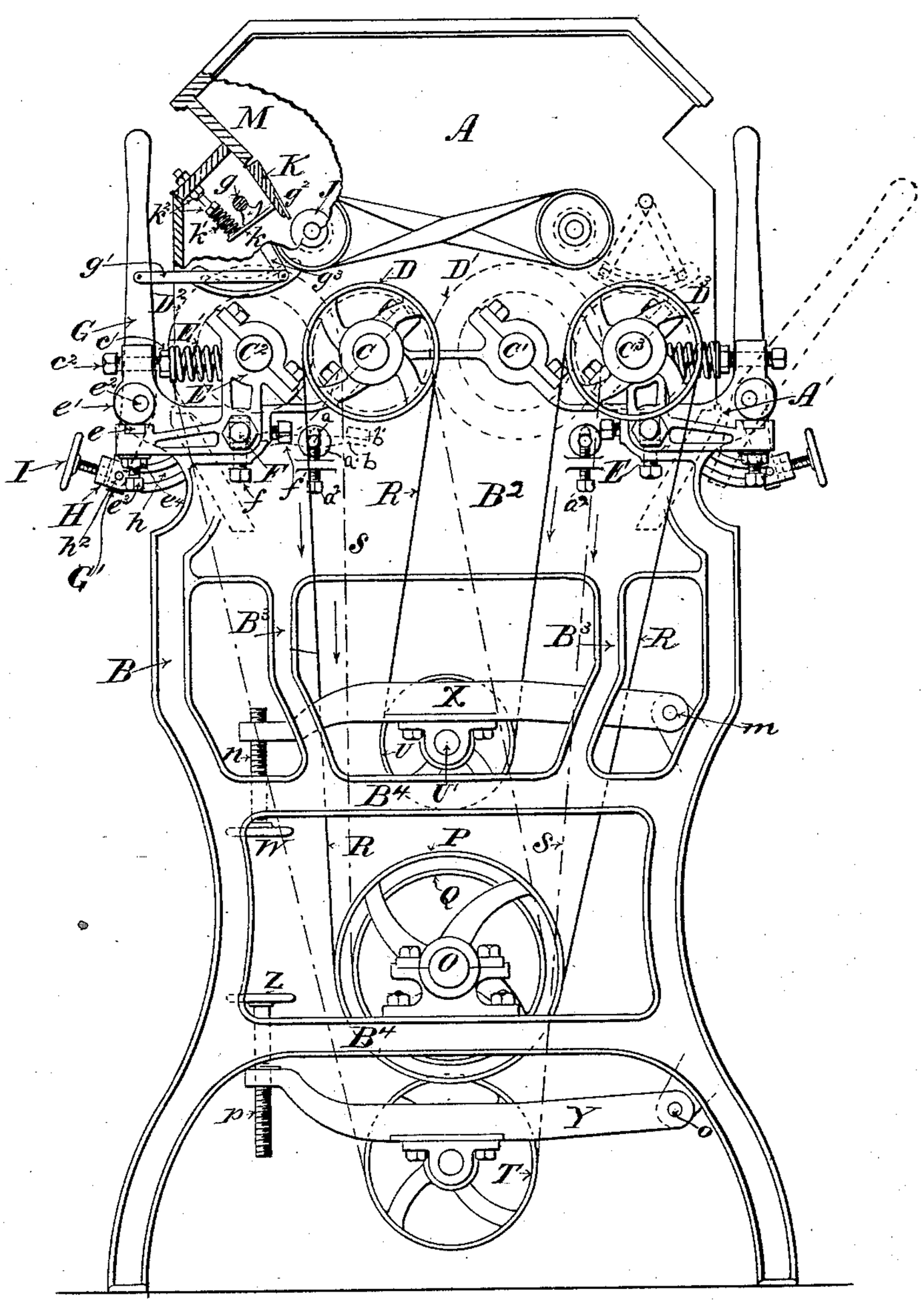
(No Model.) 2 Sheets—Sheet 1.

# J. L. WILLFORD.

## ROLLER MILL.

No. 315,201. Patented Apr. 7, 1885.

*Fig 1*

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(No Model.)

2 Sheets—Sheet 2.

# J. L. WILLFORD.

## ROLLER MILL.

No. 315,201.

Patented Apr. 7, 1885.

