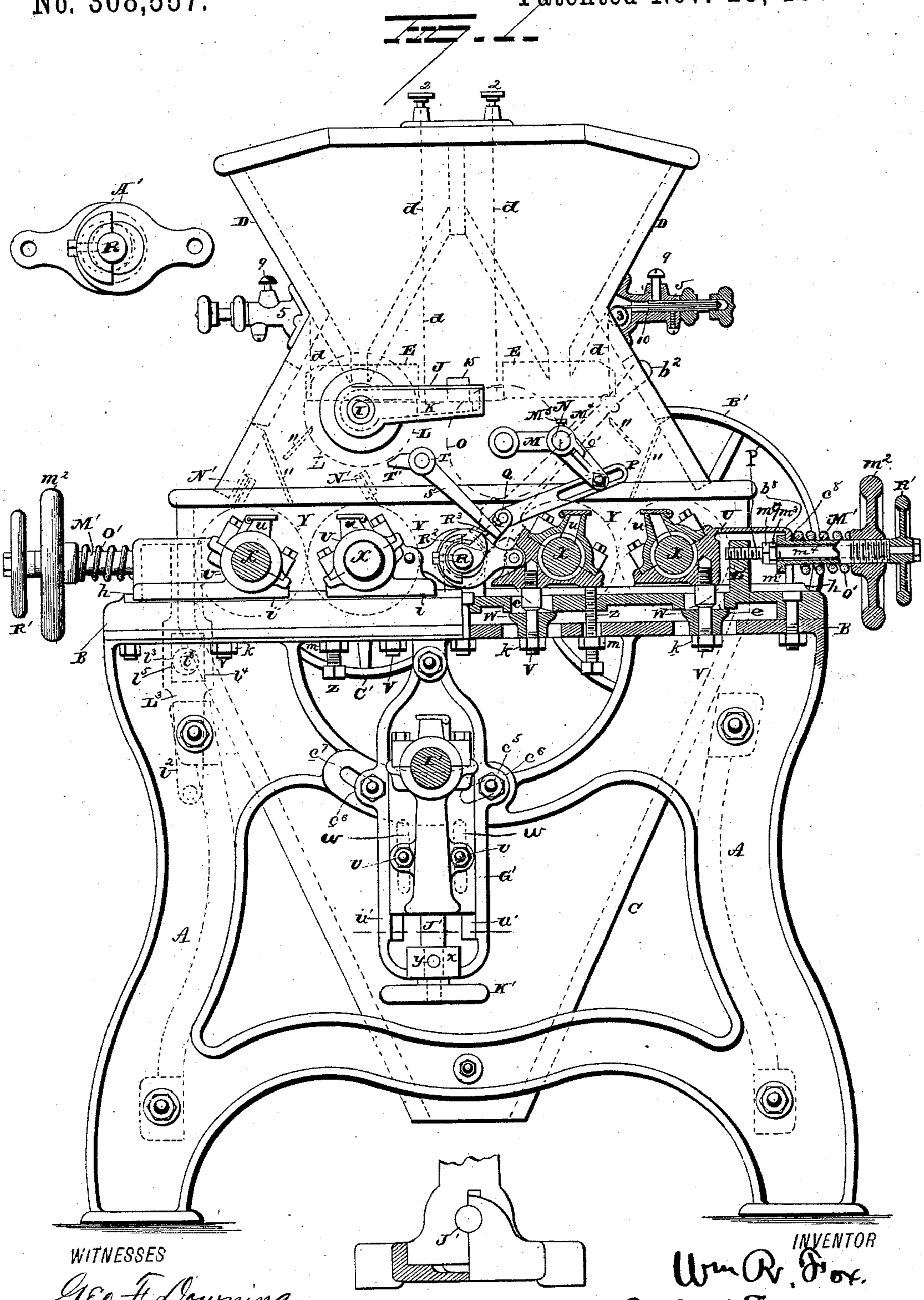
(No Model.)

6 Sheets—Sheet 1.

W. R. FOX.

ROLLER GRINDING MILL.

No. 308,557. Patented Nov. 25, 1884.



WITNESSES

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(No Model.)

6 Sheets—Sheet 2.

W. R. FOX.

ROLLER GRINDING MILL.

No. 308,557. Patented Nov. 25, 1884.

FIG. 2.

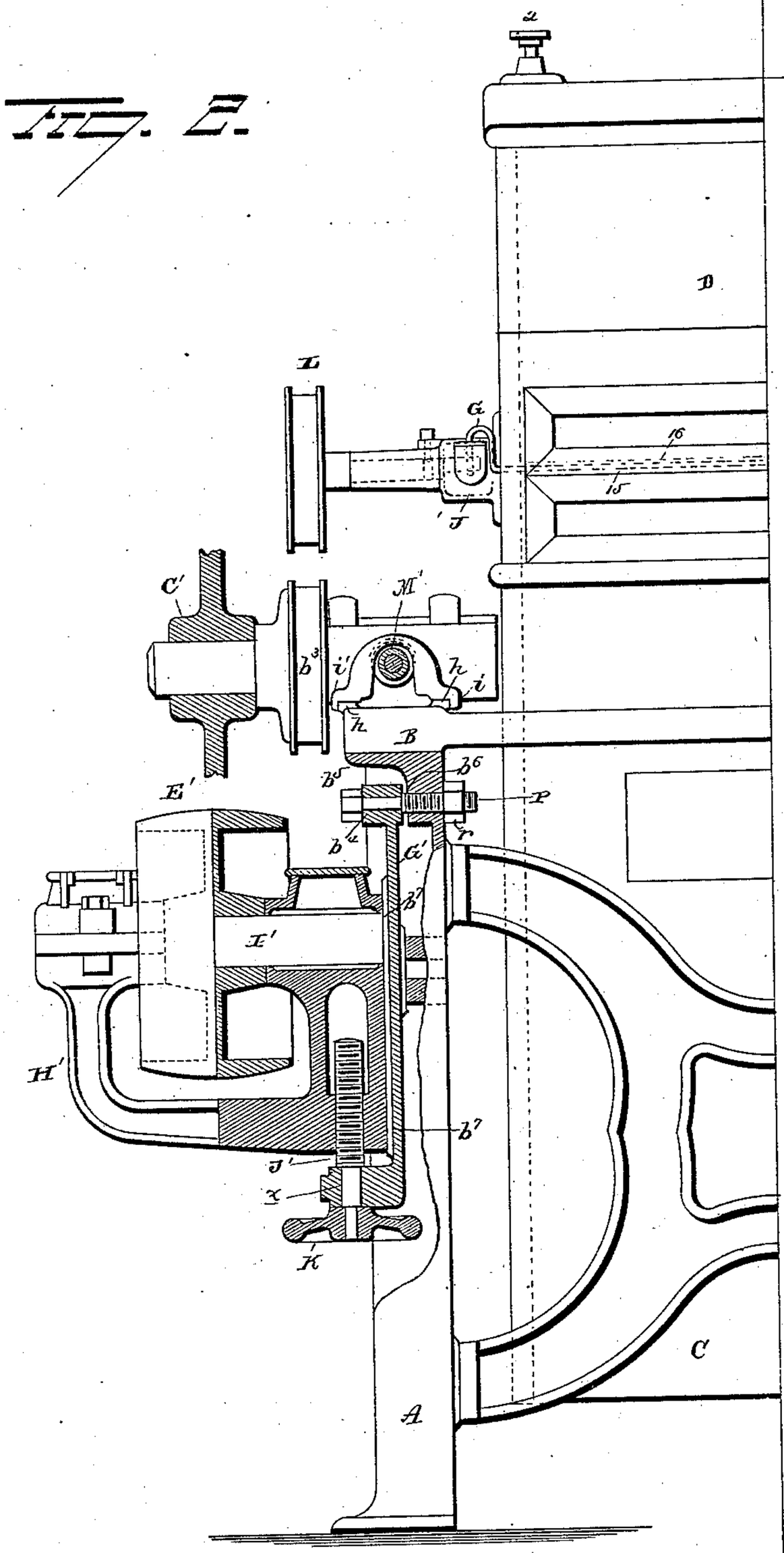
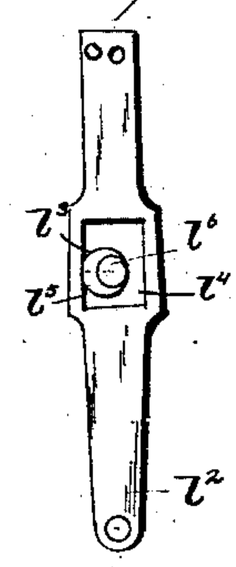


