(No Model.) 3 Sheets—Sheet 1.

R. BIRKHOLZ.

ROLLER GRINDING MILL.

No. 255,715. Patented Mar. 28, 1882.

Fig: 2.

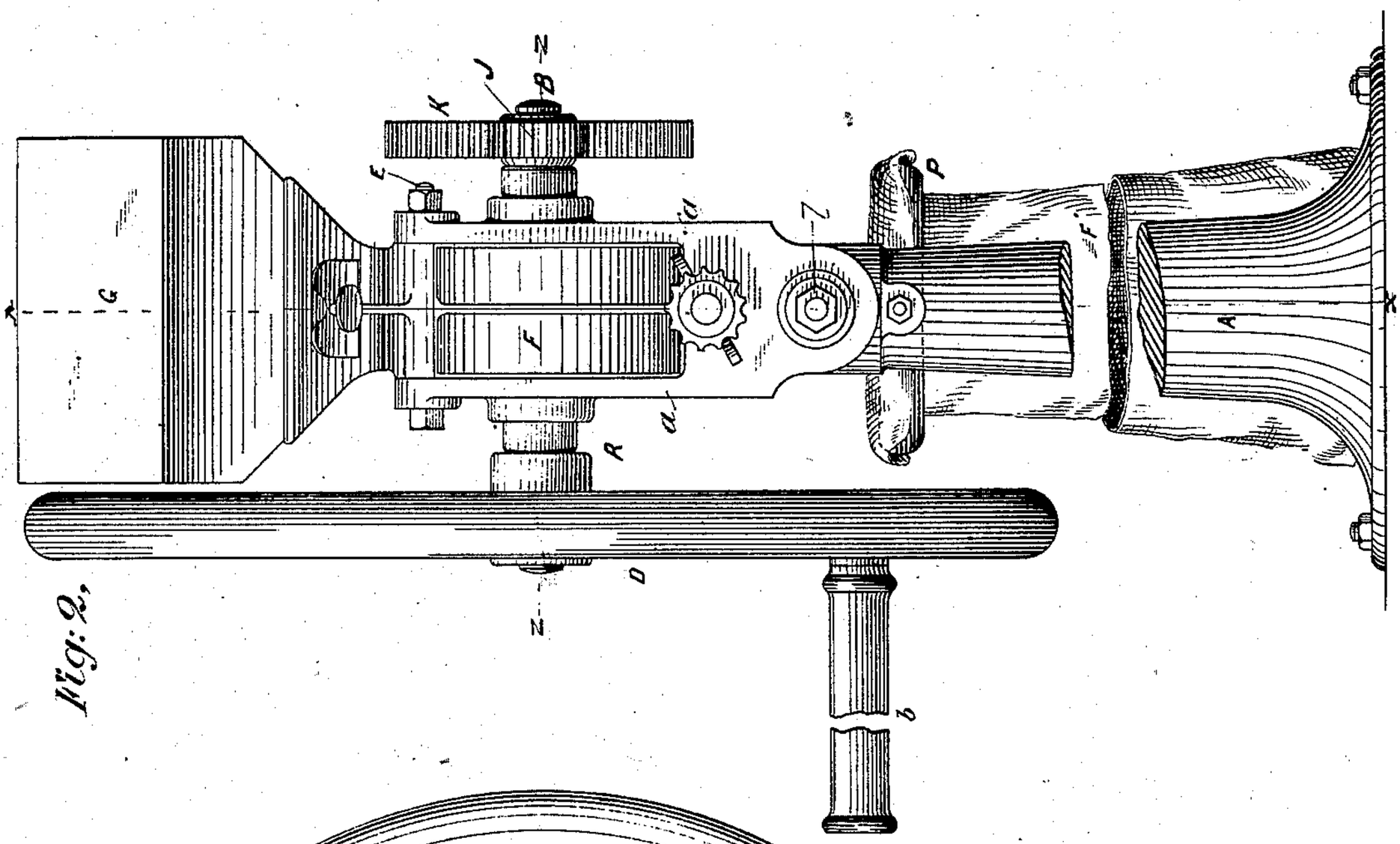
