

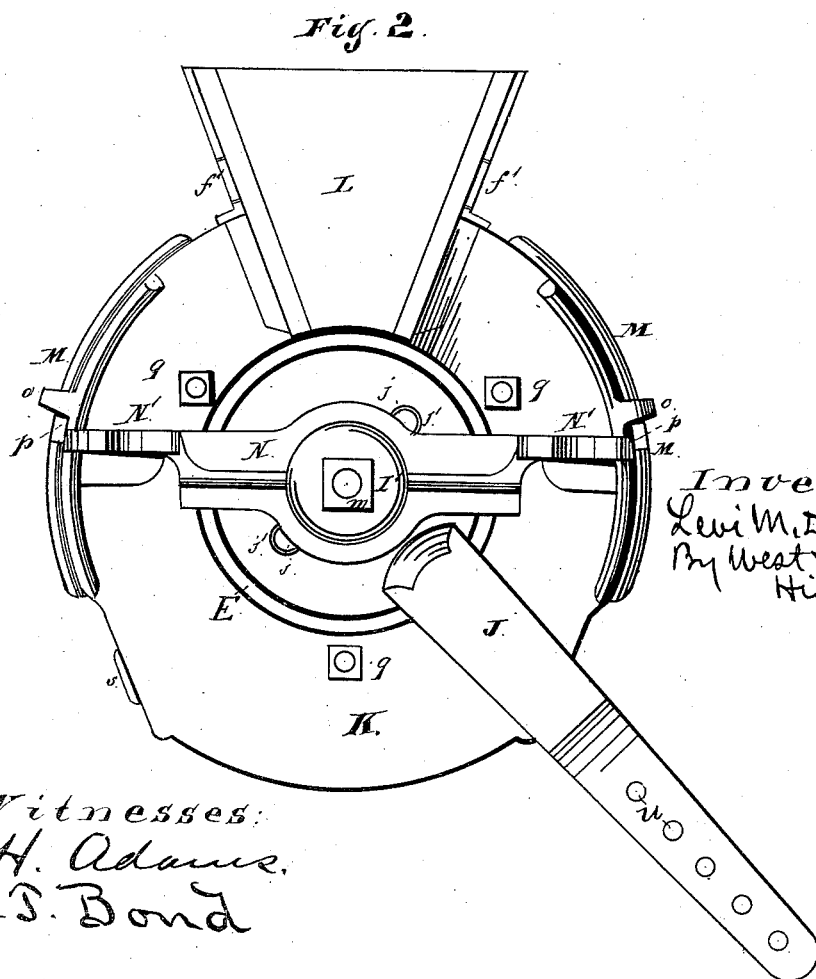
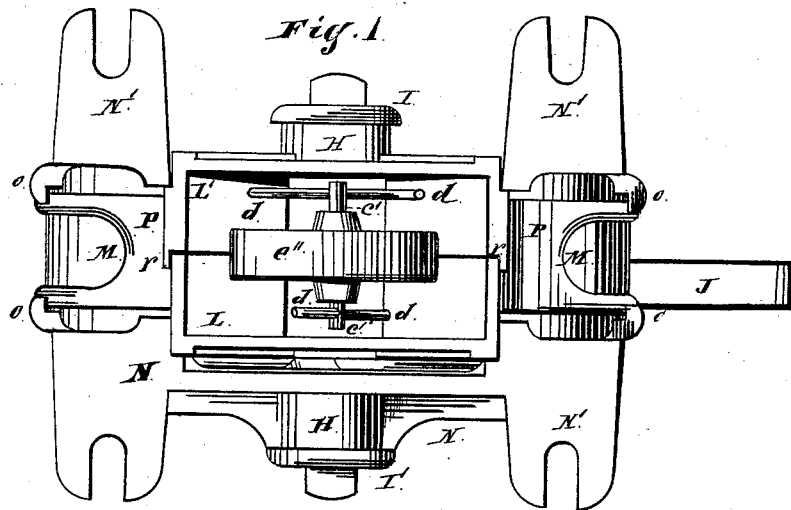
(No Model.)

4 Sheets—Sheet 1.

L. M. DEVORE.
GRINDING MILL.

No. 305,158.

Patented Sept. 16, 1884.



Inventor:
Levi M. Devore
By West & Bond
His Attys.

Witnesses:
A. H. Adams.
E. S. Bond

(No Model.)

4 Sheets—Sheet 2.

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Fig. 4.