FIG. 11.



WITNESSES

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(No Model.)

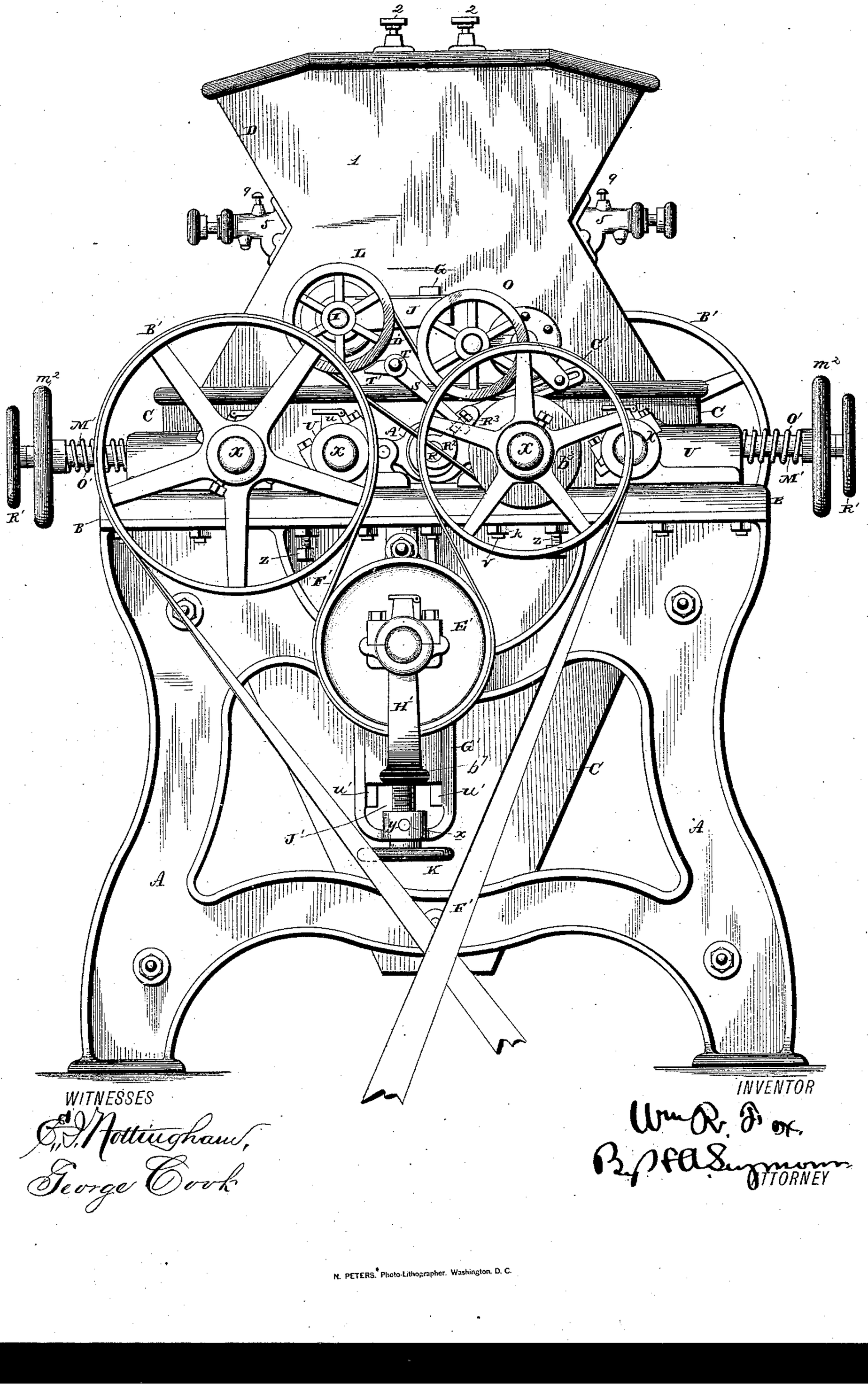
6 Sheets—Sheet 3.

W. R. FOX.

ROLLER GRINDING MILL.

No. 308,557. Patented Nov. 25, 1884.

Fig. 3.



WITNESSES

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(No Model.) 6 Sheets—Sheet 4.

W. R. FOX.

ROLLER GRINDING MILL.

No. 308,557. Patented Nov. 25, 1884.