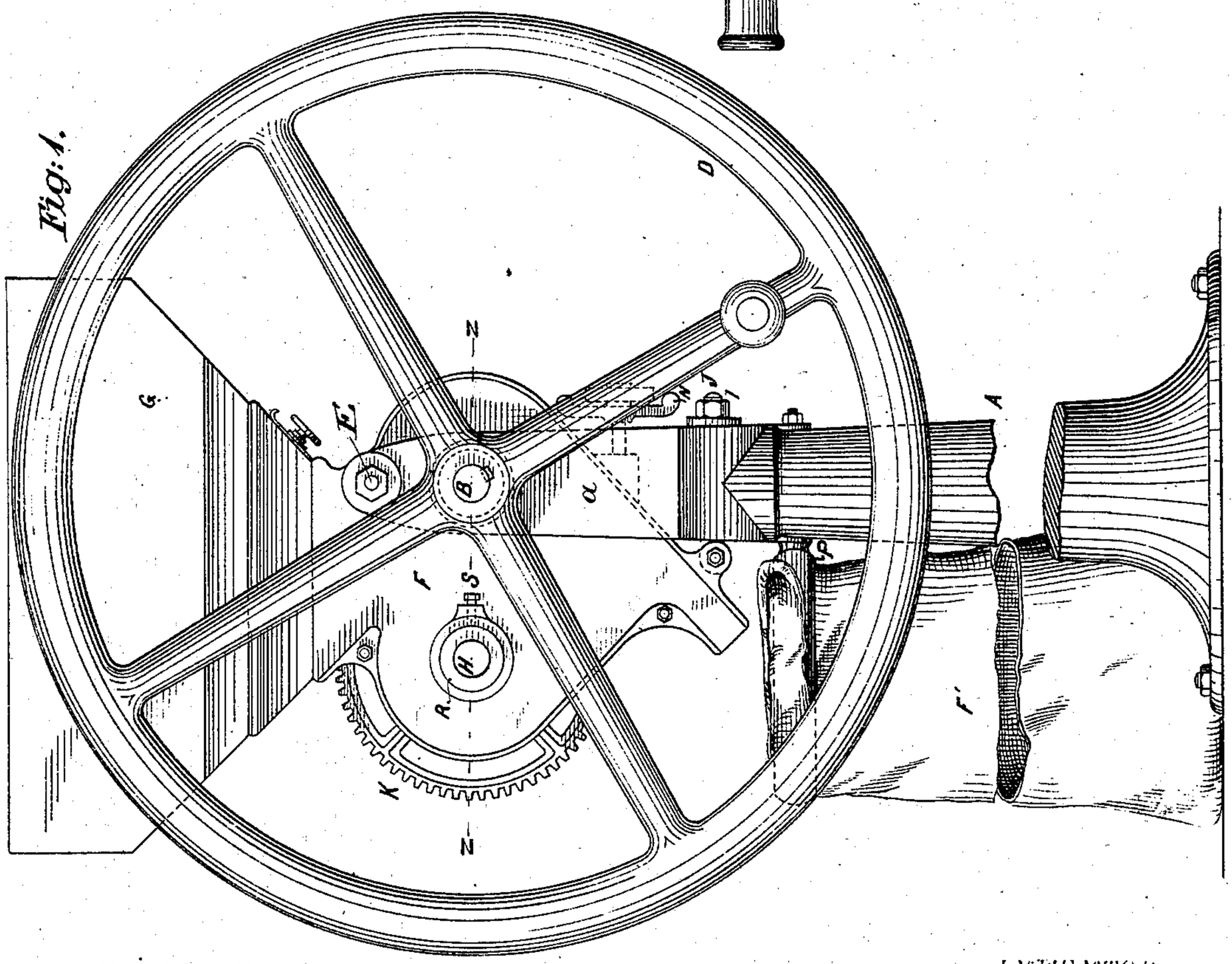


Fig: 1.



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(No Model.)

