Oct. 2, 1951 T. G. CECKA 2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Filed Jan. 30, 1947 5 Sheets-Sheet 1

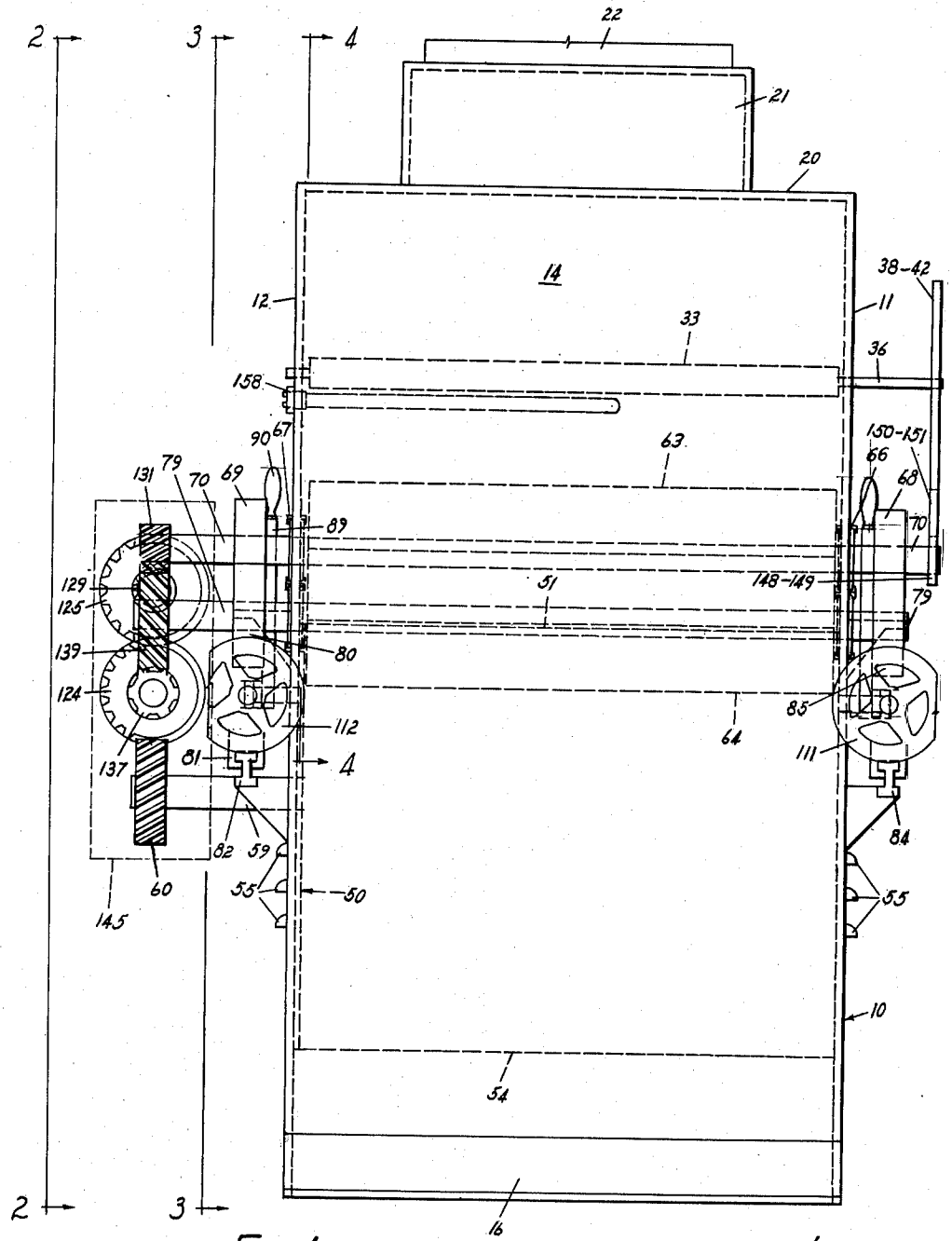


FIG. 1

INVENTOR
THOMAS G. CECKA
BY Paul, Paul & Moore
ATTORNEYS

Oct. 2, 1951 T. G. CECKA 2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Filed Jan. 30, 1947 5 Sheets-Sheet 2

