(No Model.)

4 Sheets—Sheet 1.

H. CUTLER.

GRINDING MILL.

No. 328,656. Patented Oct. 20, 1885.

Fig. 1.

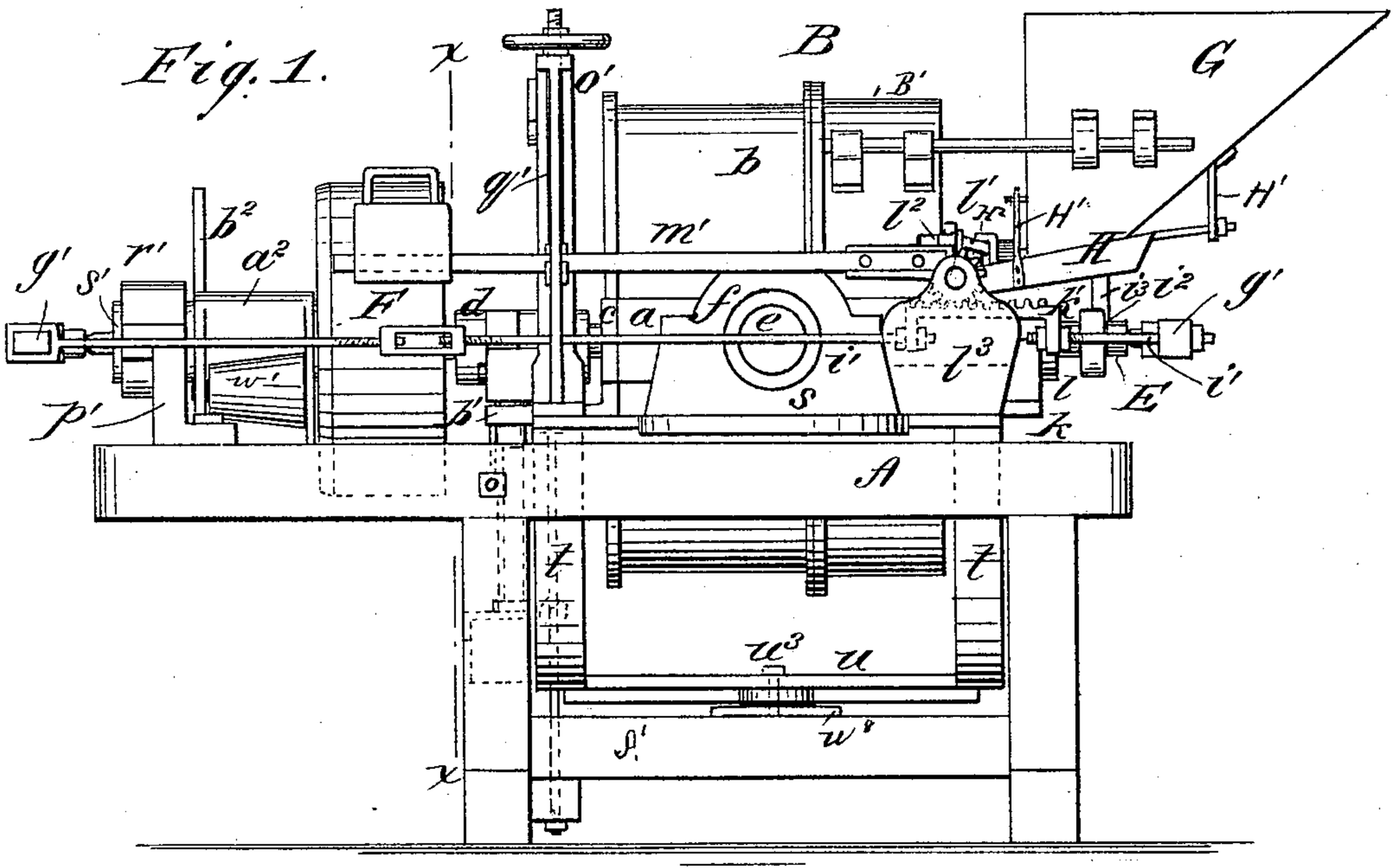
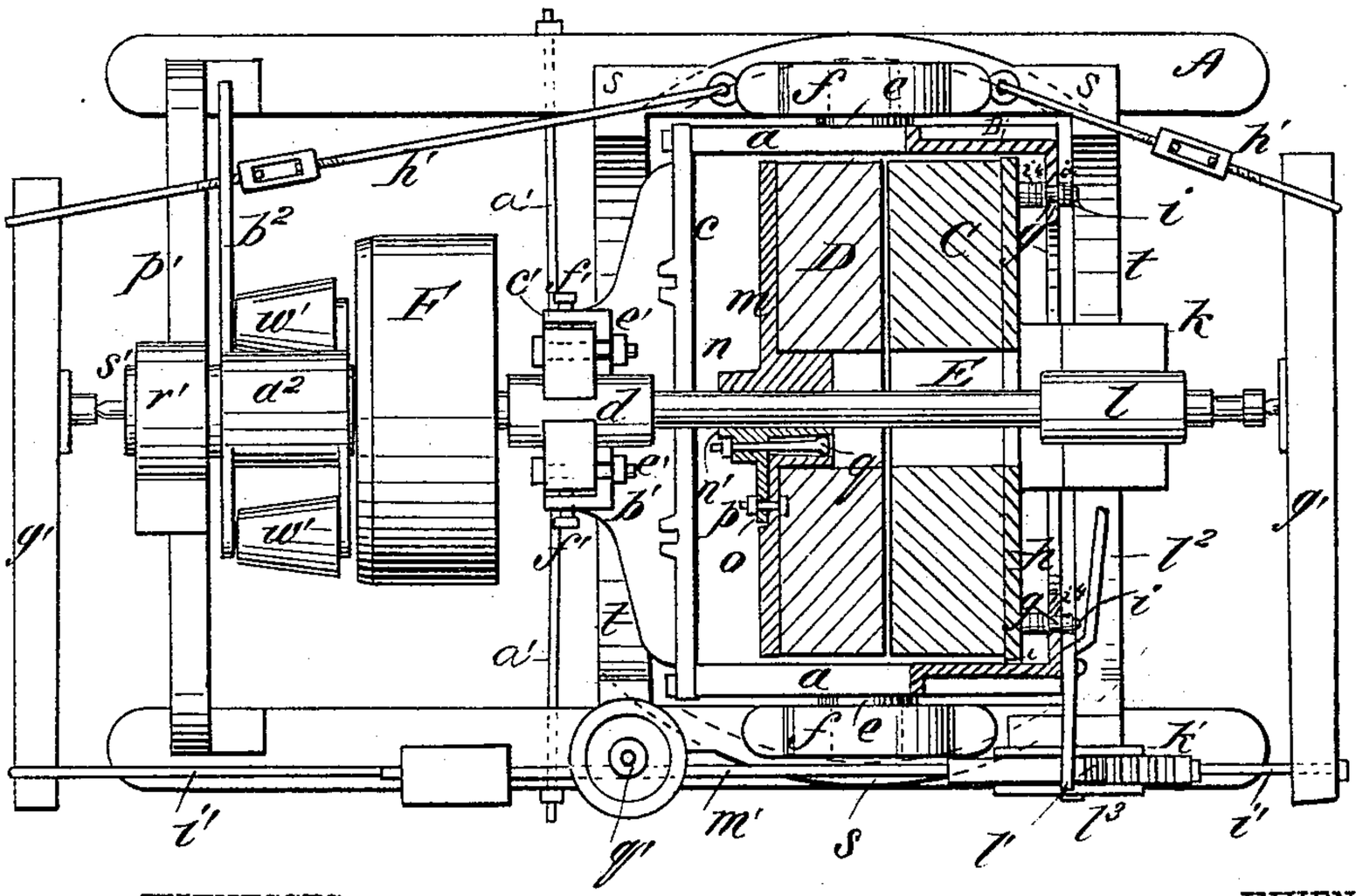