FIG. 4

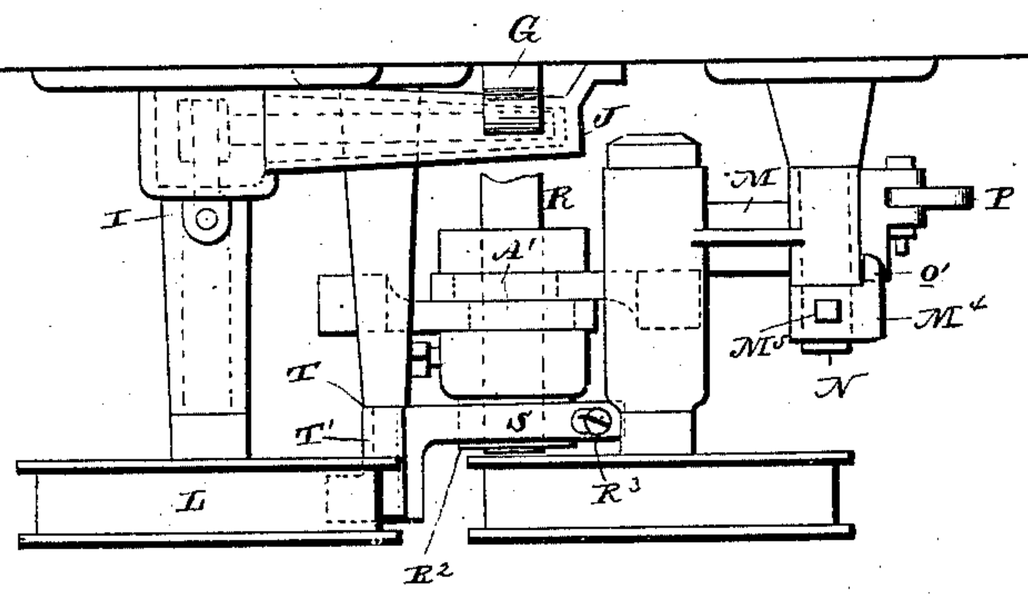
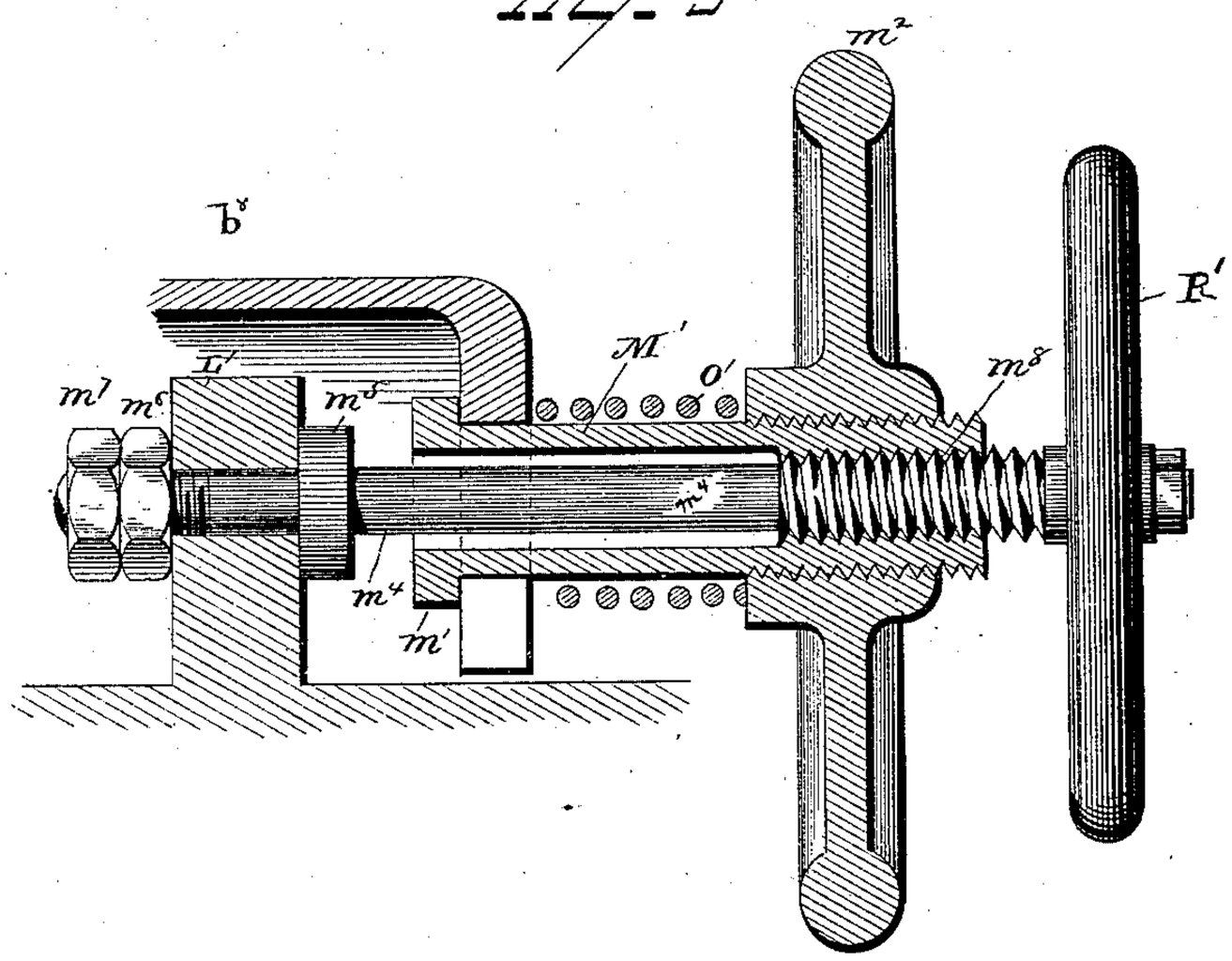


FIG. 9



WITNESSES

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(No Model.)

6 Sheets—Sheet 5.

W. R. FOX.

ROLLER GRINDING MILL.

No. 308,557.

Patented Nov. 25, 1884.