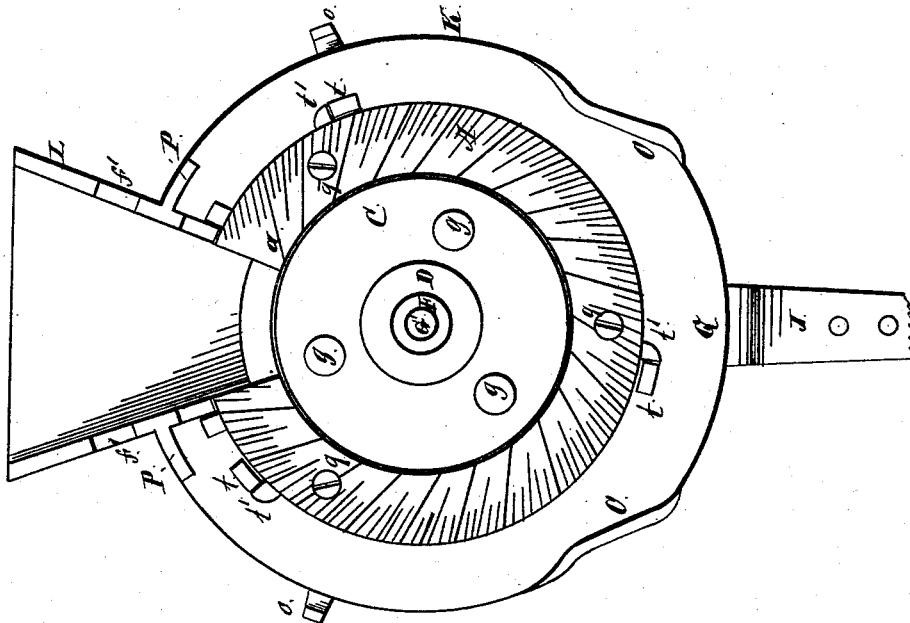
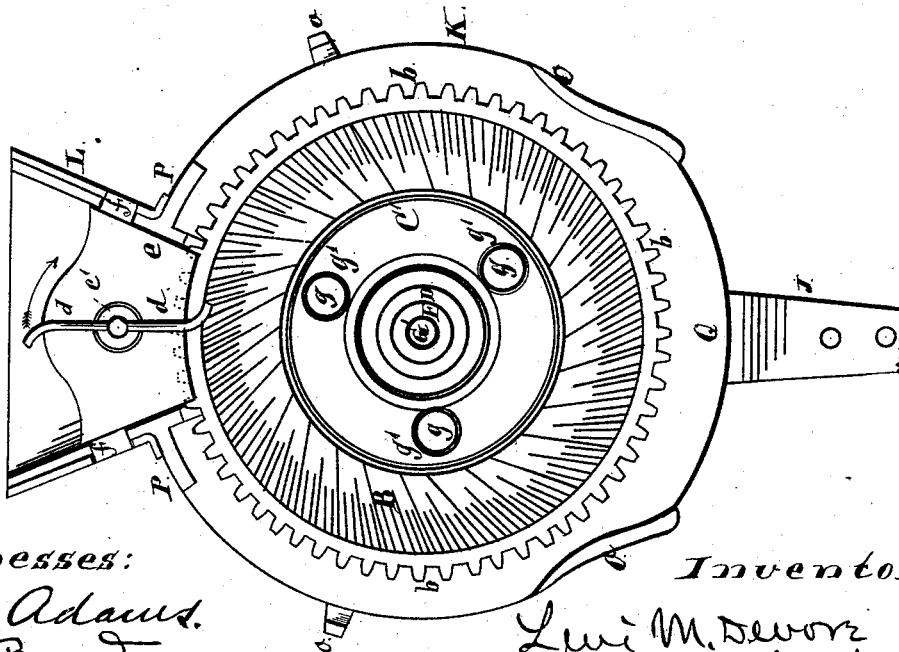


Fig. 3.