Fig. 2.



WITNESSES:

Donn Twitchell.

C. Sedgwick

INVENTOR:

H. Cutler

BY Munn & Co

ATTORNEYS.

(No Model.)

4 Sheets—Sheet 2.

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Fig. 3.

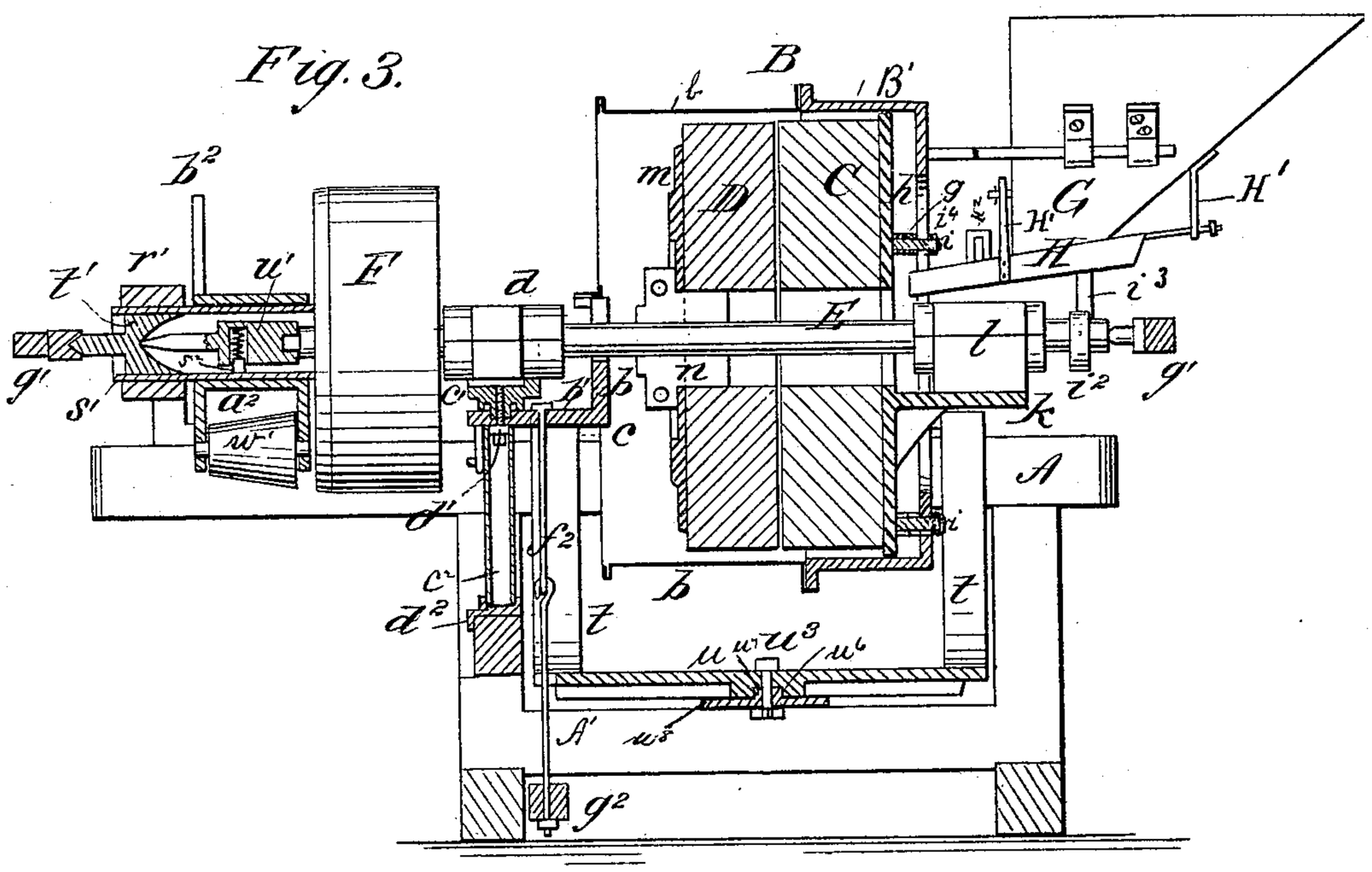


Fig. 4.

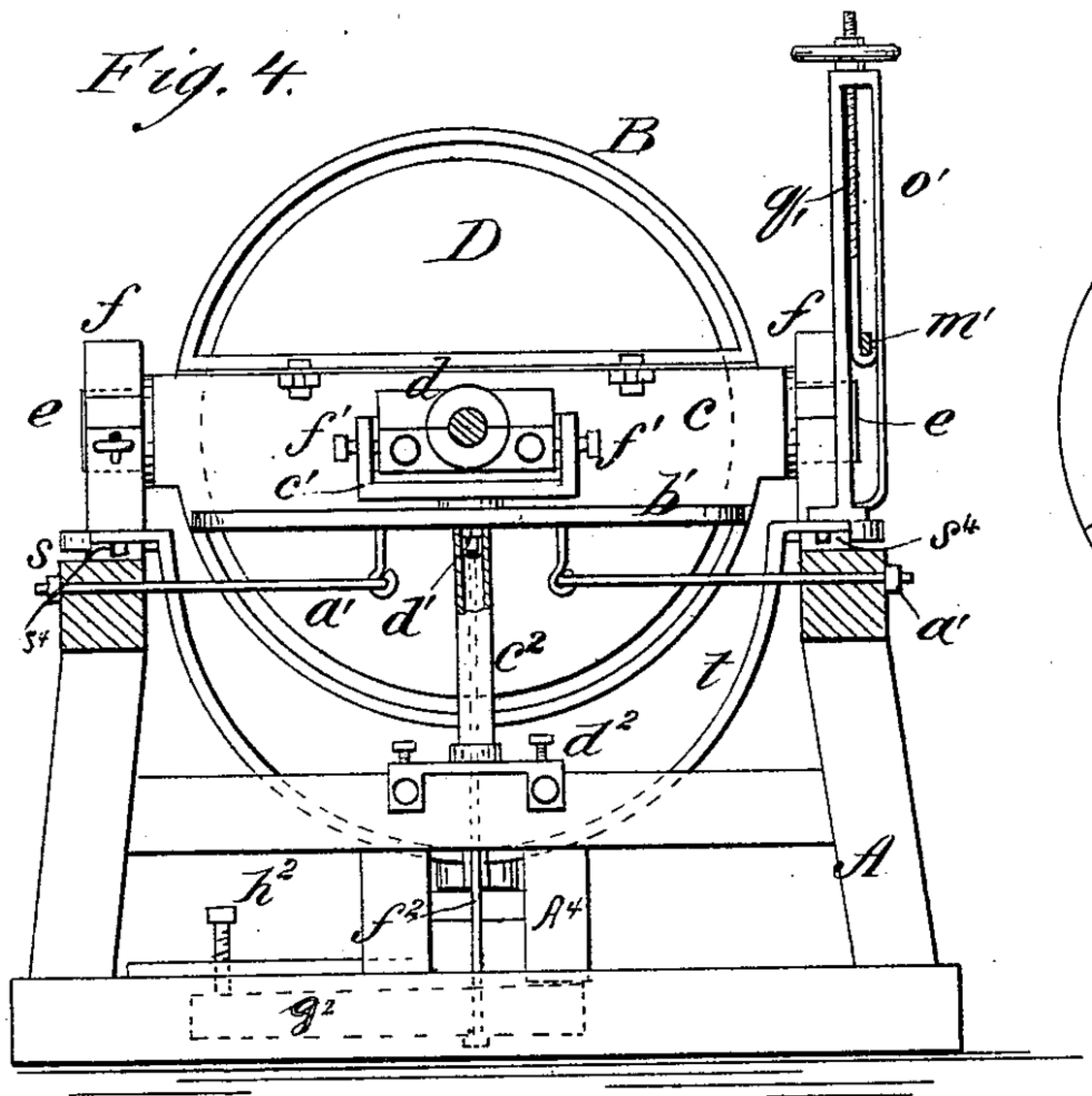
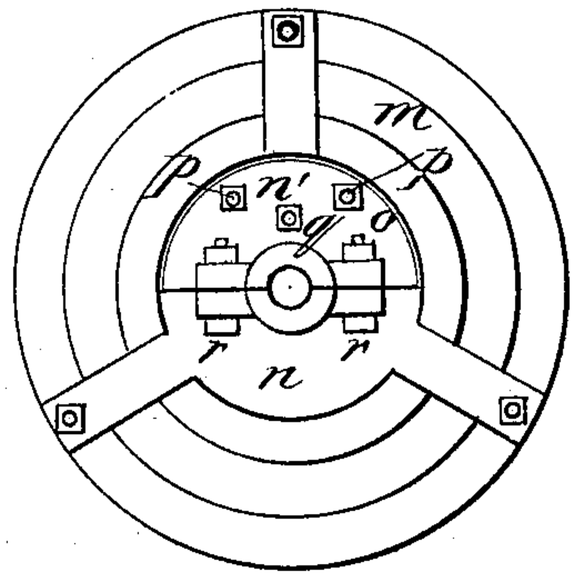