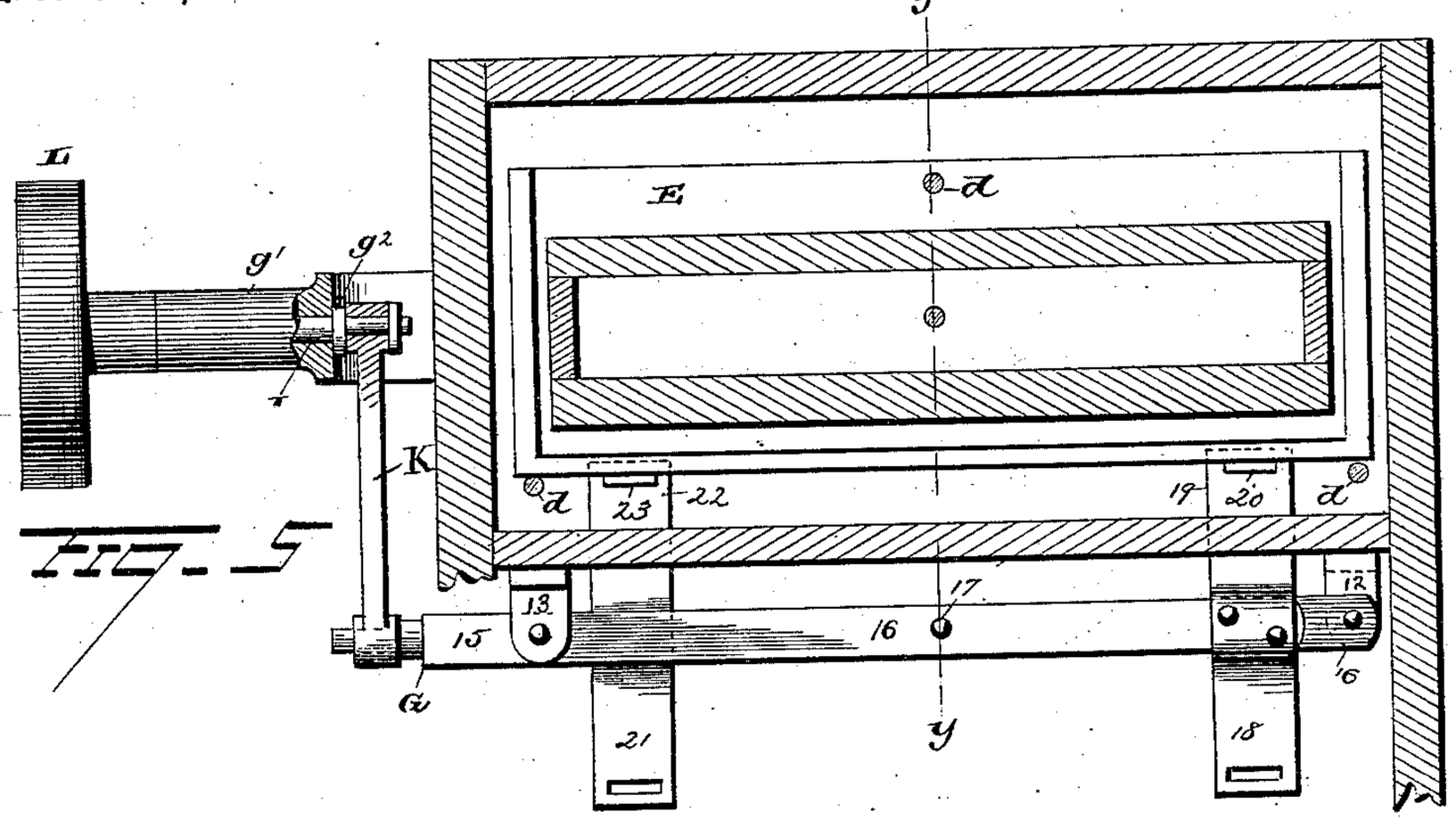

FIG. 5

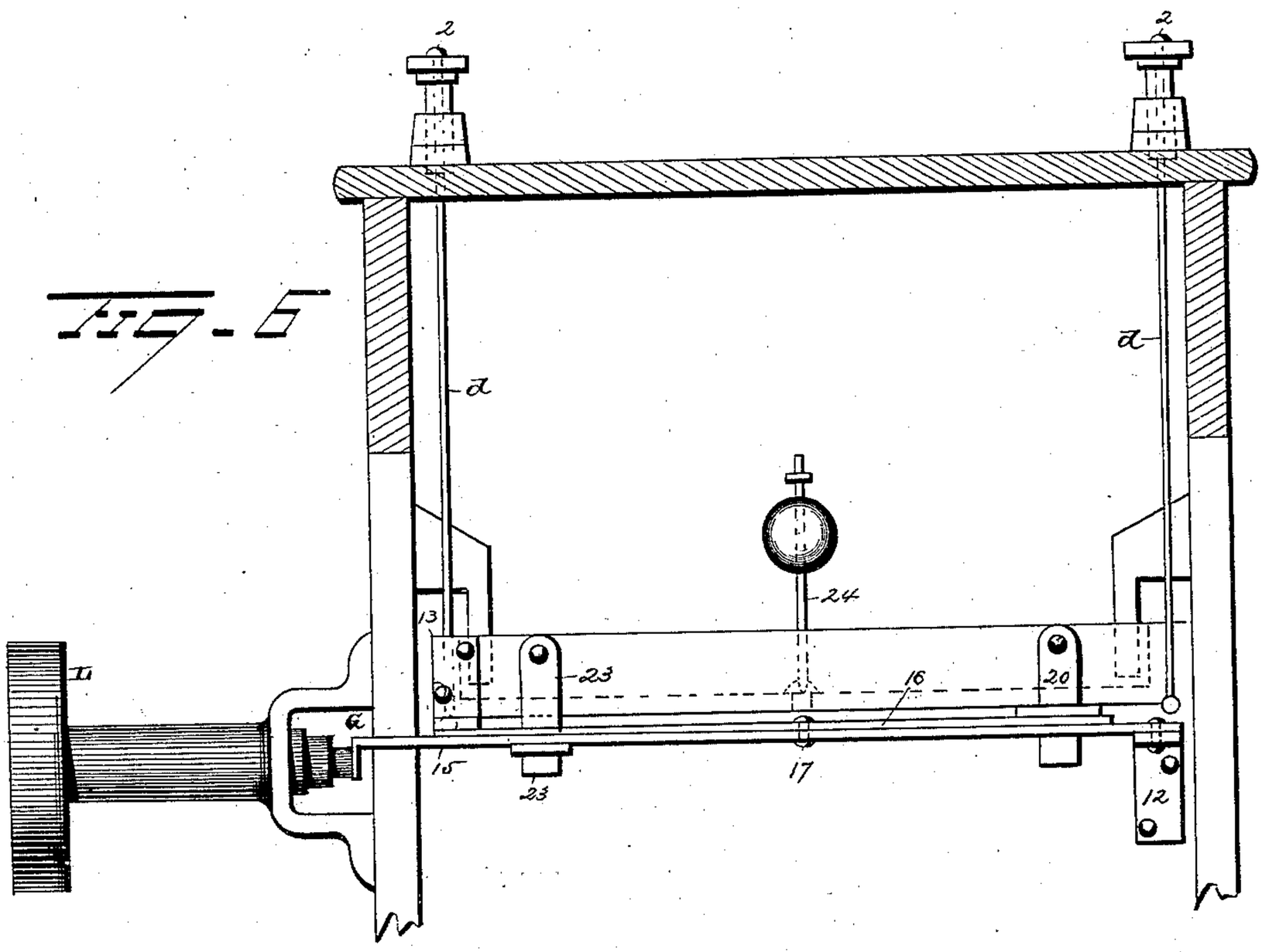

FIG. 6

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6 Sheets—Sheet 6.

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ROLLER GRINDING MILL.

No. 308,557. Patented Nov. 25, 1884.

FIG. 10.