3 Sheets—Sheet 2.

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Fig: 4,

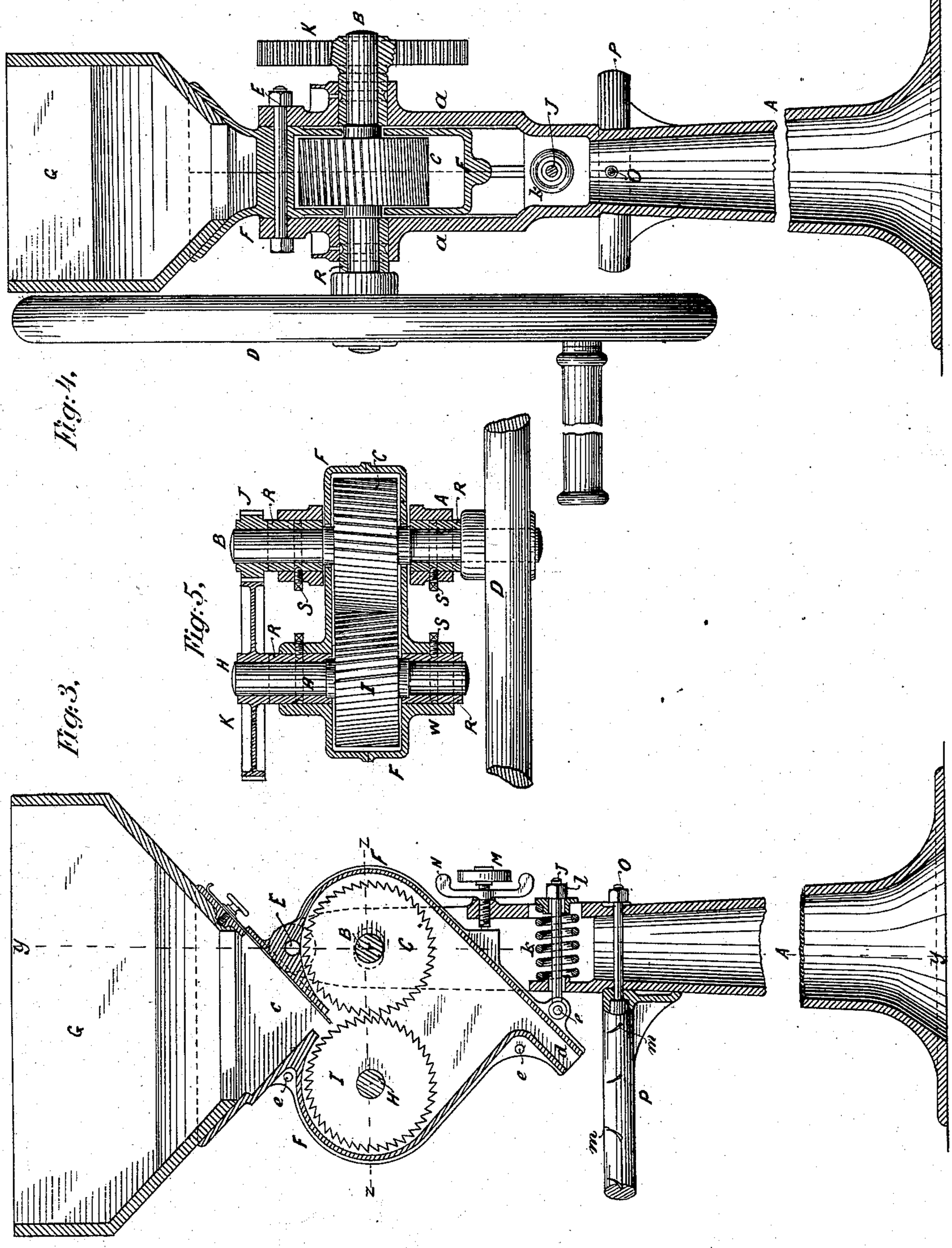

Fig: 5,

Fig: 3,

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ROLLER GRINDING MILL.

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Fig: 6.