Fig. 5.



WITNESSES:

Donn Twitchell.

C. Sedgwick

INVENTOR:

H. Cutler

BY Munn & Co

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 3.

H. CUTLER.

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Fig. 7.

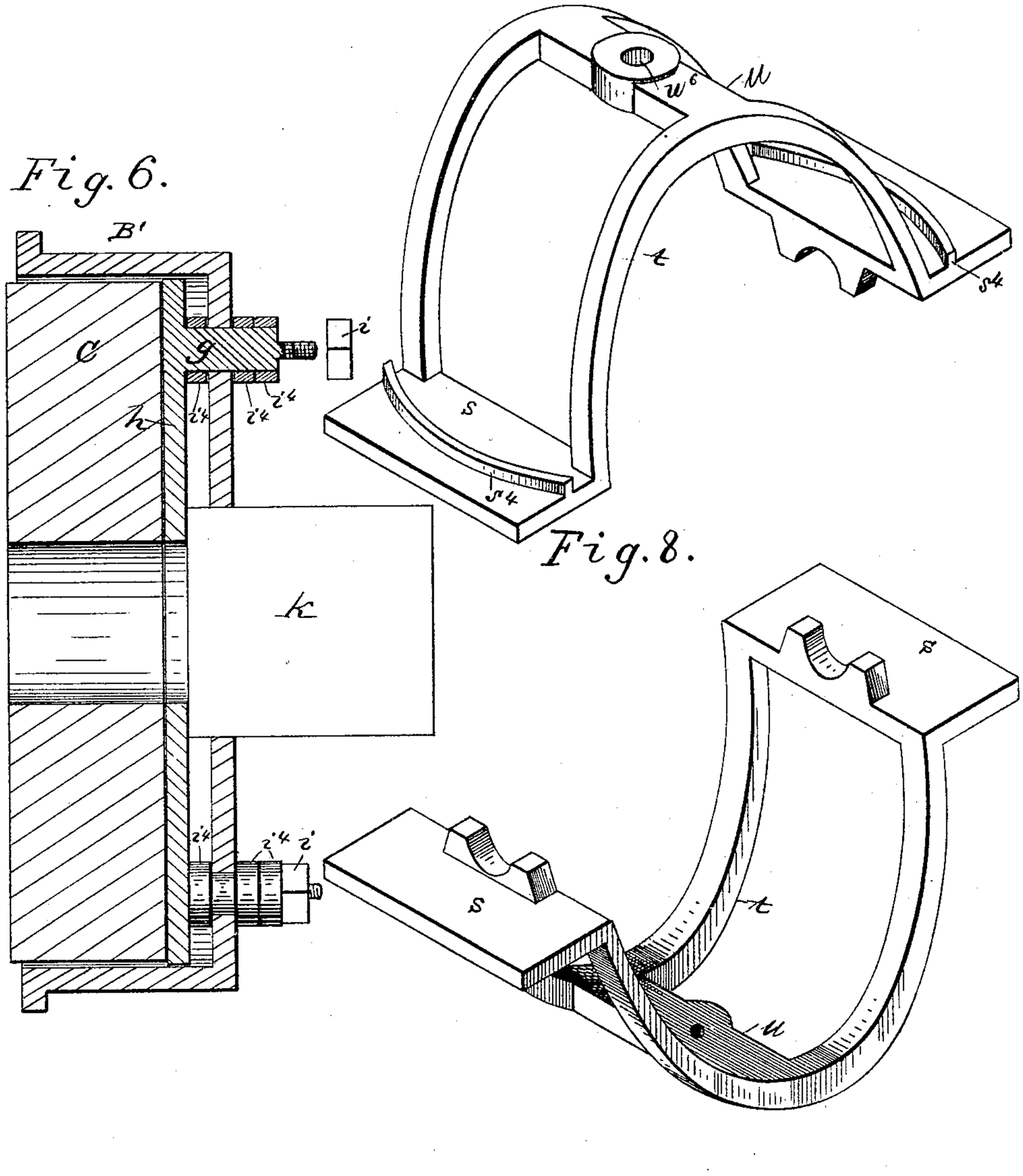

Fig. 6.

Fig. 8.

WITNESSES:

Donn Twitchell

C. Sedgwick

INVENTOR:

H. Cutler

BY Munn & Co

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 4.