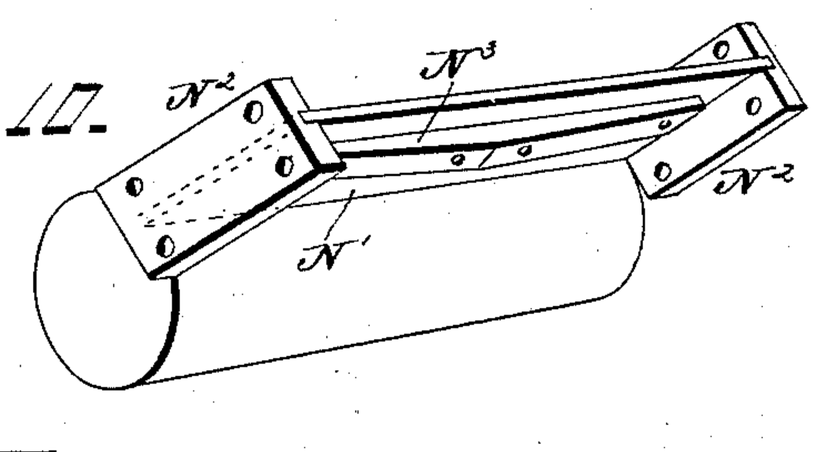


FIG. 7.

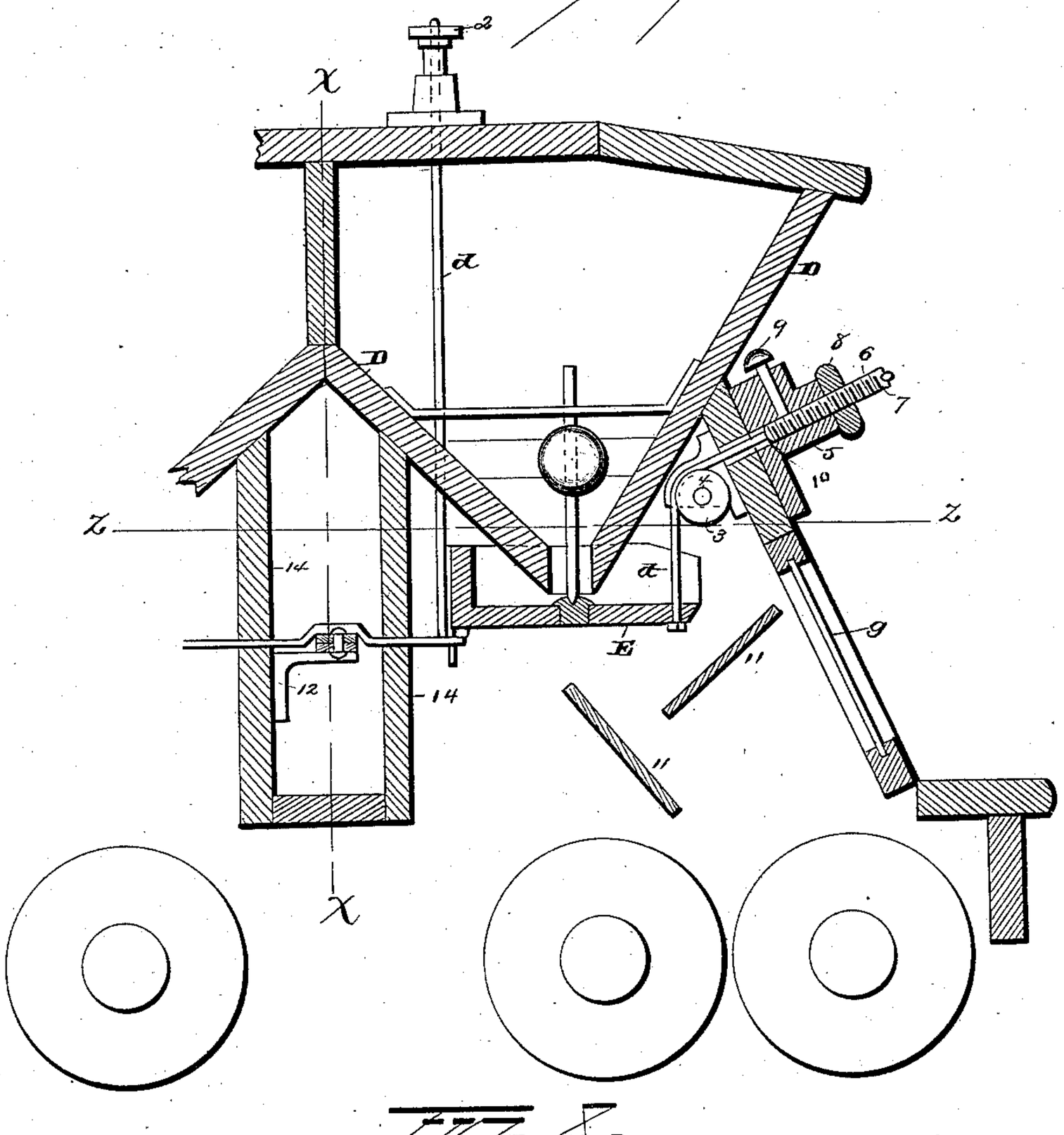
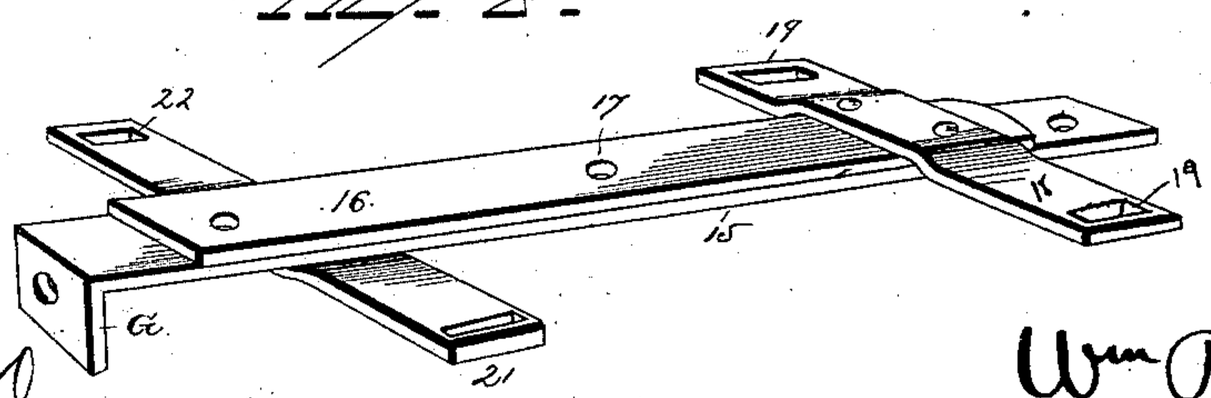


FIG. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM R. FOX, OF GRAND RAPIDS, MICHIGAN.

ROLLER GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 308,557, dated November 25, 1884.