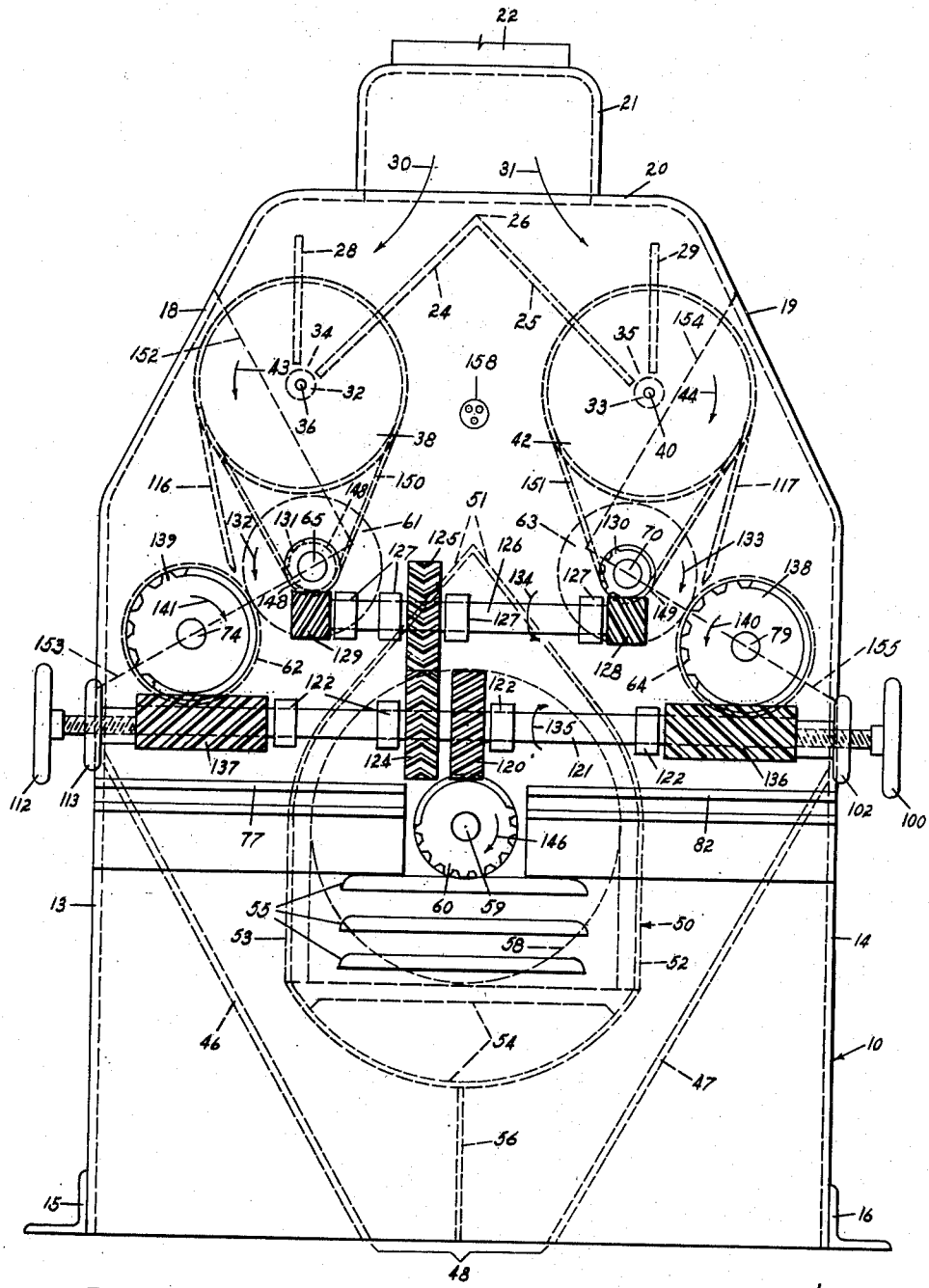


FIG. 2

INVENTOR
THOMAS G. CECKA

BY Paul, Paul & Moore

ATTORNEYS

Oct. 2, 1951 T. G. CECKA 2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Filed Jan. 30, 1947 5 Sheets-Sheet 3