H. CUTLER.

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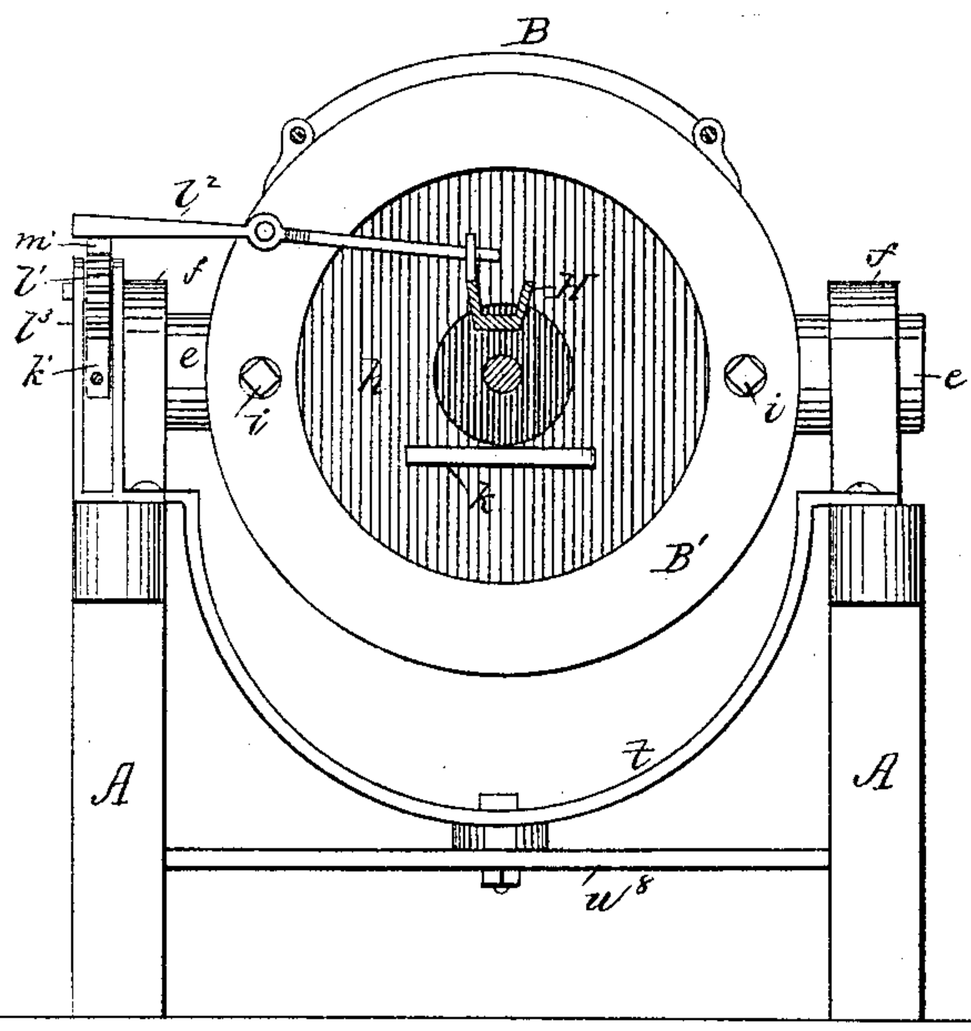
Fig. 9.



WITNESSES:

C. Sedgwick

Jno. Mathews Ritter

INVENTOR:

H. Cutler

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

HENRY CUTLER, OF NORTH WILBRAHAM, MASSACHUSETTS.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 328,656, dated October 20, 1885.

Application filed December 13, 1884. Serial No. 150,275. (No model.)

To all whom it may concern:

Be it known that I, HENRY CUTLER, of North Wilbraham, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a full, clear, and exact description.

My improvements relate to portable mills of the vertical-disk type, and have for their objects to provide for the accurate setting and adjustment of the stones to compensate for their wear and to allow of the stationary stone being dressed without removal from the case.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the mill complete. Fig. 2 is a plan view with the case and stones in section on a central horizontal line. Fig. 3 is a vertical longitudinal section of the mill. Fig. 4 is a cross-section on line *x x* of Fig. 1. Fig. 5 is a view of the back of the runner-stone, showing its adjustable box. Fig. 6 is a sectional view, on an enlarged scale, of the section B′ of the casing, the fixed stone, the attaching-plate therefor, the studs on the same projecting through the rear plate, the retaining-nuts, and the tubular washers. Fig. 7 is a perspective view, on an enlarged scale, of the under side of the turn-table frame, and Fig. 8 is a perspective view of the upper side thereof. Fig. 9 is a view showing, among other parts, the feed-operating mechanism, the shoe being in section.

A is the supporting-frame of the mill; B, the case; C, the stationary stone; D, the running stone; E, the shaft; F, the driving-pulley; G, the feed-hopper, and H the feed-shoe.

The case B inclosing the stones is formed of a cast-iron portion, B′, having lateral arms *a*, the space between arms *a* being filled out with sheet-metal sections *b*. The sections or arms *a* serve to support a cross-plate, *c*, to which the inner journal-box *d* is attached, as hereinafter specified, and on the arms *a* are formed the trunnions *e e* that are sustained in the side boxes, *f*, whereby the case B is allowed to swing in a vertical plane. In the outer end of the case are holes for cylindrical studs *g*, that project from the plate *h*, that is fixed to the back of the stationary stone. On these cylindrical studs tubular washers *i*⁴ are placed, and nuts *i* are screwed onto the ends of the studs to hold the plate *h* and the washers firmly in place. When the fixed stone C is new, the washers *i*⁴ are all placed on the studs outside of the back plate of the casing, and as the stone begins to wear away the washers are transferred, one at a time, from the outside to the inner side of the casing, which causes the face of fixed stone to lie in the proper plane. (See Fig. 6.) The washers *i*⁴ are of equal length, and each represents the distance which the stone is to be set forward at one time. By these means the stones are made interchangeable without regard to thickness.