Application filed May 8, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. FOX, of Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Roller Grinding-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 an improvement in roller grinding-mills, the object of my invention being to provide improved means for checking the feed of the grain to the rollers and simultaneously moving the latter apart, and for bringing the rollers together without the necessity of readjustment of the parts, and at the same time start the feed of the grain to the rollers.

A further object of my invention is to provide improved means for horizontally and vertically adjusting the rollers, and also to provide improved means for varying the tension of the driving-belt; and with these ends in view my invention consists in certain novel features of construction and combinations of parts, as will be hereinafter fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an end view of my improved grinder, partly in vertical section and partly in elevation, the driving-pulleys and inner wheels being removed. Fig. 2 is a front view of a portion of my machine, partly in section and partly in elevation. Fig. 3 is an end view. Fig. 4 is a plan view of a portion of the feed mechanism. Fig. 5 is a horizontal sectional view of my improved feed-regulator, taken on line Z Z of Fig. 7. Fig. 6 is a vertical sectional view taken on the line X X of Fig. 7, a portion of the hopper and partition being removed. Fig. 7 is a vertical cross-section of one of the hoppers with the feed-regulating devices attached thereto. Fig. 8 is a detached view showing my improved devices through which motion is imparted to the trays. Fig. 9 is a modification. Fig. 10 is a detached view of the roll-scraper. Fig. 11 is a modification.

A A represent the supports or uprights of the frame, and B the upper cross-pieces thereof, on which frame is supported by means of brackets the mill-casing C, extending slightly above the frame, and having its sides converging toward the bottom. On the top of this casing is secured a feed-regulator constructed as follows:

1 represents the sides of the regulator, to which are secured the sides of the hoppers D, through the lower portion of each of which the grain is fed into a tray or spout, E. Each of these trays is supported by three or more rods, *d*, or their equivalents, situated as shown, the upper ends of two of which pass through the top of the hopper, the upper ends of said rods being provided with nuts or thumb-screws 2, adapted to bear on the upper face of the hopper, and by means of which the rear end of the tray may be vertically adjusted. The rod or wire *d*, supporting the front end of the tray E, is passed over a roller or pulley, 3, secured to a spindle, 4, mounted in frame-brackets secured to the inclined face of the regulator, the said rod or wire passing through the face and lug 5, and having the enlarged end, 6, provided with a screw-thread, 7. A nut, 8, fits on the enlarged end, 6, and against the lug 5, which nut, when turned, is adapted to raise or lower the front end of the tray. The lug 5 is also provided with a perforation, in which fits a pin, 9, against the lower end of which fits the shoulder 10 of the enlarged end of the said rod or wire *d*, and holds the front end of the tray in an elevated adjustment and checks the feed of the grain. Below the tray and to the side of the regulator are secured the inclines 11, upon which falls the grain from the tray, said inclines being situated one below the other and at angles with each other. Immediately below the said inclines are situated the rollers, to be hereinafter referred to, between which the grain falls after leaving the lowest incline.

12 and 13 represent two supports or bearings secured to one of the vertical partitions, 14, separating two adjacent regulators, to which bearing 12 is loosely secured the end of a rod, 15, the other end, G, of which is left free and projects through the end of the regulator casing.

To the bearing 13 is secured the end of the rod 16, which is also pivotally secured to the rod 15 at the point 17, the other end of said rod 16 being secured to a plate, 18, provided at opposite ends with openings 19. Through

these openings 19 pass the lower ends of springs 20, the upper ends of which latter are secured to the rear side of the trays E.

To the rod 15, at a point equally distant from the point 17, is secured a plate, 21, which is also provided at opposite ends with openings 22, through which pass the lower ends of springs 23, and which are also secured to the rear ends of the trays E. These springs serve as a connection to the trays, and also as hinges when the front of the trays are raised or lowered. By thus pivoting the two rods together at a certain point, 17, and connecting them to the trays at points equally distant from said point 17, the ends of the trays, when motion is imparted thereto through the rod 15, will have the same velocity and move with a corresponding motion. To each of the trays is secured the weighted vertical rod 24, adapted to hold the tray steady when not filled with grain. The horizontal motion imparted to the tray throws the grain off of the latter in nearly a regular stream, the feed of the grain to the rollers being made regular by falling upon and passing over the inclines.

If desired, the front of one side of the regulator-casing may be provided with a strip of glass, *g*, or other transparent material, for the purpose of the inspection of the interior of the regulator and the observance of the feed of the grain to the mill.

I make no claim to the construction of the above-described regulator in this application, as it forms subject-matter of another application filed March 4, 1884, and granted July 31, 1884, No. 301,107.

To one end of the regulator-casing is secured the sleeve-bearing *g'*, in which is journaled a shaft, I, to which is connected by means of an eccentric, g^2, a pitman, K, into the end of which latter fits the bent end G of the bar 15, and to the outer end of which shaft I is secured a pulley, L, adapted to convey motion to the tray E. The end of the shaft I and the pitman K are incased by a tank, J, partially filled with oil, in order to keep the parts well lubricated, the cover or top of said tank being provided with an opening to allow of the connection of the bar 15 and pitman K. To the same side of the machine is pivoted at N a bell-crank lever, M, carrying at one end a pulley, O, the other end of said bell-crank being adjustably secured to one end of a connecting-rod, P, the other end of the latter being secured to a crank, Q, on a horizontal shaft, R, passing through the center of the machine and journaled in bearings in the ends of the casing, the said shaft being provided on the opposite end of the machine with a lever or handle, b^2, by means of which the shaft may be partially rotated. When the lever is turned in one direction, the lower arm of the bell-crank M is pulled down and the upper arm thereof raised, thereby raising the pulley O, and when the lever is turned in the opposite direction the pulley O is lowered.

Upon the stationary shaft or stud N upon which the bell-crank lever M is pivoted is placed a sleeve, M^4, loosely mounted on the shaft, and provided with a set-screw, M^5, whereby it may be rotated to any desired point and then secured against displacement. This sleeve is provided with a finger or arm, *o'*, which engages the bell-crank and serves as an adjustable stop to limit the throw or movement of the bell-crank and the belt-tightener pulley, and thus regulate the tension of the belt-tightener pulley on the belt driving the feed-regulating mechanism.

On the shaft R is secured a cam, R^2, with which engages the lower end of a set-screw, R^3, that is adjustably secured in the lower end of the bell-crank lever S, which is pivoted at T. The upper arm, T', of the bell-crank is suitably formed to serve as a brake-shoe, and is adapted to engage the periphery of the belt-pulley L. When the shaft R is turned in one direction, the cam R^2 will raise one end of the bell-crank and move its opposite end away from the belt-pulley. By turning the shaft in the opposite direction the cams allows the lower and weighted end of the bell-crank to fall, and thereby move its upper end in contact with the periphery of the belt-pulley L and operate as a brake and check its movement.