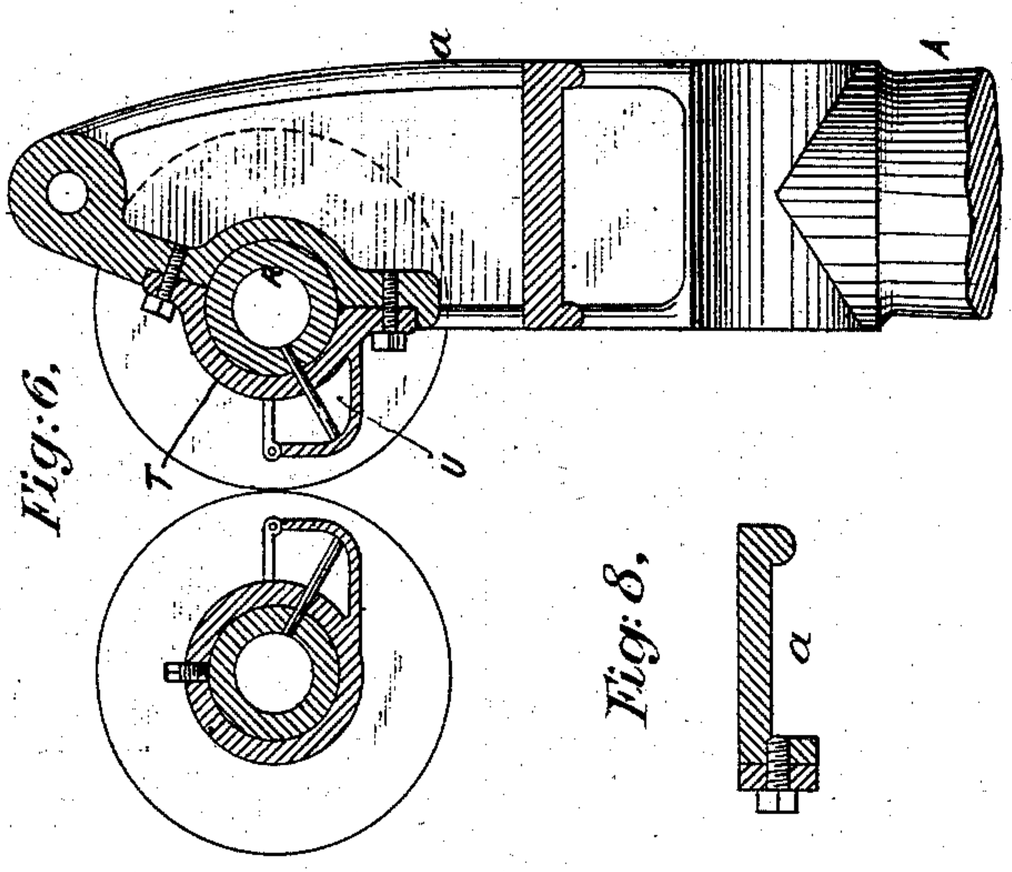
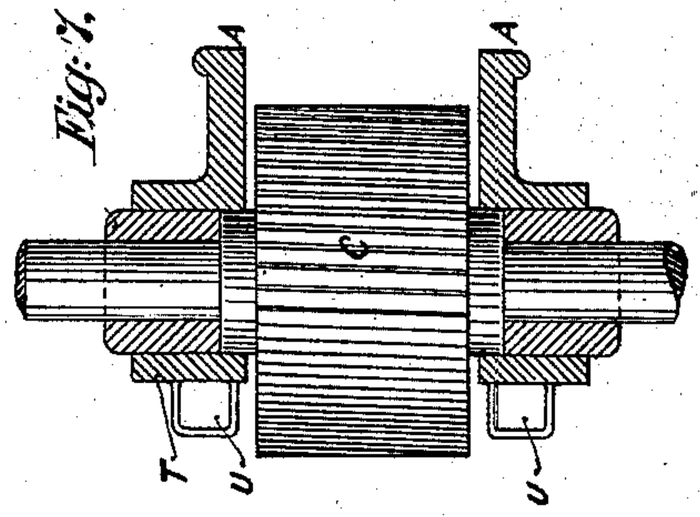


Fig: 8.