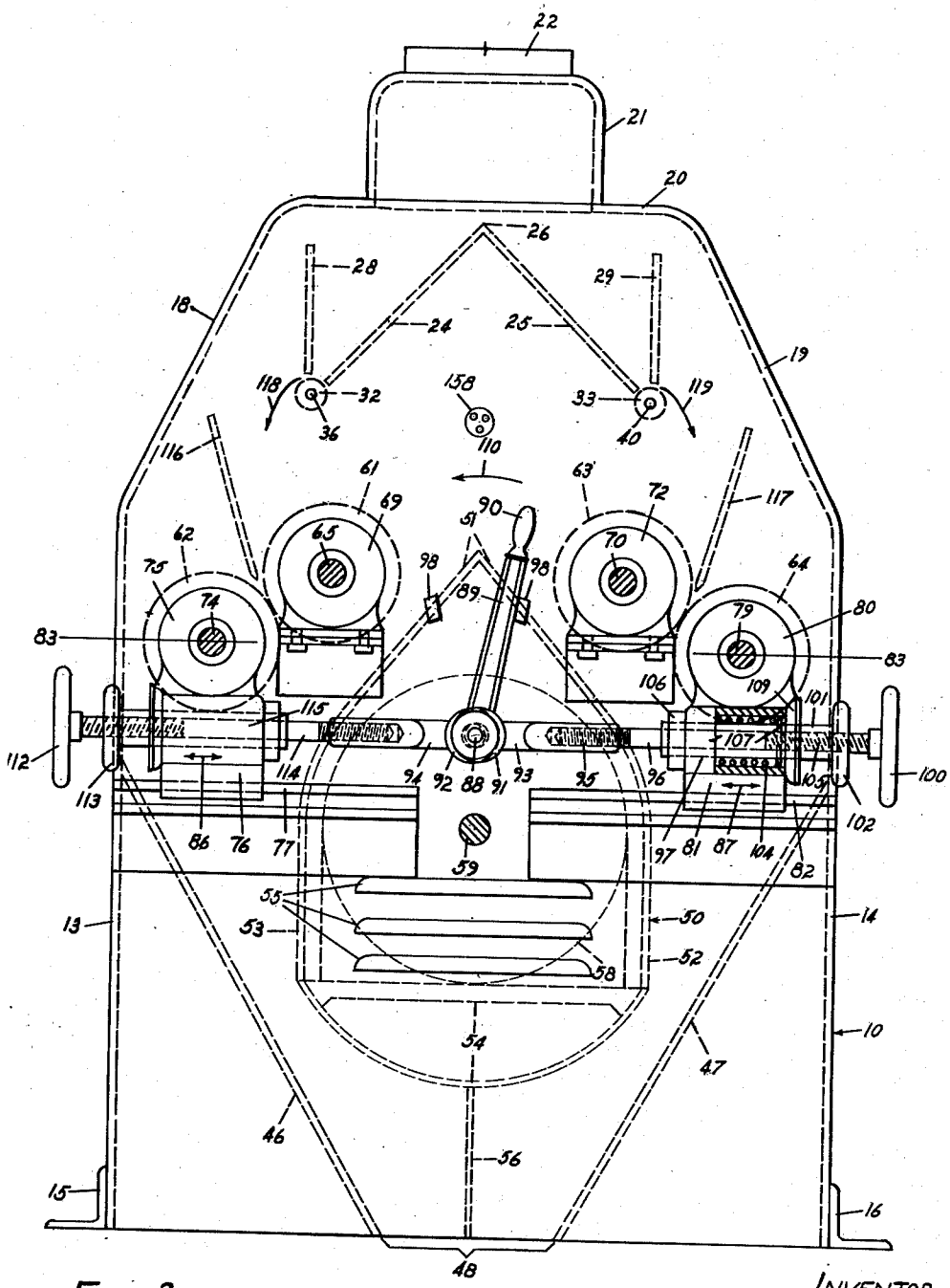


FIG. 3

INVENTOR
THOMAS G. CECKA
BY Paul, Paul & Moore
ATTORNEYS

Oct. 2, 1951 T. G. CECKA 2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Filed Jan. 30, 1947

5 Sheets-Sheet 4

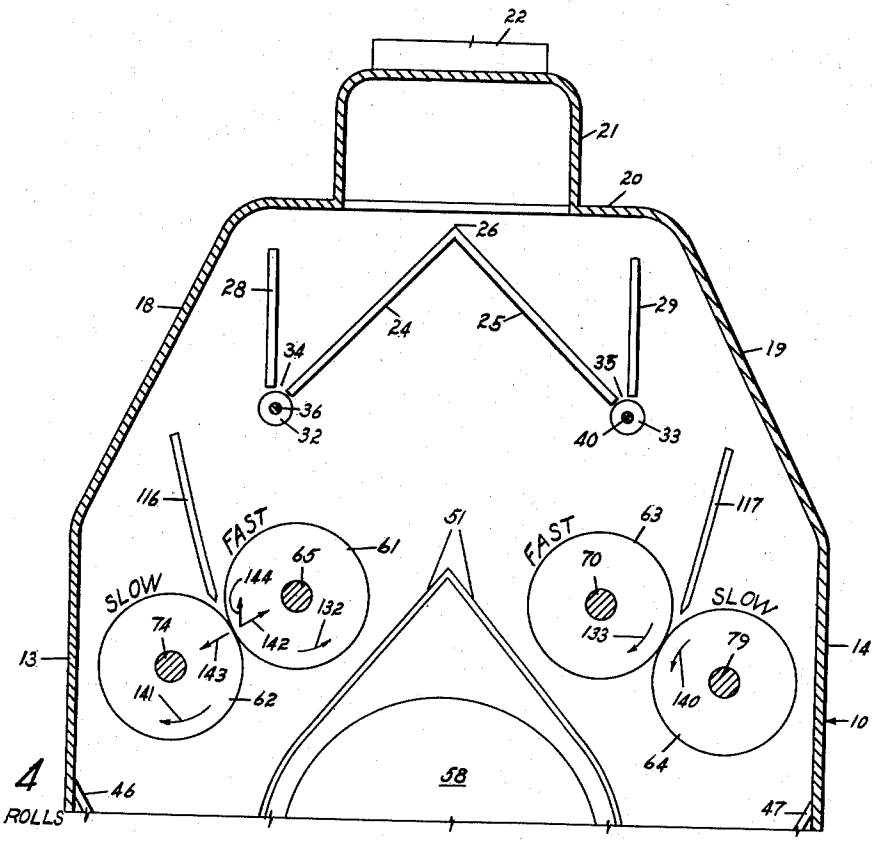


FIG. 4

NEW ROLLS

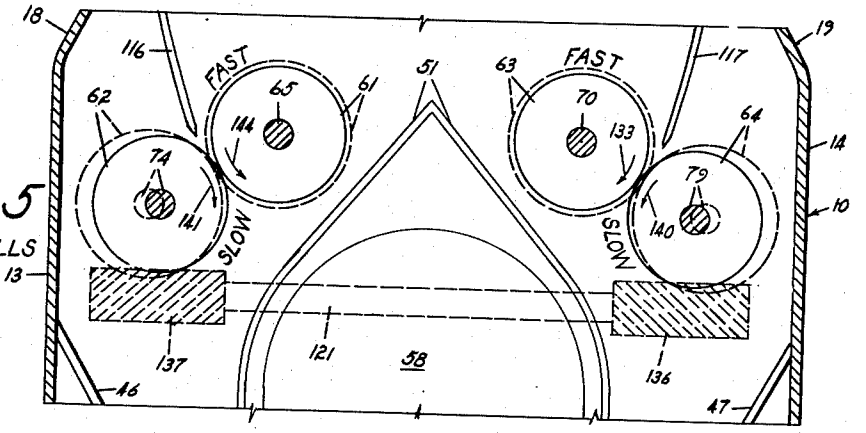


FIG. 5

OLD ROLLS

INVENTOR
THOMAS G. CECKA
BY Paul, Paul & Moore
ATTORNEYS

Oct. 2, 1951 T. G. CECKA 2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Filed Jan. 30, 1947 5 Sheets-Sheet 5