The upper faces of the cross-bars B of the frame are provided with guideways *h*, on which are fitted the sliding boxes U, the latter being provided with downwardly-projecting flanges *i*, adapted to keep the boxes in position. Each of these boxes is kept from becoming detached from the frame of the machine by means of a bolt, V, one end of which is preferably tapped into the box U, and the other end of which is provided with a washer, W, held in position against the under side of the frame B by means of a nut, *k*, screwed onto the lower end of the bolt. Four of these boxes are placed on each of the two ends of the machine, the boxes being allowed to be moved toward or away from each other by elongating the openings *e*, formed in the cross-pieces B of the frame. In these boxes are journaled shafts X, on which are secured the grain-crushing rolls Y. The upper portion of each box or bearing U is made detachable, to enable the journals of the crushing-rolls to be removed therefrom when necessary.

In order to retain the rolls of each pair in the same horizontal plane, I provide screws Z, adapted to be screwed through the top B of the frame, and having their upper ends bear on the under side of one end of the inner boxes, U, and by raising or lowering the screw thereby raise or lower the box, the screw, after being adjusted, being held in position by means of lock-nuts *m*. Each of the boxes U is provided with a lubricating-cup, *u*, adapted to receive oil or other lubricant and keep the bearings well oiled.

To one of the shafts X of the inner rolls is secured a pulley, b^3, around which passes a belt, D', which also passes around the pulley

L and around the under side of the tension-pulley O. When motion is imparted to the rolls in a manner to be hereinafter described, the motion is imparted through the belt D′ to the pulleys L and O and to the feed-regulator.

When stopping a mill it is necessary not only to stop the feed, but to separate the rolls in such manner that they can be returned to their original position without the necessity of readjustment. This I accomplish by securing to the end of the shaft R the double eccentrics A′, the outer ends of the arms of which are pivoted to the inner boxes, U.

It will now be observed that when the lever b^2 on the shaft R is operated in one direction the two inner rolls are drawn together and away from the outer rolls, the tension-pulley O raised as heretofore described from the belt D′, and the brake S applied to the pulley L simultaneously, thus completely and effectually stopping the feed of the grain to the mill. Again, by turning the lever in the opposite direction the feed is started and the inner rolls returned to their operating positions without readjustment of any of the parts, the lever being held in any desired adjustment by a sector-bar or other suitable means.

To the outer end of one of the outer shafts X is secured a large band-wheel, B′, and to the outer end of the inner shaft of the other pair of rolls is secured a smaller band-wheel, C′, and this same arrangement of band-pulleys is duplicated on the opposite side of the machine. Below these pulleys or wheels is adjustably secured a tension-pulley, E′, around which wheels or pulleys pass belts F′, which latter also pass around pulleys driven by an engine or other power. By thus employing pulleys of different diameters the rolls will move at different rates of speed, and thus cause a rubbing action upon the grain, thereby more effectually crushing the latter. This arrangement of the large and small belt-pulleys is an important feature in roller grinding-mills for the following reasons: When the two large pulleys are placed on one side of the machine and the two small pulleys on the opposite side, the belt that drives both of the small or fast pulleys has imposed thereon an undue amount of work, because the frictional contact of the rolls is sufficient to cause the rolls driven by the small pulleys to impart a greater speed to the other or slow rolls than will be imparted to them by their own driving-belt, and hence causes the large pulleys to be driven at a greater rate of speed than their driving-belt. This operation of the belts entails undue strain and work on the driving-belts and prevents the certain and fixed variable speed of the two rolls that is desirable in this type of grinding-mills. By my improved arrangement of pulleys each driving-belt engages one slow and one fast pulley, and hence an equal amount of work is imposed on each belt.

The pulley E′ is mounted in the following manner: G′ represents depending standards located on opposite sides of the machine. Each standard is provided at its upper end with a sleeve-bearing, b^4, loosely mounted on the bolt p, said sleeve-bearing being located between the nut b^5, rigidly fastened to one end of the bolt, and the shoulder b^6 on the bolt, the latter being secured in place by the nut r. This construction and arrangement of parts will enable the lower end of the suspended standard to be moved to any desired horizontal adjustment.

Each of the standards G′ is recessed and provided with guideways u', formed integral with the standard. Within the recess is located the slide b^7 of the yoke H′, said slide being provided with grooves, in which are received the guideways u'. The yoke H′ is held against displacement by the bolts v, passing through the yoke and elongated slots w, formed in the standard. The suspended standard is secured in any desired horizontal adjustment by means of the bolts c^5, extending through the laterally-projecting lugs c^6 on the standard and through the elongated slots c^7 in the frame of the machine. By adjusting the bolt p in the nut r the upper end of the standard may be inclined outwardly or inwardly, for the purpose of adjusting the tension-pulley at the proper inclination to cause the driving-belt to run true on the large and small driving-pulleys. (See Fig. 2.) In this yoke H′ is journaled a horizontal shaft, I′, to which is secured the band-wheel E′. The lower part of the standard is provided with a bearing, x, through which passes the screw J′, adapted to be screwed into the lower end of the yoke H′, and provided on its lower end with a hand-wheel, K′.

It will be now readily seen that by turning the hand-wheel K′ the yoke H′ and band-wheel E′ journaled therein may be raised or lowered, and thereby regulate the tension of the belt F′. After the pulley has been properly adjusted the bolts v are tightened, and the yoke thereby held against displacement, the screw J′ being prevented from turning by means of a set-screw, y, passing through the bearing x and impinging against an annular bearing on the screw-shaft.

On the cross-frame pieces B, near each end thereof, are formed or secured the upwardly-extending lugs or projections L′. Each one of the outer boxes, U, is provided with a lateral extension or housing or arm, b^8, that extends over and outside of the lug L′.

Through an opening, c^8, in the casing or housing b^8 is inserted a hollow shaft or sleeve, M′, the inner end thereof being provided with a collar, m', which engages the inner side of the casing. The outer end of the hollow shaft is screw-threaded, and is furnished with a screw-threaded hand-wheel, m^2. The hollow shaft is encircled by a spiral spring, O′, one end of which bears against the box-casing b^8, while its opposite end bears against the hub of the hand-wheel. Thus it will be observed that the tension of the spring may be regulated by adjusting the hand-wheel m^2.

Through the hollow shaft M′ is inserted a screw shaft or rod, m^4, which is screwed into the lug L′, and its outer end provided with a hand-wheel, R′, which engages the outer end of the hollow shaft M′.

On the shaft m^4 is placed a nut, m^3, which is screwed against the inner end of the hollow shaft and retained against rotary displacement by means of the jam-nut m^9.