Fig: 7.



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UNITED STATES PATENT OFFICE.

RICHARD BIRKHOLZ, OF MILWAUKEE, WISCONSIN.

ROLLER GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 255,715, dated March 28, 1882.

Application filed December 1, 1881. (No model.)

To all whom it may concern:

Be it known that I, RICHARD BIRKHOLZ, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain Improvements in Roller Grinding-Mills, of which the following is a specification.

My invention relates to improvements designed more particularly for use in small or portable mills, although certain of the features are applicable to mills of large size.

The principal object of the invention is to produce a mill which shall be exceedingly cheap and simple in construction, in which the accurate adjustment of the rolls may be maintained without the use of separate adjustable devices for their opposite ends, and in which the pressure applied between the rolls shall be governed automatically by the hardness of the material passing between them.

It also has as an object the production of durable and accurate ribbed rolls without incurring the expense of cutting the ribs thereon, as is now commonly practiced.

The invention consists in the combination of a standard, a hopper-frame mounted in bearings on the standard, and a movable roll mounted in and sustained by said frame; in the combination, with the above, of a spring applied to urge the hopper downward; also, in the combination, with the above-named parts, of a stop device limiting the swinging action of the hopper; also, in various minor details, which will be hereinafter described.

Referring to the accompanying drawings, Figure 1 represents a side elevation of my improved mill; Fig. 2, a rear elevation of the same; Fig. 3, a vertical central section of the same on the line *x x*, Fig. 2; Fig. 4, a transverse vertical section on the line *y y*, Fig. 3; Fig. 5, a horizontal section on the line *z z*, Figs. 1, 2, &c.; Figs. 6, 7, and 8, detail sectional views, illustrating the construction of the roller-bearings.

Referring to the drawings, A represents an upright tubular standard designed to sustain the weight of the entire mill, provided with an enlarged or flanged base and having its upper end divided into two upright parallel arms, *a*.

B represents a horizontal shaft mounted in fixed bearings or boxes in the arms *a* of the standard, and provided at its middle with a grinding-roll, C, and at its outer end with a heavy balance-wheel, D, the latter being provided with a hand-crank or handle, by means of which motion is communicated to the machine. When the machine is to be driven by power from an engine or other motor the shaft B may be provided, in place of or in addition to the balance-wheel D, with a driving-pulley to receive a belt or with a driving gear-wheel.

E represents a horizontal bolt passed transversely through the upper ends of the standard-arms *a* above the grinding-roll C, and serving as a support for the hopper body or casing F, which is pivoted and free to swing upward and downward in a vertical arc to a limited extent thereon. The casing F is made of suitable form and size to completely inclose the two grinding-rolls, being adapted to fit closely against their side or end faces, and being fashioned at the top into a small hopper or throat, *c*, through which the grain is delivered between the rolls, and being also fashioned at its lower ends beneath the rolls into a meal-receiving chamber provided with an outlet-spout, *d*. The casing F is preferably constructed, as shown in the drawings, of two equal castings meeting on a plane lying at right angles to the axes of the rolls, the two parts being slipped endwise over the journals of the rolls and secured together by means of transverse bolts *e*, as clearly represented in the drawings. In order to permit the swinging motion of the casing, its sides are slotted at the points where the stationary shaft B passes through the same, as indicated in Fig. 5 and in dotted lines in Fig. 3. To the upper part or mouth of the casing F a large wooden hopper, G, is bolted or otherwise secured to receive a supply of grain.