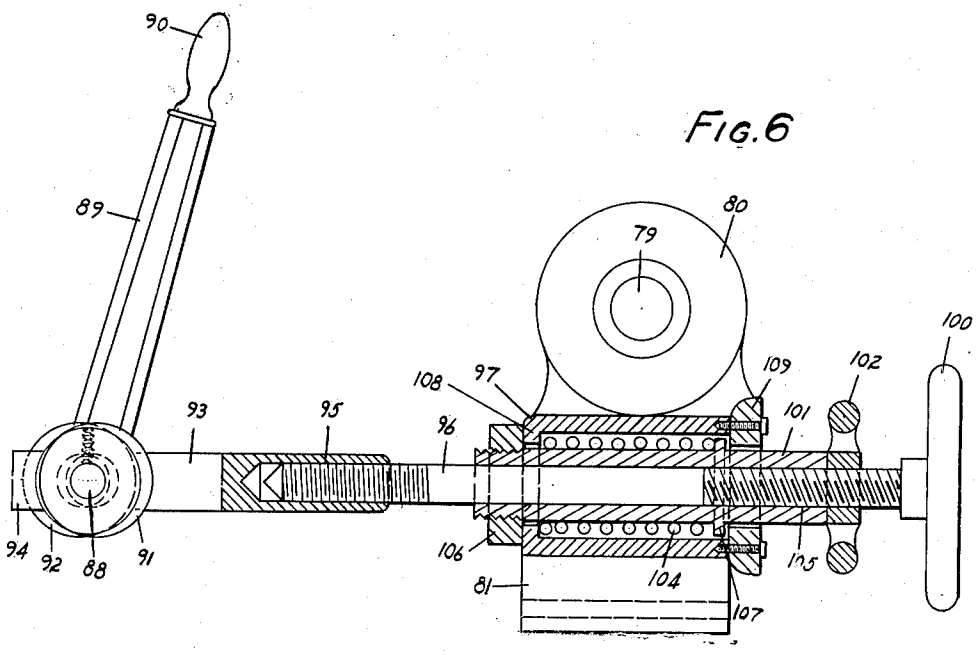


FIG. 6

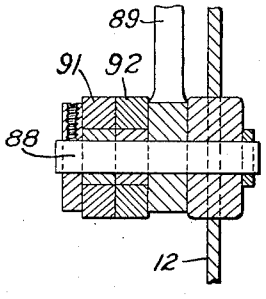


FIG. 7

INVENTOR.
THOMAS G. CECKA
BY Paul, Paul & Moore
ATTORNEYS

Patented Oct. 2, 1951

2,569,744

UNITED STATES PATENT OFFICE

2,569,744

MULTIPLE STAND ROLLER MILL WITH WORM AND WORM WHEEL DRIVE TO EACH ROLL

Thomas G. Cecka, Minneapolis, Minn., assignor to International Milling Company, Minneapolis, Minn., a corporation of Delaware

Application January 30, 1947, Serial No. 725,392

6 Claims. (Cl. 241—135)

1

This invention relates to roller mills and more particularly to improvements in the construction of roller mills of the type used in the milling of dry, pulverulent material, such as grain, feeds, mill products, salts, pharmaceuticals and the like.

Roller mills have long been used for the breaking and milling of dry material, and in the grain milling and other industries have been widely used in batteries of many mills operating in parallel. In such installations it has been common to provide a line shaft for supplying power to a battery of mills, each mill or "mill stand," as it is sometimes designated, being driven by a belt to the common line shaft, and the mills have been designed to accommodate such drives.

While these mill installations are satisfactory and have served to mill countless tons of materials, they are subject to many serious defects due to the type of installation required and due to their inherent mechanical construction.

One of the most serious defects in the common belt driven mill stand arises out of the common drive. Since all mills were of necessity belted to a common line shaft any operational defect necessitating servicing of one mill has frequently required a shut-down of the entire drive shaft and all mills connected to it. Furthermore, the belt drive itself, has involved relatively short belts with consequent high belt tensions in order to deliver the required horsepower, and this has led to defects in operation occasioned by bearing failure, misalignment of the roll, damaged rolls, etc. In addition, heavy stress of the belts is transferred from the mill to the building in which it is housed.

It is an object of the present invention to provide an improved roller mill wherein an individual drive is provided for each mill and furthermore to provide an improved gear drive between the motive power source and the several slow and fast rolls of the mill.

Other defects of the present mills have arisen out of their construction wherein the cooperating fast and slow rolls are situated at equal levels. In such roller mills the entire thrust of the rolls, occasioned by the pressure of the material being milled between them, has had to be carried by the roll shaft bearings and this bearing load, taken with the added load due to belt tension of the drive, has been the cause of frequent operational difficulties. It is an object of the present invention to provide an improved roll mill wherein the thrust due to material pressure on the rolls while milling is at least partially compensated by the weight of the roll itself so as to relieve in part the excessive load on the bearings of the mill.

2

Another serious objection to conventional mills is the fire hazard and employee hazards occasioned by the belt drives employed for driving the rolls. It is an object of the invention to eliminate these hazards by providing a self-contained gear drive unit in which the roll drive belts are eliminated and which are consequently free from danger due to the ignition of dust by static electricity on the belt and free from danger to employees. It is a further object to provide an improved self-contained milling unit wherein all working stresses are within the unit itself and not communicated to the building as with belt driven mills and which is free from the vibration which has commonly been encountered due to large rotating pulleys in belt driven mills.

It is also an object of the invention to provide an improved roller mill wherein the rolls are driven by direct mechanical gear connection from a motive power source and at the same time provision made for wide variations in adjustment of the rolls to compensate for wear of the rolls with efficient gear drive connection being maintained the while.