The disk *h*, covering the back of stone C, is formed with a horizontal flange or shelf, *k*, that projects through an opening in the back of case B, and to this shelf is attached the end journal-box, *l*, of the shaft.

As before stated, the inner journal-box, *d*, is supported on the plate *c*, secured to the arms *a* of the case, and the outer journal-box, *l*, is supported on a shelf, *k*, formed on the section B′ of the case. Said boxes support the shaft E and the runner-stone. The case B with these parts can be turned on its trunnions *e* to bring the stones into a horizontal position for the purpose of dressing the fixed stone C without the necessity of removing it from the part B′ of the casing. Before the stone C can be dressed, sheet-iron sections *b*, the shaft E, and the runner-stone D must of course be removed.

The running-stone D is attached to the shaft and secured thereon by means of the disk *m*, that has formed upon its center a half-box, *n*, projecting into the eye of the stone, and is also fitted with a plate, *o*, carrying the half-box *n*′. The plate *o* is attached to disk *m* by bolts and nuts *p*, and, as shown in Fig. 2, there is a wedge or headed key-bolt, *q*, passing through box *n*′ into a wedge-shaped space between box *n*′ and a flange on disk *m*, so that when the bolt *q* is drawn endwise by means of its nut the box *n*′ is pressed closely against the shaft. The two boxes are clamped to the shaft by the bolts and nuts *r*, which are to be loosened when the stone is to be shifted—that is, when the shaft E and the stone are to be removed to get at the stone C for dressing it.

The two side boxes, *f*, supporting the case B by its trunnions, are carried on an iron turn-table frame, constructed as follows: The boxes are formed on plates *s*, resting on the top of frame A, and on the under sides of these plates are circular tongues s^4, entering grooves in the top of the frame or in plates on the top of the frame. The plates *s* at each end are connected by semicircular bars *t*, that extend below case B far enough to allow the latter to swing on its trunnions. The plates *s* and bars *t* form in plan view a rectangular frame. The two curved bars *t* are connected by a plate, *u*, at the bottom, which plate is centered by a socket, u^6, on its under side, into which projects a boss, u^7, on a cross-plate, u^8, supported on cross-timbers A′ of the frame A. This construction allows the whole frame with the boxes *f* to swing right and left, the plates *s* moving in the circular grooves on frame A′. The pin u^3 pivotally connects the swiveled frame to the cross-plate u^8.

As shown in Figs. 2 and 4, there are guy-bolts *a′* hooked to horns on cross-plate *c*, and these bolts pass through frame A and have nuts on their ends, whereby the turn-table frame is held in any position as desired. For adjusting and leveling the shaft, and for regulating the distance between the stones, the construction and arrangement are as follows: The cross-plate *c*, connecting the two arms *a* of case B, is formed with a shelf or flange, *b′*, that supports a swiveling plate, *c′*, that rests on a stud and is fastened by a pivot-bolt, *d′*. In plate *c′* are slots that receive the bolts *e′*, that pass through wings formed on journal-box *d*, so as to fasten the box to the swivel-plate. Set-screws *f′* are also provided to hold the box in place.

When the shaft is in the horizontal position, a washer under the center bolt of the swivel-plate *c′* enters the upper end of a hollow column, c^2, that rises from the bed-frame, so as to support the shaft. The lower end of the column stands on an iron bracket, d^2, that is supported by two set-screws, so that the shaft can be raised or lowered. It can be moved sidewise by adjustment of the guy-rods *a′*, that connect to the plate *c*. A bolt, f^2, with a T-head passes through a slot in the shelf *b′* of plate *c b*, and extends down under the mill-frame, where it connects with a lever, g^2, that is worked by a screw, h^2, to draw the shaft and parts down firmly upon the column.

At the ends of the main frame there are levers *g′*, their ends at one side of the mill being connected by rods *h′* to posts on the trunnion-box, while their opposite ends are connected by rods *i′* to a rack, *k′*, which is within a housing, l^3, near the feed end of the machine. The levers *g′* carry step-boxes for the pivot ends of the shaft. The rack *k′* engages a pinion, *l′*, on the end of a weighted lever, *m′*, the outer end of which is supported by the hook end of a vertical adjusting-screw, *q′*, that is fitted in a post, *o′*. By this arrangement the weighted lever, acting through the rack *k′* and rods *i′*, presses the shaft endwise and maintains the running stone at the proper distance from the stationary stone, according to the fineness of grinding desired, and by raising or lowering the screw *q′* the downward or upward movement of lever *m′* is regulated; but the screw allows the lever to rise in case an obstruction passes between the stones. There are turn-buckles in the rods *h′* and *i′* for shortening up the connections as the stones wear.

At the end of the shaft next the driving-pulley the frame A is provided with an arch, *p′*, formed with a box, *r′*, having fixedly secured thereto a tube or sleeve, *s′*. In this sleeve is a sliding step, *t′*, whose pivot is against the lever *g′*, and its inner end receives the pivot-box *u′*, which is on the end of the shaft. The box *u′* is smaller than the sleeve, and it is retained centrally by a spring contained in a recess in the box, and resting on the bottom of the sleeve, or a loose stud may be placed in the recess between the lower end of the spring and the sleeve, so that the box can accommodate itself to the position of the pivot without friction on the sides of the sleeve. The stud being separate from the sleeve does not of course interfere with the longitudinal adjustment of the shaft E and its box. The sleeve *s′* forms an oil-box that protects the bearings from dust, and the construction shown allows removal of the box *u′* without disturbing other parts of the mill.