H represents a second horizontal shaft carrying at its middle the second grinding-roll, I, and mounted at its ends in bearings or boxes fixed rigidly in the sides of the casing F, as plainly represented. It will be seen that the second roll, I, and its shaft are thus supported by the surrounding casing F, and that as the casing swings upon the bolt E from a point above the first grinding-roll the downward movement of the casing serves to crowd the rolls toward each other, while on the other

hand its upward motion serves to separate them, the movable roll I swinging around a point eccentric to the stationary roll. Motion is communicated from the shaft of the stationary roll C by means of a small outside pinion, J, through a large gear-wheel, K, to the shaft of the second or movable roll, I. Under the arrangement shown it will be seen that the weight of the casing, the second roll and its shaft, the hopper, the material contained in the hopper, the strain of the gears, and the strain which the roll C may exert through the intermediate material upon the roll I all tend to urge the casing downward, and thus crowd the rolls toward each other. It will be readily seen, therefore, that in grinding hard substances which offer a great resistance to the movement of the rolls the movable roll is crowded downward with greater pressure than when grinding soft material, and that consequently the rolls are urged together with increased force. This action of the rolls in crowding one toward the other is in a great measure dependent upon the fact that the two rolls are driven positively at different surface speeds, the result being that the material entering between the two rolls and offering a resistance to their rotation tends to lock them together in such manner that the rotation of the stationary rolls tends to turn the movable rolls and the support downward. Owing to this action it will be seen that the mill is in a degree automatic or self-adjusting as regards the pressure applied to force the rolls together, the rolls being crowded together with a greater force when grinding hard material than when grinding material which is softer. This feature of automatic adjustment I believe to be original with myself, and it is obvious that it may be secured by any suitable arrangement of parts, provided this mode of action is retained.

As an additional means of drawing the rolls together I may make use of a spring to tip the casing downward. This spring may be of any suitable construction and applied in any suitable manner; but I prefer, as shown in the drawings, to pivot to the lower end of the casing a bolt, J, passing transversely through the standard A, and bearing on its rear end a nut, *l*, and a washer acted upon by a spiral spring, *k*, seated within the standard around the bolt, as plainly represented in Figs. 3 and 4. By adjusting the nut the tension of the spring may be increased and the pressure between the rolls augmented to any extent required. In place of the nut, any other suitable device may be employed as a means of adjusting the spring.

In practice it is found desirable to provide means whereby the grinding-surfaces of the rolls shall be prevented from coming in contact with each other. To this end I provide the standard with any suitable stop device to limit the downward motion of the hopper-frame. The device represented in the drawings consists simply of a screw, M, inserted through the standard A, and arranged to encounter a lug or stud on the under side of the hopper-frame. In order to prevent the screw M from being jarred out of adjustment by the vibration of the mill, the jam-nut N is applied, as shown in the drawings.

In practice I find the most convenient receptacle for the chop or grist to be an ordinary sack, and in order to hold such receptacle in position beneath the delivery-spout *d*, I connect to the standard by a bolt, *o*, a horizontal ring, P, provided on the inside with a series of small upturned hooks or teeth, *m*, adapted to engage with the edge of the bag and to sustain its mouth in an open position beneath the spout. In place of the teeth, any other fastening devices may be used.

Inasmuch as nails, stones, and other foreign matters of refractory character are liable to find their way into the mill and endanger breakage of the parts, the bolt E is constructed of such size and strength in relation to the other parts of the mill that it will give way before the other parts receive a dangerous strain. This breakage of the bolt will permit the hopper-frame to fall to a limited extent and throw the movable roll away from the roll C, thus avoiding the danger of serious injury to the mill. When the breakage of the parts occurs the hopper-frame will be sustained and prevented from falling by the shaft of the roll B.

The roll shafts or journals may be mounted in boxes or bearings of any suitable construction; but it is desirable that these boxes shall be adjustable to compensate for wear—that they should be readily removable in order that they may be replaced by others when badly worn. I prefer to make use of cylindrical bearings or boxes, such as represented in Figs. 4 and 5, each bearing R consisting merely of a tube or sleeve slipped around the shaft closely into a seat in the side of the support, and secured by means of a set-screw, S, tapped into the support, and bearing at the inner end in a groove encircling the box or bearing. The bearings of the movable roll are supported in the hopper-frame, and the bearings of the stationary roll mounted in the arms of the standard A.