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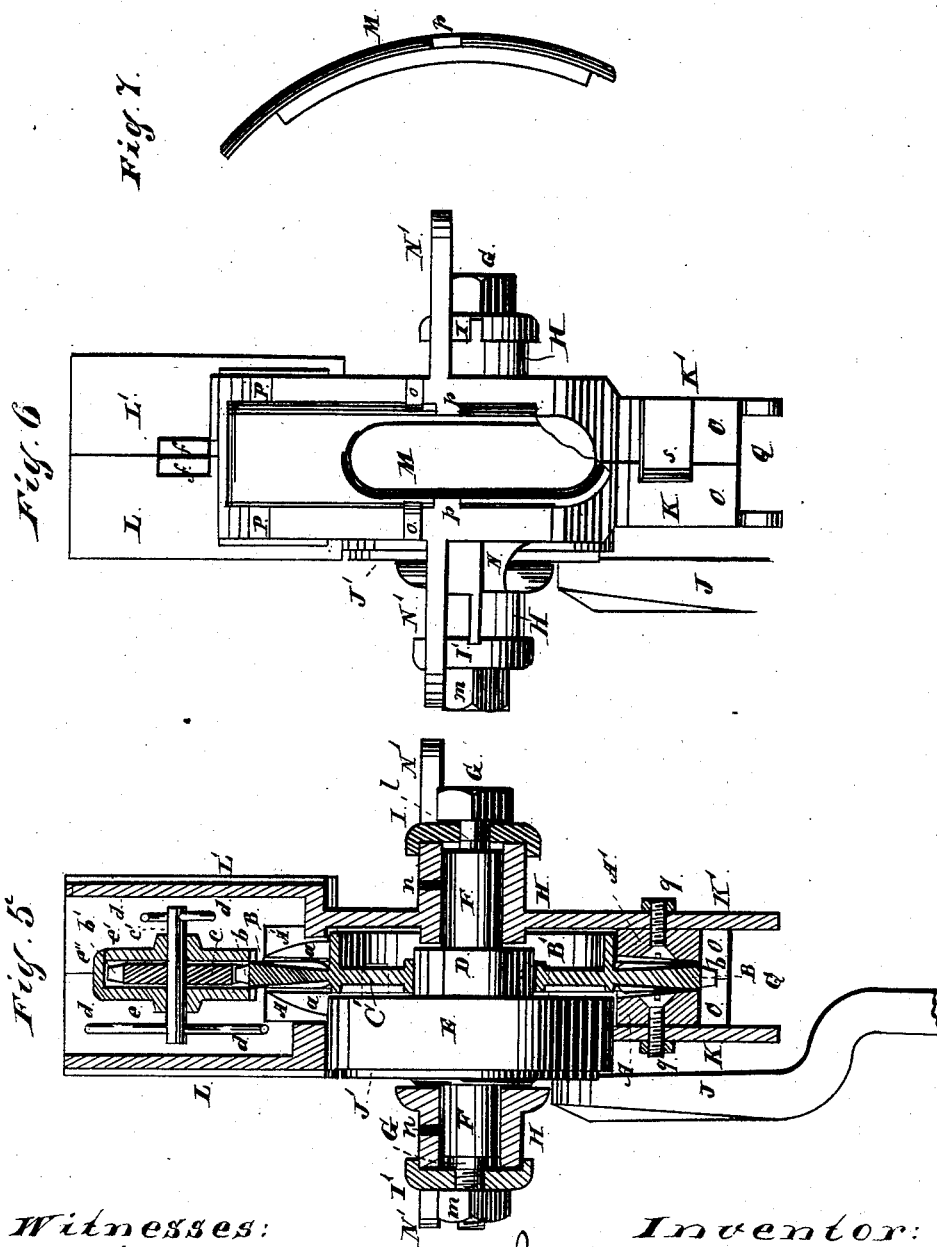
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L. M. DEVORE.
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(No Model.)

4 Sheets—Sheet 4.

L. M. DEVORE.

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No. 305,158.

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Fig. 8.

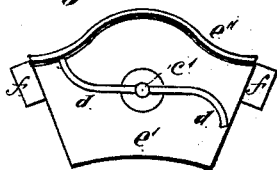


Fig. 9.

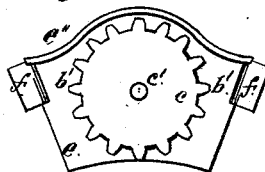


Fig. 10.

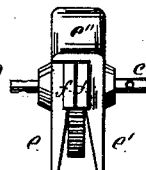


Fig. 16.

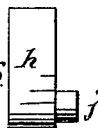


Fig. 11.

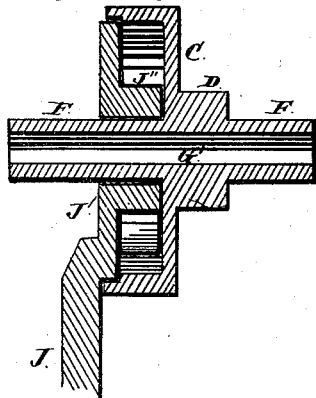


Fig. 13.