The oil-box sleeve *s′* also serves as a bearing for the collar a^2 of the belt-shifting device. There are segmental flanges on the collar, between which are fitted three cone-pulleys, *w′*, that have their larger ends close up to the driving-pulley. The cone-pulleys are within about one-half of the circle described by the drive-pulley F.

In practice I provide any ordinary shifter for throwing the belt off of the driving-pulley F. When thrown from the drive-pulley, the belt will fall upon the sleeve a^2, which will cause said belt to become slack and motionless. The belt in this position does not touch the conical rollers *w′*, which, in the normal position of the sleeve a^2, are below the shaft E, as shown in the drawings. If the belt is to be shifted from the sleeve a^2 to its position on the drive-pulley, the lever b^2 is forced down, and this throws the pulleys *w′* outward toward that side of the pulley around which the belt passes. The curves described by the conical pulleys and the drive-pulleys are now on the same arc. This movement of course tightens the belt just as it would be if in place on the drive-pulley, and the bases of the conical-shaped pulleys being next to the pulley the belt will ride up said pulleys and start the drive-pulley F and be drawn to its proper place thereon. To enable the belt to more readily pass from the conical pulleys to the drive-pulley, the adjacent edge of the latter is beveled, as clearly shown in the drawings.

The feed-shoe H is suspended loosely and centrally from the hopper G by means of hangers H′, so that it will be free to rock. The under side of the shoe has a downward-extending arm, i^3, that projects into the path of the beater i^2 on the shaft E, so that a vibratory movement will be given the shoe by said beater. A lever, l^2, is pivoted at its center to the rear end of the casing B′, and one end of the said lever extends across the adjacent edge of the shoe through a loop, H^2, and the other end extends across the upper face of the lever m'. If the lever m' is raised to throw the stones apart, it will raise that end of the lever l^2 resting thereon, which will of course depress the opposite end, and this in turn will depress the side of the shoe on which it rests, and thereby cause the depending-arm i^3 to be thrown out of the path of the beater to stop the vibratory movement and the feed.

When the stones are to be adjusted, the case, with the stones inclosed, is turned up to bring the stones on a horizontal line. While in this position the runner-stone, with the shaft through its center, is placed on the stationary stone with the two faces arranged so that they stand in just such relation to each other as they should when the mill is in operation. One end of the shaft is already fixed in the outer box, and it is only necessary to secure the other end to retain the stones in proper adjustment. This is done by sliding the box *d* down on the shaft until its wings strike the swivel-plate, which assumes a position corresponding to the line of the shaft. The pivot-bolt is then drawn tightly, the box bolted to the plate, and the set-screws run up. Thus both ends of the shaft are secured to the case, the stone faces are parallel, and all parts are carried by the case. The case can then be turned to bring the stones vertical, and secure them in place by the guy-bolts. As the position of the mill-shaft is frequently changed to accommodate the faces of the stones, it is necessary to change the position of the case, so that the mill-shaft can be kept in line with the power-shaft. The guy-bolts moving the turn-table frame and the set-screws for raising the supporting-column permit such adjustment without disturbing the adjustment of the stones.

It is well known that mills do the best work when the faces of the stones remain perfectly parallel and the wear is even; but in vertical mills this even wear of the stones cannot be maintained on account of the uneven wear of the boxes and giving way of the frame under the strain of the driving-belt, which causes the stationary stone to wear most at one side of the center, and the edges of the running stone to wear faster than the middle portion, so that before long the mill becomes unfit for doing good work, and must be overhauled at great expense of time and labor.

By the improved construction described hereinbefore, the stones being first set accurately, the adjustment is readily maintained, both as regards the relation of the stones to each other and of the shaft and the running stone, by resetting the boxes before the wear has caused a change in the angle of the stone-faces, and thus the uneven wear is reduced to a minimum. I may also use larger stones than is usually practicable in this class of mills.

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

1. The combination, with the main frame A, the casing B, comprising the cast-metal section B′, provided with trunnions *e* and lateral arms *a*, and sheet-metal sections *b*, and the fixed and running stones within said casing, of the swiveled frame comprising the plates *s*, the journal-boxes *f* thereon, the curved bars *t*, connecting the ends of said plates, and the bar or plate *u*, connecting the plates *t* at the center of their curves, and bearing on the casing B, substantially as set forth.

2. The casing B, comprising the cast-metal section B′, having lateral arms *a* and sheet-metal portions *b*, secured to said arms, substantially as set forth.

3. The casing B, comprising the cast-metal section B′, having lateral arms *a*, and trunnions *e* integral therewith, the sheet-metal sections *b*, and the cross-plate *c*, the swiveled plate *c′*, and box *d*, in combination with the stones D C, and the disk *h*, secured to the stone C and provided with the shelf *k* and box *l*, substantially as set forth.

4. In a grinding-mill, the disk *m*, adjustable plate *o*, half-boxes *n n′*, and key-bolt *q*, combined with the running-stone and shaft, substantially as and for the purpose set forth.