*Fig. 2.*

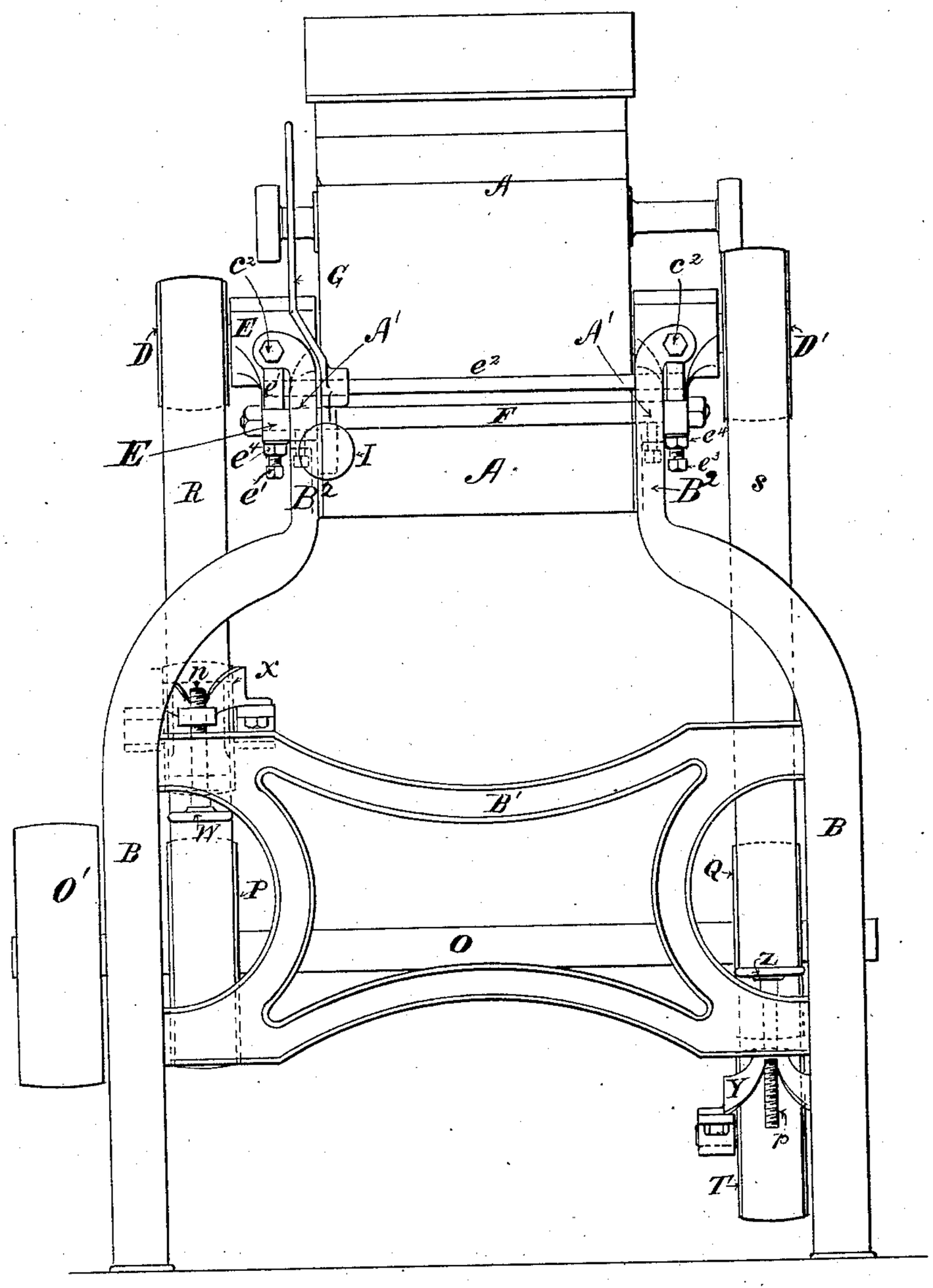



*Fig. 3.*

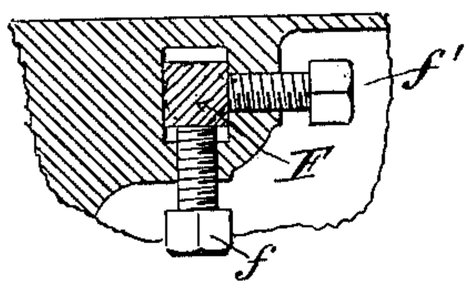



*Fig. 4.*

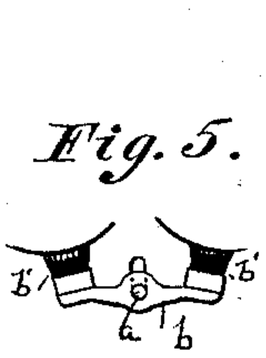
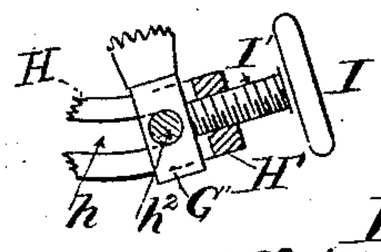



*Fig. 5.*

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# UNITED STATES PATENT OFFICE.