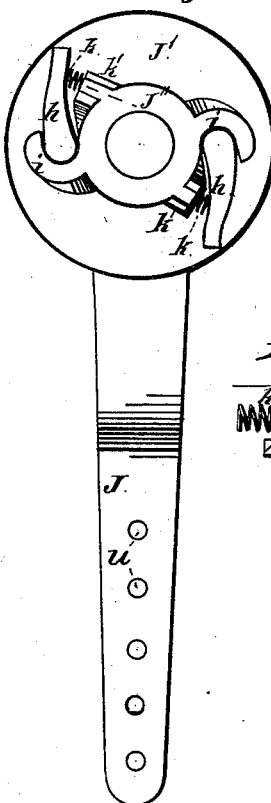


Fig. 12.

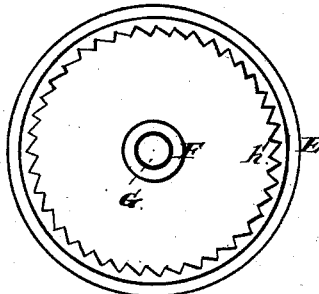
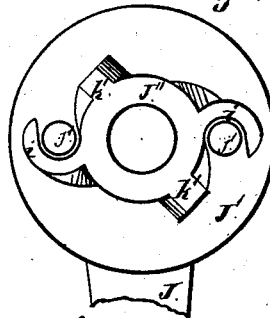


Fig. 14.



Fig. 15.



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UNITED STATES PATENT OFFICE.

LEVI M. DEVORE, OF FREEPORT, ILLINOIS, ASSIGNOR TO THE FREEPORT
SPRING HINGE COMPANY, OF SAME PLACE.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 305,158, dated September 16, 1884.

Application filed March 14, 1881. (No model.)

To all whom it may concern:

Be it known that I, LEVI M. DEVORE, residing at Freeport, in the county of Stephenson and State of Illinois, and a citizen of the United States, have invented new and useful Improvements in Grinding-Mills, of which the following is a full description, reference being had to the accompanying drawings, in which—

Figure 1 is a top or plan view; Fig. 2, a side elevation; Fig. 3, a side elevation with one side of the casing removed; Fig. 4, a side elevation with one side of the casing and the revolving grinding-ring removed; Fig. 5, a vertical cross section; Fig. 6, an edge elevation with one corner of the removable section or cover of the case broken away; Fig. 7, a detail, being an edge view of one of the removable sections or covers of the case; Fig. 8, a detail, being a side elevation of the beater or agitator case or housing, and showing also the form of the beaters or agitators; Fig. 9, a side elevation of the beater or agitator case or housing with one side removed; Fig. 10, an end view of the beater case or housing, showing the driving pinion and shaft with the beaters or agitators removed; Fig. 11, a detail, being a vertical section of the journal, the ratchet-drum, the lever-head, and the lever-arm, the latter being broken off; Fig. 12, a detail, being a side elevation or face view of the journal and ratchet-drum, showing the ratchet-teeth on the interior of the drum; Fig. 13, a detail, being a side elevation or face view of the lever and its head, showing also the pawls or ratchets for driving the drum; Fig. 14, a detail of the spring and its receptacle for keeping the pawls or ratchets engaged; Fig. 15, a detail, being a side elevation or face view of the lever-head, showing the recesses for the pawls or ratchets and the receptacles for the springs; Fig. 16, a detail, being a side elevation showing the form of pawls.

This invention relates to grinding-mills designed more especially for grinding small quantities, and intended for the use of farmers and others, and adapted to be used in connection with a windmill or other light motive power, and to that class of such mills in which the material to be ground is placed or fed into a

suitable hopper, having therein agitators or beaters to assist in passing or forcing the material from the hopper between grinding-surfaces, formed on annular metallic burrs or rings, located in a suitable casing, with an opening for the discharge of the ground material. In this class of mills the burrs or rings are usually three in number, and are arranged in parallel planes, concentric with each other, each outer burr or ring having its interior face provided with a grinding-surface, and being secured to the interior of the casing—one on each side—so as to be stationary, and having an opening coinciding with the hopper-opening for the passage of the material, and the center burr or ring having both faces provided with grinding-surfaces, and being mounted on or connected with a revolving journal or arbor, by means of which and suitable actuating devices it can be given a rotary movement from the motive power.