It is a further object of the invention to provide an improved mill wherein the fast roll is positioned above and partially overlying the slow roll so as to eliminate the necessity for tramming the rolls (i. e. maintaining precise parallelism) under milling conditions. It is a further object to provide an improved gear drive wherein shorter shafting is provided. This reduces bowing of the roll shafts and torsional strains which were common causes of failures with the rather long roll shafts needed in belt driven mills.

Other and further objects of the invention are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated with reference to the drawings in which

Figure 1 is a side elevational view of the machine with certain parts removed;

Figure 2 is an end elevational view taken in the direction of arrows 2—2 of Figure 1 showing the drive gears exposed and their enclosing housing removed;

Figure 3 is a sectional view taken in the direction of arrows 3—3 of Figure 1;

Figure 4 is a fragmentary sectional view taken along the lines and in the direction of arrows 4—4 of Figure 1 illustrating the position of the rolls when they are new;

Figure 5 is a fragmentary sectional view corresponding to Figure 4, likewise taken along the line and in the direction of arrows 4—4 of Figure 1,

illustrating the rolls after they have been reduced in diameter during their service life;

Figure 6 is an enlarged detail of the adjusting mechanism for moving one of the roll shafts and is representative of the mechanism used for adjusting the ends of the rolls; and

Figure 7 is a fragmentary sectional view through one of the quick throw-out levers and associated cams.

Throughout the drawings corresponding numerals refer to the same parts.

Referring to the drawings the machine comprises a frame and housing generally designated 10 having end plates 11 and 12 and side plates 13 and 14. The housing may be cast or fabricated of any suitable materials and is preferably provided with a bolting flange at 15 and 16 by which the machine can be bolted to the milling floor. The upper portions of the side plates 13 and 14 converge inwardly at 18 and 19 and thence are shaped in to form the top 20 which is provided with a header 21 which is in turn attached to the supply chute 22.

The interior space of the housing is provided with upwardly converging baffles 24—25 which meet at the point 26. These baffles, together with the baffle boards 28 and 29, all extend from one end plate 11 to the other end plate 12 and form interior hoppers so that the material being fed flows in the direction of arrows 30 and 31 onto the feed rolls 32 and 33. The feed rolls are relatively small diameter and serve almost to close the bottom spaces 34 and 35 formed by the converging baffles 24—28 and 25—29, respectively.

Feed roll 32 is mounted upon the feed roll shaft 36 which is journaled in the end plates 11 and 12 and extends outwardly beyond rear end plate 11 and carries a relatively large diameter pulley 38. Similarly, the feed roll 33 is carried upon the shaft 40 which is likewise journaled in the end plates 11 and 12 and extends out beyond rear end plate 11, as shown in Figure 1, where it carries the pulley 42. Feed roll 32, its shaft and pulley rotate in the direction of arrow 43, and feed roll 33, its shaft and pulley 42 rotate in the direction of arrow 44, being belt driven as hereinafter described. Likewise, within the housing there are a pair of downwardly extending and converging baffles 46 and 47 which extend from the side walls 13 and 14, respectively, and at their lower ends form a chute space 48 which is connected to delivery chutes leading to classifying machinery below the milling floor. The converging chute formed by the baffles 46 and 47 collects the milled material as hereinafter described and thus delivers it from the mill.

Within the space between the baffles 46 and 47 there is a motor housing enclosure or tunnel 50 which extends from end plate 11 to end plate 12. The housing has a bottom portion 54 and sides 52 and 53 which converge upwardly at their top portions 51—51 at an angle such that the milled material will not lodge thereon. The motor housing tunnel 50 is formed integrally with the end walls 11 and 12 and is suitably supported by interior bracing not illustrated. The end walls 11 and 12 are, of course, provided with opening plates on the ends of the tunnel 50 and these plates are provided with louvers 55 so as to allow through ventilation from one end to the other for cooling the drive motor therein. The motor 58 which is mounted in tunnel 50 is thus completely isolated from the milled material falling downwardly within the hopper space formed between the baffles 46 and 47. From motor 58 there extends

a shaft 59 carrying a main drive gear 60. Below the housing tunnel there is a central web 56 extending from end plate 11 to end plate 12 which serves to separate the two streams of milled material falling on opposite sides of the housing 50. In some instances these streams may be different, and the separation 56 thus permits them to be separately withdrawn.

Within the main housing there are also positioned two pairs of milling rollers 61—62 and 63—64, each roller being provided with a shaft upon which it is journaled. The shaft 65 carries roll 61 and extends through stuffing boxes 66 and 67 in the end plates and is journaled upon pillow block 68 which is mounted upon end plate 11 and pillow block 69 which is mounted upon plate 12. Similarly, shaft 70 of roll 63 likewise extends through the stuffing boxes in the end plates 11 and 12 and is likewise journaled in suitable bearings fastened on the end plates, one of the bearings 72 on end plate 12 being illustrated in Figure 3. The bearings carrying the shafts 65 and 70 and hence the rolls 61 and 63, respectively, are journaled upon fixed journals which do not move in respect to the end plates 11 and 12. Hence, the axis of rotation of the rolls 61 and 63 remains fixed throughout their service life.