By turning the hand-wheel R′ the box may be moved and secured in any desired lateral adjustment, while the box may always yield laterally on the hollow shaft or sleeve and against the tension of the spiral spring. Thus I am enabled to secure any desired adjustment of the box to adapt the mill for fine or coarse grinding, and further provide for a lateral yielding of the boxes and outer roll, so that foreign substances may pass through the rolls without breaking or seriously impairing the rolls or other portions of the mill.

Instead of constructing the adjusting and laterally-yielding mechanism as above described, I may construct the parts as shown in Fig. 9, which is a modification.

In Fig. 9 the box-casing has inserted therein a hollow shaft or sleeve, M′, provided with a collar, m', a spiral spring, O′, and adjustable hand-wheel, m^2, as above described. In this construction the shaft m^4 is secured to the lug L′ by means of the collar m^5 and nuts m^6 m^7, while its outer end is screw-threaded and engages the screw-threaded opening m^8 in the outer end of the hollow shaft. To the outer end of the shaft m^4 is secured a hand-wheel, R′.

In both of the devices above described it will be observed that the spring and both hand-wheels are located on the outer side of the lug. This construction and arrangement of parts enable the lug to be located in quite close proximity to the box, and thereby insure a nearly direct application of the power for regulating the adjustment of the box. Again, by locating the parts outside of the lug, ample space is obtained for the employment of the hand-wheels.

In grinding flour means must be provided for scraping the flour from the rolls, as otherwise the flour would adhere to the rolls and operate to force the rolls apart and seriously interfere with the operation of grinding. Hence I provide a scraper that is simple and effective in its operation, the following being a description of its construction and arrangement relatively to the rolls: Each roll is provided with a scraper, N′, which consists of a strip of sheet metal extending throughout the length of the rolls. Each scraper N′ is supported at its opposite ends in guideways N^2, secured to the inner sides of the mill-casing. As the scrapers are located above the rolls, they will be fed downward on the rolls by gravity and remove any flour or substances adhering to the rolls. To impart proper weight and stiffness to the scraper, I rivet or otherwise secure thereto the cast or wrought metal bars N^3.

If desired, the mill may be constructed so that the outer roll of one pair may be moved outwardly independent of the other set and the rolls separated. To accomplish this result I provide at each end of the machine a lever, L^3, having a downwardly-projecting arm, l^2, pivoted at its lower end. Arm l^2 is provided with an opening, l^3, in which is fitted a sliding box, l^4, having an eccentric bearing, l^5, mounted therein. A shaft, l^6, mounted in the end frames of the mill, extends through the eccentric bearings. By rotating the shaft l^6, the levers L^3, which are connected in any suitable manner to the boxes of the outer rolls, may be moved laterally in either direction.

As it is evident that many slight changes in the construction, the form, and the relative arrangement of the different parts of my improved grinding-mill might be resorted to without departing from the spirit and scope of my invention, I would have it understood that I do not limit or restrict myself to the exact construction and arrangement of parts as shown and described; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a roller-mill, the combination, with two pairs of rolls and a feed-regulator, of a belt-pulley for actuating the feed-regulator, a belt-tightener pulley, a bell-crank lever on which the tightener-pulley is journaled, and a shaft connected to one roll of each pair and to the bell-crank lever, for the purpose of simultaneously separating the rolls and checking the feed.

2. In a roller grinding-mill, the combination, with two series of rolls, a feed-regulator located above the rolls, a pulley for actuating the feed-regulator, and a shaft located between and connected to the inner rolls of both series, of a bell-crank lever provided at one end with a belt-tightening wheel adapted to bear against the feed-regulator driving-belt, and adjustably connected at its opposite end to the shaft, whereby when the shaft is turned in one direction the rolls are separated and the feeding mechanism checked.

3. In a roller grinding-mill, the combination, with the belt-pulley for actuating the feed-regulator, of a belt-tightener pulley, a brake, rock-shaft, and connecting devices for operating the brake and belt-tightener pulley simultaneously, substantially as set forth.

4. In a roller grinding-mill, the combination, with the feed-regulator, its driving-belt and pulleys, and brake and belt-tightener pulley, of a set of grinding-rolls and means for simultaneously moving one of the rolls of each set and for actuating the brake and the belt-tightener pulley, substantially as set forth.

5. In a roller grinding-mill, the combination, with two pairs of rolls, the inner rolls of each pair being journaled in laterally-adjustable bearings, a rock-shaft located between said inner rolls, and eccentric rods or bars connecting the rock-shaft and adjustable bearings, of the feed-regulator, a belt for

driving the same, a tightener for said belt, and devices connecting the tightener and rock-shaft, substantially as set forth.

6. In a roller grinding-mill, the combination, with a roller-frame and roller-bearings, the entire series of which is mounted on said frame and adapted to slide thereon, of bolts screwed into the bearings and provided with washers that engage the under side of the frame, said bolts being adapted to hold the bearings in position.

7. In a roller grinding-mill, the combination, with rolls and a series of sliding bearings in which said rolls are journaled, of bolts screwed into the bearings and provided with washers impinging against the mill-frame, and set-screws arranged to engage the under side of the bearings at one side of their vertical centers for imparting vertical adjustment to the bearings and rollers, substantially as set forth.

8. The combination, with two series of rollers and movable bearings supporting the inner rollers of both series, of a rock-shaft carrying eccentrics, and rigid arms connecting the eccentrics with the bearings of the rollers, whereby when the shaft is turned in one direction the arms draw both inner rollers away from the outer rollers, and when turned in the opposite direction force both inner rollers toward the outer rollers, substantially as set forth.

9. In a roller grinding-mill, the combination, with the frame and a depending standard journaled at its upper end on a bolt or stud secured to the frame, said standard provided with guideways, of a yoke provided with a grooved slide adapted to fit said ways, bolts for securing the slide to the standard, and a screw for imparting vertical adjustment to the slide, substantially as set forth.

10. In a grinding-mill, the combination, with a roll and laterally-movable bearings formed with an arm or casing, of an adjustable spring pressing against said arm or casing, and an adjusting-screw engaging a lug or projection on the mill-frame inside the arm or casing, substantially as set forth.

11. In a roller grinding-mill, the combination, with a roll supported at each end by a laterally-movable bearing having a laterally-projecting casing or arm, and a lug formed on the mill-frame inside of said arm or casing, of a hollow shaft inserted through an opening in the arm or casing, a spiral spring encircling said hollow shaft, a hand-wheel mounted thereon for regulating the tension of the spring, a screw-threaded shaft inserted in the hollow shaft and engaging said lug or projection, and a hand-wheel for operating the screw-shaft, substantially as set forth.

12. In a roller grinding-mill, the combination, with a feed-regulator, a shaft for actuating the regulator, an eccentric, and a rod connecting said shaft and the trays, of an oil-trough located outside of the machine-frame and inclosing the eccentric and eccentric-rod, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM R. FOX.

Witnesses:
S. G. NOTTINGHAM,
GEORGE COOK.