The objects of this invention are to perfect and increase the feed and give the material a better and more uniform delivery to the grinding-surfaces; to furnish a cheap, simple, and efficient support for the beaters or agitators, which can be readily attached to or detached from the hopper, and which, when attached, will support the beaters properly, allow perfect freedom of motion, and maintain the proper relation between the devices which impart movement to the beaters; to make the beaters or agitators self-clearing and render their action more effective and thorough; to impart a rotary movement to the beaters or agitators direct from the center or revolving grinding-ring or burr, and have the driving mechanism self-acting to prevent clogging; to connect or attach the center ring or burr to its journal or arbor and allow free side-play to an extent sufficient to adjust the center ring and maintain the proper relation and parallelism between the grinding-surfaces without impairing the connection or attachment in any respect between the ring and its journal or arbor; to simplify and improve the form, construction, and arrangement of the journal or arbor and the devices for imparting rotation to the center ring or burr from the rotation of the journal or arbor, and to prevent binding

of the center ring or burr from the action of the actuating lever or device which operates the journal or arbor; to simplify and improve the means for securing the casing together and retaining the journal or arbor and other devices in position, and to simplify and improve generally the construction, arrangement, and operation of the mill; and its nature consists in the construction, also in the combinations, of parts hereinafter particularly described, and then specifically defined by the claims.

In the drawings, A A' represent the stationary grinding-rings or burrs; B, the center or revolving grinding-ring or burr; B', the annular flange or rim on the ring B; C, the backing or connecting plate supporting the ring B; C', the center or web of the ring B; D, the hub or center of the plate C; E, the ratchet-drum; F, the journal or arbor; G, the clamping-bolt; G', the longitudinal opening through the arbor F; H, the journal boxes or bearings on the walls of the casing; I I', the washers or end-pressure plates; J, the reciprocating lever; J', the head of the lever; J'', the hub or center of the head J'; K K', the plates or walls of the main casing; L L', the extensions of the plates K K', forming the hopper; M, the removable sections of the inclosing-rim; N, the cross-bar or flange on the plate K; N', the ears for attaching the mill to its frame or support; O P, the sections of the inclosing-rim formed on the plates K K'; Q, the opening for the discharge of the ground material; *a*, the depression or concavity on the inner face of each ring A A' at the mouth thereof; *b*, the cogs or leaves on the periphery of the ring B; *b'*, the cogs or leaves on the pinion *c*; *c*, the pinion for driving the beaters; *d*, the beaters; *e e' e''*, the frame or housing supporting the beaters; *f f*, the lugs or tenons on the ends of the housing; *f'* *f'*, the openings or mortises for the lugs *f* in the hopper-casing; *g*, the retaining-pins on the plate C; *g'*, the openings in the web C' for the pins *g*; *h*, the pawls or ratchets; *h'*, the ratchet-teeth on the drum E; *i*, the curved walls on the hub J'; *j*, the pivots of the pawls; *j'*, the openings in the head J' for the pivots *j*; *k*, the springs for projecting the outer ends of the pawls *h*; *k'*, the sockets for the springs *k*; *l*, the square shoulder on the end of the bolt G; *m*, the set-nut; *n*, the oil-passages in the boxes H; *o*, the catches for the covers M; *p*, the notches in the covers M; *q*, the screws for attaching the rings A A'; *r*, the overhung lip or edge for joining the plates or walls L L'; *s*, the lip or projection for preventing side movement of the plates K K'; *t t'*, the lugs for holding the rings A A' firmly, and preventing strain on the screws *q*; *u*, the adjusting-holes in the arm of the lever J.

The rings or burrs A A' are each formed from an annular cast-metal ring, not continuous, but having a side opening to form a mouth for the passage of the material from the hopper to the grinding-surfaces, and having an

open center, and provided on the interior face with a grinding-surface, and in these respects may be of any of the usual and well-known forms of construction. At the mouth of each ring, on the side that the material enters, is formed a concavity or depression, *a*, the face of which has a gradual slope, and is smooth, or nearly so. This concavity or depression *a* forms a pocket or receptacle at the mouth of the ring, extending inward and narrowing gradually to meet the grinding-face, into which the material will readily enter, and from which it will be easily drawn by the action of the revolving ring into the grinding-space between the grinding-surfaces. This concavity or depression prevents the material from accumulating in the ring-opening and at the mouth of the hopper by allowing the material to enter therein and be carried therefrom by the rotation of the revolving ring, and by its use the feed will be largely increased and rendered more reliable and effective, as there is no projecting or abrupt surface or face on the end of the ring at the opening against which the material will strike and be retarded, and no rough surface on the face of the cavity to interfere with the flow of the material after it enters, the flow being accelerated by the action of the revolving ring.