Roll 62 is supported upon shaft 74 which likewise extends out through stuffed boxes in the end plates 11 and 12 and is supported by journals 75 illustrated in Figure 3 and a corresponding journal at the other end of the machine. These journals are mounted upon a frame 76 having a T-slot connection to a correspondingly shaped slide 77 attached to the end plates 11 and 12. Similarly, roll 64 is mounted upon shaft 79 which likewise extends out through suitable stuffing boxes in the end plates 11 and 12 and is carried by journals mounted upon each end plate, as hereinafter described. One of the journals 80 is illustrated in Figure 3 and there is a corresponding journal at the other end of the machine. The journal 80 is likewise mounted upon the frame 81 which has a T-slot connection to the correspondingly shaped slide 82 which is solidly fastened to the end plate 12. The journals at each end of the machine carrying the roll shafts 74 and 79 of rolls 62 and 64, respectively, are thus permitted to move in a plane transverse to the machine, the plane being at lines 83—83. Suitable sliding stuffing boxes are provided at each end of each shaft 74 and 79 where they pass through the end plates 11 and 12 and thus keep dust from the milling operation from passing out of the mill around the shafts. The stuffing boxes are either split diametrically or are made so as to lift from the machine frame, so as to allow removal of the rolls and their shafts and gears when the mill frame is opened as hereinafter described.

Figure 3 shows the two slides 77 and 82 which are permanently fastened to end plate 12. Figure 1 shows the slide 82 which carries journal 80 adjacent end plate 12 and also shows the slide 84 carrying the journal 85 at the other end of the machine upon which the shaft 79 is mounted. It is to be understood, of course, that the journal, not illustrated adjacent rear end plate 11 and at the far end of shaft 74, is likewise mounted upon a slide exactly similar to that shown at 77 and 82 in Figure 3. The journal constructions for the shafts 74 and 79 and their adjustments hereinafter described are identical at each end of the machine and therefore it is only necessary to

describe in detail the construction adjacent the end plate 12.

Referring to Figure 3 the slide 77 carries the frame 76 so that the frame 76 carrying the journal 75 may move in a translatory motion back and forth in the direction of the double arrow 86. Similarly, the slide 82 which mounts the frame 81 carrying the journal 80 permits the frame 81 and journal 80 to be moved in the direction of the double arrow 87. Thus, both the journals 75 and 80 can move back and forth and hence carrying the shafts 74 and 79 in a transverse plane at the level of line 83—83. The degree of such movement permitted in the machine is sufficient to accommodate not only the desired opening of the machine for clearing any jams that may occur, but also sufficient to permit the movement of rolls 62 and 64 more closely adjacent the rolls 61 and 63, respectively, so as to maintain the desired close clearance for milling as the rolls are reduced in size during their service life. It may be pointed out at this juncture that in ordinary miling practice for flour milling machinery, the rolls 61 and 63, 62 and 64 are approximately nine inches in diameter as initially manufactured. The rolls may be smooth or corrugated (rough), depending upon the type of milling effect desired. As the milling takes place, there is some wear on the roll and it is customary to remove the rolls from the machine from time to time and re-finish them to true and accurate diameter throughout their length and to re-corrugate them when corrugations are desired. This effects an overall reduction in the diameter of the roll and compensatory adjustment must therefore be provided to maintain desired close clearance for milling. Figure 4 represents the position of the rolls set close as during miling when the rolls are of maximum diameter when new. Figure 5 in the full line position illustrates the position of the rolls likewise set close for milling but after they have been reduced in diameter during the service life. The dotted lines in Figure 5 illustrate the position of the rolls when they are new and corresponds thus to the full line showing of Figure 4.

Figure 3 and Figure 6, which is an enlarged view of the mechanism for shaft 79, illustrate the mechanism for adjustment of each of the adjustable rolls 62 and 64. For this purpose there is provided a shaft 88 and another shaft coaxial with it at the other end of the machine. Both shafts are mounted on their adjacent end plates. Upon the shaft there is mounted an oscillatable lever 89 having a handle portion 90; the lever carries two eccentrics 91 and 92 to which there are attached eccentric links 93 and 94, respectively. Link 93 serves roll 64 and link 94 serves roll 62. The link 93 has a threaded connection at 95 to the rod 96, and rod 96 extends through a cylindrical space 97 in the bearing frame 81 and thence to termination at the hand wheel 100 which is solidly mounted on rod 96. By turning the hand wheel 100 the rod may be threaded more or less into the threaded connection 95. Upon the rod 96 there is mounted sleeve 101 which is threaded at 105 upon the rod 96. The threads 95 are fine threads and 105 are coarse threads. Hence, by rotating rod 96 by means of hand wheel 100 the sleeve can be moved axially in respect to eccentric link 93. A "locking nut" hand wheel 102 is threaded on shaft 96 at threads 105 and by turning wheel 102 tight, any adjustment of the sleeve 101 on rod 96 can be fixed. Sleeve 101 has a nut at 106 and an internal collar at 107. Spring 104 bears

against the collar 107 and against the end web 108 of the cylinder 97. By initially turning up nut 106 the spring 104 may be adjusted to a given compression. A cover plate 109 serves as a journal around sleeve 101 and closes the cylindrical space 97. Cover plate 109 is held onto the cylinder 97 by several cap screws.