5. The combination, with the frame A, having semicircular grooves in the upper surfaces of its side bars, of a swiveled frame provided with side plates, *s*, semicircular tongues s^4 on the under side thereof entering said grooves, boxes *f* on said plates, and the casing B, having trunnions *e*, journaled in said boxes, substantially as set forth.

6. The combination, with the main frame, the horizontal swiveled U-shaped frame therein, and the casing B, journaled to swing vertically in said swiveled frame, of the shaft E, bearings therefor connected with the casing B, the runner-stone on said shaft, the fixed stone secured to the back plate of the casing, and mechanism connected with the main frame and the swiveled frame, for adjusting the said swiveled frame in any desired position, whereby a horizontal and vertical adjustment is afforded the casing, substantially as set forth.

7. In a grinding-mill, the casing, a fixed and a runner stone, shaft, boxes, and trunnions, in combination with a swiveled frame having boxes for the trunnions and rods for horizontally adjusting the position of the casing, substantially as set forth.

8. The combination of the casing having trunnions, fixed and runner stones, inner and outer shaft-boxes, a swiveled frame in which the casing is journaled, and a vertically-ad-

justable post below the inner box, and means for clamping the casing on the said post, substantially as set forth.

9. The combination of the casing, the runner and fixed stones therein, the boxes *d l*, the swiveled plate *c'*, cross-plate *c*, provided with the flange *b'*, the swiveled frame in which said casing is journaled, the tubular post c^2, the pivot-bolt *d'*, the vertically-adjustable bracket d^2, T-headed bolt f^2, lever g^2, and screw h^2, substantially as set forth.

10. The combination of the casing, the fixed and runner stones therein, the runner-stone shaft, the shelf *k*, a box, *l*, the cross-plate *c*, flange *b'*, swiveling plate *c'*, box *d*, bolts *e'*, and the set-screws *f* for holding the box in place, substantially as set forth.

11. The combination, in a grinding-mill, with the stones, the runner-shaft, and the frame, of the arch *p'*, having a box, *k'*, sleeve *s'*, fixed within said box, removable box *u'* on the end of the shaft, and the removable step *t'*, and adjustable bearings or centers for the said step and the outer end of the shaft, substantially as set forth.

12. The combination, with the frame and the runner-shaft of a grinding-mill, of the arch *p'*, box *r'*, the fixed sleeve *s'*, the removable pivot-box *u'* on the end of the shaft within sleeve *s'*, a spring interposed between the box and the interior of the sleeve, and the removable step *t'*, and the connected adjusting-levers *g'*, substantially as set forth.

13. The combination, with the runner-shaft and the frame of a grinding-mill, of the arch *p'*, box *r'*, fixed sleeve *s'*, the removable pivot-box *u'*, having a recess in its side, the spring therein, the separate pin $s^{2\prime}$, interposed between the spring and the inner surface of the sleeve, and the removable step *t'*, and the connected adjusting-levers *g'*, substantially as set forth.

14. The combination, with the casing, the fixed and runner stones therein, the swiveled frame in which said casing is journaled, the runner-stone shaft, the horizontal levers *g'*, having bearings for the opposite ends of the shaft, the guy-rods *h' h'*, connecting the levers *g'* at one end with the swiveled frame, the rods *i'*, connecting the opposite ends of said levers, the rack *k'*, the pinion *l'*, and the weighted lever *m'*, substantially as set forth.

15. The combination, with the casing, the fixed and runner stones therein, the runner-shaft, the swiveled frame in which the casing is journaled, the horizontal levers *g'*, having bearings for the ends of the shaft, the guy-rods *h'*, connecting one end of the levers *g'* to the swiveled frame, the rods *i'*, the rack *k'*, pinion *l'*, weighted lever *m'*, and the vertical adjustable screw-hook *q'*, substantially as set forth.

16. In a mill, the combination, with the back plate having apertures, of the disk *h*, having a shaft-eye, the studs *g*, tubular washers i^4, the nuts *i*, and the shelf *k*, having a box, *l*, thereon in line with the shaft-eye, substantially as set forth.

17. The combination, with the runner-shaft of a grinding-mill, having the drive-pulley F, of the frame provided with the arch *p'*, and box *r'*, the sleeve *s'* extending through the box *r'*, adjacent to the pulley F, and a belt-shifting device mounted on the exterior of said sleeve *s'*, substantially as set forth.

18. The combination, with the runner-shaft of a mill, having the drive-pulley F, of the frame provided with the fixed sleeve *s'*, the collar a^2, journaled on the fixed sleeve, the conical pulleys *w'*, journaled in a semicircle on segmental arms of the collar with the bases of the cones adjacent to the drive-pulley, and a lever for operating the collar a^2 and its pulleys.

19. In a mill, the combination, with the shaft E, having a beater, i^2, the levers *g'*, rods *h' i'*, rack *k'*, and operating-lever *m'*, of the vibratory feed-shoe H, suspended centrally below the hopper, and having the arm i^3, and the centrally-pivoted lever l^2, having one end resting on the upper side of the lever *m'*, and its opposite end resting on the adjacent edge of the shoe, whereby when the lever *m'* is raised the opposite end of lever l^2 will be depressed to stop the feed, as described.

20. In a mill, the vibratory feed-shoe H, suspended centrally below the hopper, in combination with the casing B, centrally-pivoted lever l^2 on the back plate thereof, and the weighted lever *m'*, substantially as set forth.

HENRY CUTLER.

Witnesses:
W. F. BENNETT,
JAMES E. MCINTIRE.