In order to afford the long and solid support for the boxes or bearings, the support is provided with outside hubs or bosses to receive them, as plainly represented. By making the boxes of cylindrical form and inserting them in the manner described, their ready rotation at will is permitted, so that the wear may be equalized upon their inner surfaces. Instead, however, of seating the boxes or bearings of the stationary roll D in bosses formed upon the support, as above described, the parts may be constructed as shown in Figs. 6 and 7, in which it will be seen that the boxes are seated in recesses in one side of the standard-arms *a*, and secured therein by clamp-plates T, fastened by bolts. By loosening the bolts the rotation or removal of the box is permitted. This arrangement also permits the introduction of thin sheet metal at any point outside of the

box, thus permitting the box and shaft to be accurately adjusted, as required. This feature will be found of great value and convenience in the event of the parts being jarred slightly out of line, as frequently occurs in practice.

In order to keep the bearings properly lubricated, I cast upon the outside of the casing and the standard, respectively, oil-reservoirs U, and insert a wick from said reservoir inward to the respective journal, as plainly represented in Fig. 6, suitable holes being cored, of course, for the admission of the wick.

In the course of a long experience in the operation of roller-mills I have found it extremely difficult to insure an exact parallelism of the axes of the two rolls. In mills as at present constructed it is, I believe, the universal practice to construct rolls of a length usually several times as great as their diameters. This construction necessitates the application of separate adjusting devices to the two ends of each roll. In practice it is found impossible to secure an exactly uniform adjustment of the pressure devices, and consequently much difficulty is experienced on account of the rolls grinding unequally at the two ends, the material being ground finer at one end than at the other. In order to overcome this difficulty, I construct my rolls of a length or breadth considerably less than their diameter, as plainly represented in the drawings, and supporting the two ends of each roll in one and the same casting. The single support of the movable roll being arranged to move at right angles to the axis of the opposite roll, I am enabled to maintain at all times, and by means of a single set of adjusting devices, an exact uniform space between the two rolls from end to end, under all adjustments and conditions.

Having thus described my invention, what I claim is—

1. The combination of the standard, the roll mounted in fixed bearings in the standard, the hopper-frame pivoted to the standard, and the movable roll journaled in and supported by the hopper-frame, as described and shown, whereby a proper relation is maintained between the hopper and rolls and the weight of the hopper applied to aid in forcing the rolls together.

2. The combination of the standard, the roll mounted in fixed bearings thereon, the swinging hopper-frame, the movable rolls sustained by the hopper-frame, and a spring applied, substantially as described, to urge the hopper downward.

3. The combination of the standard, the fixed roll, the swinging hopper-frame, a second roll sustained by the hopper-frame, and a stop device, substantially such as shown, to limit the swinging motion of the hopper-frame.

4. The combination of the standard, the roll mounted in fixed bearings therein, the hopper-supporting frame having a pivotal connection with the standard, the second roll sustained by the hopper-frame, the spring tending to swing the hopper-frame downward, and an adjustable device, substantially as shown, to limit the movement of the hopper under the action of the spring.

5. In combination with the standard, the stationary roll mounted therein, and the movable roll, the swinging hopper frame or casing adapted to inclose the two rolls and pivoted to the standard at a point above the axes of the rolls.

6. The combination of the forked standard, the roller-casing pivoted to and within said standard, and the two grinding-rolls mounted within the casing and supported one by the standard and the other by the casing, substantially as described and shown.

7. In combination with the grinding-roll mounted in fixed bearings, the second roll mounted in a support which swings from the center above the axis of the stationary roll, and pinions connecting the two rolls, as shown, whereby motion is imparted from the first roll to the second and the strain of the driving-pinion caused to assist in urging the movable roll downward.

8. The combination of the standard, the fixed roll, the movable roll, the swinging roll-supporting frame encircling the shaft of the stationary roll, and the frame-supporting bolt E, proportioned in relation to the other parts to break or give way when the mill is subjected to excessive strain.

RICHARD BIRKHOLZ.

Witnesses:
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