The hand lever is first moved against right-hand stop 98, to "roll closed" position in which the eccentric links 93 and 94 are moved towards each other. Then by rotating the hand wheels 100, it is possible to vary the position of sleeve 101, for example, with reference to link 93 and move the periphery of roll 64 towards the periphery of roll 63 for proper grinding. During this adjustment spring 104 holds web 108 against nut 106. The adjustment may be locked by tightening hand wheel 102. As milling pressure (i. e. the pressure exerted by the material being ground) develops, this may be sufficient to compress spring 104 further and move the entire journal 80 outwardly from the vertical center line of the machine and along rod 96. When this occurs a clearance will develop between nut 106 and web 108. To maintain a given fineness of grind a readjustment of the wheel 100 may be required so as to change the position of journal 80 while the mill is operating and the milling pressure is on. In any event spring 104 will compress and permit hard obstacles to be cleared by the rolls. In order to move the rolls 64 and 62 quickly away from rolls 63 and 61, respectively, handle 90 is moved in the direction of arrow 110 against left-hand stop 98. When the handle 90 is moved in the direction of arrow 110, the entire bearing support 75 is quickly moved towards the side wall 13 of the machine by action of eccentric 92 through link 94 and rod 114, and thus roll 62 is thus quickly moved away from roll 61 so as to clear any obstruction that may have developed on that side of the machine and at the same time bearing 80 is moved toward side wall 14 and roll 64 is moved away from roll 63. The bearing construction on the far end of the machine (plate 11) is exactly analogous and by means of its hand lever, not illustrated, the rolls 62 and 64 may be quickly moved to clear position at that end. Usually the hand levers at the two ends of the machine are connected together by linkages for simultaneous movement so that by pulling the lever on either end of the machine, the rolls may be quickly separated. Since the adjustments at the two ends of the machine are independent, it is possible to maintain accurately the uniform clearance between the rolls 63 and 64, regardless of irregularities in operation of the mill. This is called tramming, i. e. maintaining the rolls parallel. Since the fixed, fast speed rolls 61 and 63 of the present mill diagonally overlie the adjustable slow-speed rolls 62 and 64, and the rolls 62 and 64 are movable in a horizontal plane through the machine, much less critical parallel adjustment or "tramming" is required, as compared with older mills in which the rolls are on the same level. One of the hand wheels 111 of the bearing support 85 is shown in Figure 1. It is understood that the bearing support 85 is precisely the same as that previously described for bearing support 81.

Likewise the shaft 74 carried on the bearing support 76 and the corresponding bearing support at the opposite end of the machine for shaft 74, are provided with adjusting hand wheels 112—113 which permits variation in the closeness of the rolls and the pressure necessary to move the

rolls apart. The hand lever 90 at each end of the machine operates the link 94 as well as the link 93, and hence both of the rolls 62 and 63 are moving to the open position when the lever 89 is moved in the direction of arrow 110. The tension shaft attached to link 94 is illustrated at 114 and it extends through the housing 115 and terminates at wheel 112. Each end 11 and 12 is preferably provided with stops 98 for limiting the movement of lever 90 in its open and operating positions.

Within the machine housing there are provided adjustable baffles 116 and 117 which serve to direct the downwardly falling material directly into the nip of each pair of rolls 63—64 and 61—62. The grain falls downwardly from the feed rolls 32 and 33 in the general direction of arrows 118 and 119 and are directed by the boards 116 and 117 into the nip space between the differentially revolving rolls.

The mechanism for rotating the rolls is illustrated in Figures 1 and 2. The motor shaft 59 is provided with a spiral gear 60 mating with a corresponding spiral gear 120 on countershaft 121. The shaft 121 is supported in a plurality of bearings 122 and is therefore rotated by the gears 60 and 120 at approximately motor speed. Upon shaft 121 there is a herringbone gear 124 which mates with a corresponding herringbone gear 125 upon the countershaft 126 which is likewise supported by the bearings 127. Since the gears 124 and 125 are approximately the same diameter the countershaft 126 is likewise rotated at approximately motor speed. At the ends of the shaft 126 there are provided worm gears 128 and 129 which mate, respectively, with the worm wheels 130 and 131 on the ends of roll shafts 70 and 65, respectively. The gear pairs 128—130 and 129—131 afford approximately a 1 to 1 gear ratio and therefore the rolls 61 and 63 are rotated at approximately motor speed. By suitably selecting the angle of the gears 128—130 and 129—131, the fast roll 61 may be caused to rotate in the direction of arrow 132 and at the same time fast roll 63 may be caused to rotate in the direction of arrow 133. With such rotation the countershaft 126 rotates in the direction of arrow 134 and countershaft 121 rotates in the direction of arrow 135, the motor being rotated in the direction of arrow 146. The thrust caused by gears 128 and 129 reacted with gears 130 and 131, respectively, is therefore approximately balanced and relatively little end thrust is transmitted by shaft 126 to the bearings 127 in which it operates.

Upon shaft 121 there are provided worm gears 136 and 137 of equal diameter which mate with relatively larger worm wheels 138 and 139 causing the latter and the roll shafts and rolls which they drive to be rotated in the direction of arrows 140 and 141, respectively, but at a much lower speed than the rotation of rolls 61 and 63. By appropriate selection of the gear ratio of the gear pairs 136—138 and 137—139, the rolls 62 and 64 can be caused to rotate at any desired speed relative to the speed of rolls 61 and 63 and accordingly the desired relatively peripheral velocity for adequate grinding of various materials can be varied to suit the conditions needed in the particular grinding operation under consideration. It will be noticed also that the rotation of shaft 121 in the direction of arrow 135 causes the rotation of gears 138 and 139 in opposite directions. Therefore, the end thrust produced by each of the gears 136 and 137 upon the shaft 121 is substantially balanced. The only appreciable end thrust on this shaft is that produced by the gears 60 reacting against gear 120.

The gears 136 and 137 are made relatively long and since they are of uniform pitch diameter throughout their length, they mate precisely with the gears 138 and 139, respectively, regardless of the adjustment position of the latter gears as determined by the position of their bearing blocks 75 and 80. Therefore, the bearing blocks 75 and 80 and the corresponding bearings at the opposite end of the machine may be moved by the quick opening handle 90 and their position may be adjusted by the hand wheels 100, 102, 112 and 113 and the corresponding adjustment wheels at the opposite end of the machine as desired, without disturbing the precise mating of the gears 136 and 137 with the corresponding gears 138 and 139, respectively. Furthermore, as the rolls are reduced in diameter as shown in Figures 4 and 5, thus requiring the closer together setting, depicted in Figure 5, this fact likewise does not effect the accurate mating of the gears 138 and 139 upon their driving gears 136 and 137, respectively, since the gears 138 and 139 simply operate at positions on gears 136 and 137 which are a little closer to the center of the mill.

