outer edge of the master ring 90. The crushing shoes 84 are of course connected to the master ring by means of fastening devices 60.

With reference to Figure 16, it will be noted that each fastening device 60 comprises a pair of elongated sections 86 having their outer sides formed with shoulders 87 which hold the fastening device against endwise movement after the application of a tapered wedge designated by the numeral 88. The fastening device may be constructed of hard wood and upon coming into contact with the water swells somewhat and is more firmly held in position.

The several types of crushing members are of course arranged within the mill and act as a means for thoroughly and uniformly crushing the ore passed through the mill. The operation of the improved mill is substantially the same as the construction illustrated in my prior patent with the exception of the advantages derived from the

use of the improved forms of crushing disks and from the use of the specific form of liner.

Particular attention is directed to the showing in Figure 13 wherein the openings 81 are tapered toward the material collecting ends thereof so that material received in the openings 81 is firmly packed against the outer portions of the spokes to positively overcome the tendency of the shoes to work loose through wear which will occur without this provision. The fact that the openings 81 are tapered toward the outer ends thereof allows the material to pack in the openings freely and at the same time positively prevents the material from squeezing out.

It is also important to note that by making the shoes separate rather than solid, the possibility of tempering or annealing is accomplished, giving a more uniform degree of toughness than can be secured by casting them solid.

Having thus described the invention, what is claimed is:—

1. A crushing device for mills comprising a master ring, crushing shoes having openings receiving said ring, said shoes being provided with radial openings communicating with said first named openings whereby the material being ground will be packed within said radial openings and engaged with said ring, and fastening devices for securing said shoes to said ring.

2. A crushing device for mills comprising a master ring, crushing shoes having grooves receiving the ring and provided with openings communicating with said grooves for receiving the material to be operated on, and means to secure the shoes to the ring.

3. A crushing member for mills comprising a master ring having an annular series of spokes, and shoes detachably connected to said spokes, said shoes being provided with openings adapted to receive material to be packed in engagement with said spokes.

4. A free rolling gravity actuated crushing member for mills comprising a master ring having spokes, the terminal portions of which are tapered to define shoulders, crushing shoes having material collecting openings receiving the tapered portions of said spokes, said material collecting openings being decreased in cross sectional area toward the material inlet ends thereof whereby material collected in the openings is firmly packed in engagement with said ring to hold the shoes against loosening, and means to secure said shoes to the spokes, said shoulders being engaged with the shoes.

5. A free rolling gravity actuated crushing member for mills comprising a ring having an annular series of spokes, separate crushing shoes having openings for receiving said spokes, said material collecting openings being decreased in cross sectional area toward the material inlet ends thereof whereby material collected in the openings is packed firmly in engagement with said spokes to hold the shoes against loosening on the spokes, said shoes and said spokes being provided with registering openings, and fastening devices passing through said registering openings.

6. A free rolling gravity actuated crushing member for mills comprising a master ring, and separate crushing shoes having material collecting openings receiving said ring and being decreased in cross sectional area toward the material inlet ends thereof, whereby material collected in the openings is firmly packed in engagement with said ring to hold the shoes against loosening.

7. A free rolling gravity actuated crushing member for mills comprising a master ring adapted to be rotated at a high speed, separately formed crushing shoes having material collecting openings extending therethrough and receiving said ring, said material collecting openings being gradually decreased in cross sectional area toward the material inlet ends thereof, whereby material collected in the openings is firmly packed in engagement with said ring to hold the shoes against loosening, the outer portions of said ring being enclosed in said shoes and protected thereby, and separate fastening devices cooperating with the material collected in said material collecting openings to hold the shoes in place on the ring.

8. A crushing member comprising a body, and shoes carried thereby, and having openings extended outwardly from said body whereby the material operated on is packed in said openings in engagement with said body to hold the shoes in position.

GEORGE W. MORTHLAND.