JOSEPH L. WILLFORD, OF MINNEAPOLIS, MINNESOTA.

## ROLLER-MILL.

SPECIFICATION forming part of Letters Patent No. 315,201, dated April 7, 1885.

Application filed November 17, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH L. WILLFORD, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Roller-Mills; and I do hereby 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 roller-mills; and the objects I have in view are to provide a mill that shall have a simple and inexpensive automatic feeding device, a simple and efficient device for vertically adjusting the movable roll, an improved means for moving the movable roll from the fixed roll and holding it at any desired point, a new roll-cleaning device, a new construction of supporting-frame, and a new drive for a double mill.

To these ends my invention consists, generally, in the construction and combinations of devices hereinafter described, and particularly pointed out in the claims.

In the drawings, Figure 1 is a side elevation, partly broken away, of my improved machine. Fig. 2 is a front elevation. Figs. 3 and 4 are details. Fig. 5 is a detail of roll-cleaner.

B is the supporting-frame of the machine, and A is the casing in which the grinding-rolls are mounted.

The machine shown in the drawings is a double machine having two sets of grinding-rolls. C and C′ are the fixed rolls, and $C^2$ and $C^3$ are the yielding rolls. The rolls $C^2$ and $C^3$ are each mounted in pivoted supports E, and they are held against the fixed rolls by springs E′, the tension of the springs being regulated by screws $c^2$ and nuts $c'$. The pivoted supports E are of bell-crank-lever shape, and are provided on the upper sides of the horizontal arms with steel plates *e*, which are held in place by bolts $e^3$ and nuts $e^4$. Above these plates is a shaft, $e^2$, carrying eccentrics $e'$. A lever, G, is secured to the shaft $e^2$. When the lever G is thrown to the position shown by dotted lines at the right hand of Fig. 1, the outer ends of arms E are depressed by the eccentrics, and the roll $C^2$ or $C^3$ is thrown away from the fixed roll C or C′. The lever G has the arm G′ extending below the shaft to which the lever is secured. An arm, H, projects from the side of the machine, and has a slot, *h*, and at its end a projection, H′, at right angles to the arm itself. A screw-rod, I′, having hand-wheel I, is tapped through the projection H′ of arm H. The end of rod I′ is adapted to bear against the lower end, G′, of lever G. (See Fig. 4.) By means of this screw I′ the lower end of the lever may be moved and a fine adjustment of the rolls secured.

When it is desired to have the rolls very near to each other, but not touching, the roll $C^2$ may be allowed to move in against the other roll, and then by giving the hand-wheel a partial turn the lower end of the lever will be slightly moved and the roll moved a little distance from the fixed roll.

By operating the lever G the rolls may be separated without changing the position of the screw I′, and when the lever is released the yielding roll will return to exactly its former position.

By means of the set screw $h^2$ the arm G′ may be clamped to the projection H when it is desired to hold the movable roll away from the other roll for any purpose. When arm G′ is released, the yielding roll moves in until the arm is stopped by the end of screw I′, when the roll will be in its original position. The arms E are mounted on the cylindrical ends of a rectangular or flat-sided bar, F, (see Figs. 1, 2, and 3,) which is supported in slotted projections A′ from the frame of the machine. Adjusting-screws *f* are arranged under the bar F, one at each side of the machine. By these screws the bar F may be vertically adjusted, and thereby the movable roll will also be adjusted. Set-screws *f′* are provided for clamping the bar F when it has been brought to the desired position by the screws *f*. Above the grinding-rolls is a feed-roll, J, and hopper M for each set of grinding-rolls. The hopper M is provided with a hinged feed-valve, K, which has an arm, *k*, projecting from its under side. A spring, *k′*, bears upon the arm and holds the valve against the feed-roll and allows it to open under the pressure of the material in the hopper. By the nuts $k^2$ the tension of the spring may be regulated.

The edge of the valve K is provided with an adjustable metal plate, which is held on the valve-plate by screws which pass through slots in the valve-plate. The screws may be loosened, the plate K′ adjusted, and the plate clamped again by the screws.