Referring to Figures 4 and 5, particularly, the pressure caused by the grinding of material between the rolls 61 and 62, for example, is in the direction of arrows 142 and 143. The force of arrow 142 has an upward component 144 which therefore merely tends to lift the weight of the roll 61, or stated another way the weight of the roll 61 tends to maintain the milling pressure upon the cooperating roll 62. Similarly, the weight of roll 63 tends to maintain the milling pressure upon its cooperating roll 64. This is a distinct advantage as compared with earlier mills wherein the entire milling pressure had to be sustained by the bearings carrying the roll shafts. In addition, the elimination of the drive belts and the provision of a geared drive reduces bearing pressure, permits the use of shorter shafts which consequently distort less under load, reduces fire hazard and employee hazard, and at the same time greatly reduces vibration and the transmission of vibratory and belt stress to the building carrying the mill.

Referring to Figure 1 the entire gear train for driving the rolls from the motor, together with the countershafts is preferably enclosed in a suitable gear housing shown by the dotted lines 145 which is suitably supported from the end plate 12 of the mill. The housing has not been shown in detail since it will be understood adequately to enclose the gears so as to permit their complete lubrication during operation. Likewise the bearings of the various countershafts are intended merely as illustrative, it being understood that adequate bearing supports will be provided on one or both sides of each gear in order to sustain the loads encountered during service. At the rear end of the mill the shafts 65 and 70 protrude outwardly beyond their bearing and are provided with V-belt pulleys 148 and 149 which serve to drive the belts 150 and 151 and thus propel the material feed roll pulleys 38 and 42, respectively. The feed rolls thus are operated at relatively low speeds whenever the mill is in operation. The main housing of the mill and also the gear drive housing 145 are provided with removable sections which separate along the planes 152, 153, 154 and 155 so as to permit the rolls 61—64, their

shafts and drive gears, to be lifted bodily from the mill for renewal or replacement.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments herein except as defined by the appended claims.

What I claim is:

1. A roller mill comprising a frame, a first pair of rollers positioned in an elevated transverse plane through the frame and substantially symmetrically about a vertical center plane through the frame, a second pair of rollers journaled on the frame and positioned in a lower transverse plane and more widely spaced than said first rollers from said center plane, means for moving each of the second rollers toward and away from the center plane of the frame so as to position the periphery of each of said second rollers closer or farther away from the position of the more elevated first roller to which it is adjacent, a first transverse countershaft journaled in the frame and worm gear means connecting said shaft to each of the first pair of rollers, a second transverse countershaft journaled on the frame and worm gear means connecting said second shaft to each of said second pair of rollers, a power source on the frame and drive means connecting it to the first and second countershafts.

2. The apparatus of claim 1 further characterized in that the worm gear means connecting the first countershaft and the first pair of rollers drives said first rollers in opposite directions and the worm gear means connecting the second countershaft to the second pair of rollers drives said second rollers in opposite directions.

3. The apparatus of claim 1 further characterized in that the power means is an electric motor having a gear connection to the second countershaft, said second countershaft being geared to the first countershaft.

4. A roller mill comprising an enclosing housing, a material feed chute having means therein for providing separated flows of grain to each of a pair of spaced feed rolls cooperating therewith for feeding material downwardly in spaced planes extending substantially the length of the housing, a pair of cooperating grinding rolls situated beneath each feed roll in the path of falling material fed thereby, each pair of grinding rolls comprising an elevated roll, journal means for said elevated roll, and a lower roll, journal means for said lower roll, said lower rolls being positioned beneath each feed roll and mounted for movement in a horizontal plane toward and away from its cooperating more elevated slow roll through a range of movement sufficient to position the peripheries of the rolls in spaced relation or in grinding relation regardless of reduction of diameter of the cooperating rolls during their service life, a first countershaft, worm gear means connecting the countershaft to each of the slow rolls and a second countershaft, worm gear means connecting said second countershaft to each of the fast rolls, and a motor mounted on the housing and gear means connecting it to each of the countershafts.

5. The apparatus of claim 4 further characterized in that the motor is mounted within the housing in a ventilated enclosed space separated from the spaces below the cooperating pairs of rollers.

6. The apparatus of claim 4 further characterized in that the slow rollers are mounted on slidable journals and adjustment means is provided at each end of the housing for moving them directly towards and away from each other while gear connected to their countershaft drive.

THOMAS G. CECKA.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
199,605	Wegmann	Jan. 22, 1878
240,453	Oexle	Apr. 19, 1881
255,860	Holt	Apr. 4, 1882
335,257	Van Gelder	Feb. 2, 1886
411,404	Wagner	Sept. 17, 1889
447,951	Kapler	Mar. 10, 1891
459,352	Wagner	Sept. 8, 1891
1,130,365	Altheide	Mar. 2, 1915
1,199,938	Sorenson	Oct. 3, 1916
1,713,487	Torrance	May 14, 1929
2,022,135	Newhouse	Nov. 26, 1935
2,293,670	Sickman	Aug. 18, 1942

FOREIGN PATENTS

Number	Country	Date
1,179	Great Britain	Mar. 5, 1883
1,107	Great Britain	Jan. 24, 1888
6,990	Austria	Mar. 10, 1902
12,087	Great Britain	of 1909
344,019	Italy	Oct. 21, 1936
487,759	Great Britain	June 24, 1938