Above the arm *k* is a rod, *g*, extending from one side of the casing to the other, and having an arm, $g^3$, on one end outside of the casing. This rod carries a cam, $g^2$, which is adapted to bear on the arm *k* and to close the valve when desired. When the cam is in the position shown in Fig. 1, the valve may be opened under the pressure of the material in the hopper. When the rod is turned so as to bring the toe of the cam against the arm, the valve will be closed and the feed stopped. The cam may be set by the arm $g^3$ so that the valve may be opened only to a certain point, and the feed thus regulated. In some instances I connect the arm $g^3$ with the lever G by a link, as *g*′, and then when the yielding roll is thrown away from the other roll by operating the lever G the valve will by the same operation be closed by the cam $g^2$, and the feed will be stopped. Below each set of rolls is a cleaning device for cleaning the rolls.

The construction and arrangement of this device are as follows: A rod, *a*, extends through the casing and projects through oblong slots in the walls. Washers *a*′ on the rods cover these slots, and screws $a^2$ are provided, by which it may be vertically adjusted.

On the rod *a* near each end, within the casing, an arm, *b*, is mounted. These arms are loosely mounted on the rod, and are free to turn thereon. The ends of the arms extend under the grinding-rolls, and brushes *b*′ are secured to them, extending from the end of one arm to the corresponding end of the other arm. The rod *a* is raised by the adjusting-screws until the brushes bear against the rolls. As the arms are free to turn on the rod, the device is automatically leveled and adjusted against the rolls and adapts itself to their surfaces, the brushes themselves serving as springs. Scrapers may be substituted for the brushes, and then it will be necessary to support rod *a* on suitable springs. The upper part of each side of frame B is a vertical web, $B^2$, cast in one piece with the lower part of the frame. These webs form the sides of the casing below the roll-bearings. The bearings for the fixed rolls are preferably formed on these webs, and to them the upper part of the casing A is secured. From the lower edges of the webs $B^2$ the frame B is extended outwardly, preferably on curved lines, substantially as shown in Fig. 2, and then is again vertical, and so continues to the base. Below the webs $B^2$ the frame is open, but provided with suitable strengthening-bars, $B^3$ and $B^4$, these bars being so located and shaped as not to interfere with the belts hereinafter described. The two parts of the frame are secured together and braced by suitable spiders, B′, substantially as shown in Fig. 2. Mounted in the frame upon suitable bearings is a counter-shaft, O, provided with a driving-pulley, O′, and with belt-pulleys P and Q. (The pulley O′ is omitted in Fig. 1.) The pulley P is inside the frame B and in the vertical plane with the roll-pulleys D and $D^3$, and the pulley Q is inside the frame and in the plane of roll-pulleys D′ and $D^2$. Below the pulley Q is an idler, T, carried in a divided lever, Y, pivoted at *o* to a projection from the spider $B^4$, and having the adjusting-screw *p* with hand-wheel Z. An idler, U, is similarly mounted in lever X above the pulley P, said lever being pivoted at *m* and provided with adjusting-screw *n*, having hand-wheel W. Belts R and S are used in connection with the shaft O for driving the grinding-rolls.

In order not to obscure the drawings, belt S is shown entirely in dotted lines in Fig. 1. The belt R passes under the pulley P, over the roll-pulleys D and $D^3$, and under the idler U. The belt S passes under pulley Q, over roll-pulleys D′ and $D^2$, and under the idler T. The belts move in the direction of the arrows in Fig. 1, and thereby rotate in toward each other the two grinding-rolls of each set. The levers and idlers serve as belt-tighteners. I am enabled by this arrangement of pulleys to rotate all the rolls with two belts, neither being crossed. By this construction of frame, I get outside bearings for the counter-shaft O, and have the pulleys and belts within the frame B.

In passing by or around the mill there is no danger of running against the pulleys or belts. When the driving-pulley and one of the belt-pulleys are both on one end of the shaft outside the frame, the driving-pulley is so far from the bearing that there is a great deal of strain upon the shaft. This is obviated by the arrangement I have described.

The driving-pulley may in some instances be located within the frame.

I have shown and described a convenient arrangement of driving-belts for the grinding-rolls; but these belts may be differently arranged and still pass through the open projecting portions of the frame, and the roll-pulleys will be on the outside of the frame and the main portions of the driving-belts within the frame.

By having all the rolls driven from a counter-shaft mounted in the machine-frame, I am enabled to place two or more machines side by side with their counter-shafts in line, and couple the counter-shafts together, and drive all the machines from one driving-belt.

I claim as my invention—

1. The combination, with the hopper and feed-roll of a roller-mill, of a spring-controlled hinged valve, a cam arranged to bear on said valve, and means for operating the cam, whereby the valve may be held in a closed position, or the cam may be set to predetermine the point to which the valve may open under pressure of the material in the hopper, all substantially as described.

2. The combination, in a roller-mill, with

the hopper and feed-roll, of a hinged valve having an arm attached thereto, a spring bearing on the arm, a rod carrying a cam engaging with the arm, and means for operating the rod, all substantially as described.

3. The combination, in a roller-mill, with the hopper and feed-roll, of a hinged spring-controlled feed-valve, a cam arranged to bear on said valve, and connected means for operating the cam and withdrawing the movable grinding-roll, whereby the feed-valve is positively closed as the grinding-rolls are separated, and whereby as the rolls are moved together the cam is moved from the feed-valve and set to determine the point to which the valve may open under pressure of the material in the hopper, as and for the purpose set forth.

4. The combination, with the pivoted bell-crank levers carrying the movable roll, of a rod carrying eccentrics adapted to bear on said levers, an operating-lever for said eccentrics having an arm extending beyond its pivot, and an adjusting-screw arranged to bear against the short arm of the lever, all substantially as described, whereby a fine adjustment of the rolls may be secured and the rolls may be separated and returned to the same adjustment without changing the position of the adjusting-screw.

5. The combination, with the pivoted bell-crank supports carrying the yielding roller, of eccentrics arranged to bear on the horizontal arms of said supports, lever G, for operating said eccentrics, arm G′, slotted projection H, clamping-screw $h^2$, and adjusting-screw I′, all substantially as described, and for the purpose set forth.

6. The combination, in a roller-mill, of a flat-sided bar and screws for raising said bar, with arms journaled on the bar and carrying the yielding roller, all substantially as described.

7. The combination, in a roller-mill, of a bar having two or more flat sides, screws for vertically adjusting the bar and set-screws for clamping the bar, with arms journaled on said bar and carrying the yielding roller, all substantially as described.

8. The combination, in a roller-mill, of a bar extending across the mill, said bar being rectangular in cross-section and having cylindrical ends, arms mounted on said bar and carrying the yielding roller, screws for adjusting said bar, and set-screws for clamping said bar, all substantially as described.

9. The combination, with a pair of grinding-rolls, of an adjustable rod arranged beneath said rolls, arms loosely mounted on said rod, each arm extending under both rolls, and cleaning devices mounted on said arms and adapted to bear on the rolls, substantially as described.

10. A roller-mill having its supporting-frame outwardly extended at a point below the roll-pulleys, said outwardly-extended portions being open to permit the roll-belts to pass therethrough, as and for the purpose set forth.

11. In a roller-mill, the frame B, having the vertical webs $B^2$, and the projecting portions below said webs, said projecting portions being open to permit the roll-belts to pass therethrough, substantially as described.

12. In a roller-mill, the frame B, having the webs $B^2$, the open projecting portions below said webs, and the spiders B′, substantially as described.

13. The combination, in a roller-mill, with the roll-pulleys, of a frame having open outwardly-extended portions below the roll-pulleys, and roll-driving belts passing through said projecting portions, as described, and for the purpose set forth.

14. The combination, in a roller-mill, with the roll-pulleys, of a supporting-frame having open projecting portions below the roll-pulleys, a shaft having belt-pulleys within the supporting-frame, and driving-belts from the shaft-pulleys to the roll-pulleys passing through said open projecting portions of the frame, substantially as described.

15. The combination, with the casing A, and the grinding-rolls provided with belt-pulleys, of the supporting-frame B, extended outwardly below said pulleys, the shaft O, having pulleys P and Q, arranged within the frame, and belts passing between said pulleys and the roll-pulleys through said projecting portions of the frame, substantially as described.

16. The combination, with the casing A, and the grinding-rolls C $C^2$ $C^3$ C′, provided, respectively, with pulleys D $D^2$ $D^3$ D′, of the supporting-frame B, projecting outwardly below the roll-pulleys, the counter-shaft O, having pulleys P and Q, belts R and S, arranged as described, and passing through the projecting portions of the frame, and idlers U and T, and means for adjusting the idlers, all substantially as described.

17. The combination, in a roller-mill, with the roll-pulleys and the frame having the open projecting portions, of roll-driving belts passing through said projecting portions, levers pivoted within the frame and extending to its front, belt-tightening pulleys mounted in the levers, and means for adjusting the forward ends of said levers, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH L. WILLFORD.

Witnesses:

AMASA C. PAUL,

ELECTUS A. PRATT.