The ring B is formed from a continuous cast-metal ring, provided on both faces with a grinding-surface, and having at its center a web, C', and in these respects may be of any of the usual and well-known forms of construction. On one side, at the junction of the web and ring, is an annular flange or rim, B', corresponding in exterior diameter to or nearly to the diameter of the open center of the stationary ring, so as to enter therein, and having the requisite depth to fill or nearly fill the space between the face of the web and the exterior wall or casing, the object being to prevent the ground material from entering beneath the rim to any great extent and clogging and interfering with the rotation of the ring B. The opposite face of the web has no flange, but has, as shown, a small bead or ledge, which comes out flush, or nearly so, with the plane of the grinding-surface to engage the face of the supporting-plate C, to which the ring B is connected, which plate centers with the web C' and corresponds in diameter, or nearly so, therewith, the plate, as shown, having an enlargement at its center, forming a hub, D, which enters an opening of a larger diameter at the center of the web. The ring B is connected with the plate C by means of pins *g* on the plate and openings *g'* in the web. The openings *g'* are somewhat larger in diameter than the pins, so that when the pins are inserted there will be a space around each pin between the wall thereof and the wall of its opening. These spaces around the pins, and the space around the wall of the hub or center D, and the wall of its opening in the web, allow sufficient play for the ring to self-

adjust itself, so that the plane of either side will conform to the plane of the adjacent stationary ring and be self-regulating in regard to keeping the proper space between them for grinding purposes. This self-adjustment corrects any little discrepancies in the set of the rings, or irregularities or inequalities in the grinding-surfaces by allowing the plane of travel of the center ring to adapt itself accordingly, and it also overcomes any irregularity in the run of the shaft by which the ring is driven by allowing the ring to keep in a correct plane regardless of the plane of the shaft, and prevents binding between the rings and on the shaft, and does away with the necessity of great accuracy of fitting or nicety of adjustment in the arrangement of the parts.

As shown, the backing-plate C is formed with the axle or journal which drives the ring B; but, in so far as relates to the self-adjustable feature of the ring, this plate C might be formed separate and be secured to the axle or journal by means of set-screws passing through the hub D, or in some other suitable manner. On the periphery of this plate C, on the opposite side to that which receives the ring B, is an annular flange or rim, E, of sufficient width to extend, when the parts are together, from the plate C through and slightly beyond or flush with the outer face of the wall or casing, through an opening formed in the wall or casing, corresponding in diameter to or nearly to the diameter of the open center of the stationary ring. This flange or rim, with the flange or rim B', form a complete housing or covering, which protects the driving devices, by which a rotary movement is given to the ring B, from becoming clogged or rendered inoperative from the ground material or other source.

For convenience in manufacture and ease of adjustment, and location in their position in the case, and in their relation to each other, and for the further purpose of adding strength and durability, and avoiding the necessity of fitting up the plate C with its hub D, flange or rim E and axle or spindle F are cast in a single piece, the end of the axle or spindle on one side projecting out from the center of the hub D, and the end on the other side from the center of the plate C, beyond the plane of the edge of the rim E, the two ends forming the journals by which the axle or spindle is mounted or supported in its bearings, which bearings H are formed on the side plates of the casing, and are so located as to properly center the ring B with the stationary rings. Each bearing H has an opening or passage, n, leading from its exterior face to the journal, through which oil or other lubricant can pass, to properly lubricate the journals, by which means the process of lubricating or oiling can be thoroughly, easily, and expeditiously performed without disturbing the parts.

The axle or spindle F has a central circu-

lar longitudinal opening, G', for the passage of a bolt, G, having the portion of its stem which passes through the opening circular, to allow the axle or spindle to revolve. One end of this bolt is provided with a head, adjacent to which the stem has a square portion, l. The other end is screw-threaded to receive a nut, m. The square portion l fits a correspondingly-shaped opening at the center of a cap or bearing plate, J, and the other end passes through a circular opening at the center of a cap or bearing-plate, l'. These caps or bearing-plates J' fit over and bear against the ends of the respective journal-bearings, and form supports to enable the bolt to perform its function of holding the parts together, and in order to prevent the bolt from turning in setting the nut m to place, or from the motion of the axle, or from any other cause, the plate J is provided on its edge with a notch, which engages a projection on the end of the bearing and forms a lock for the plate, which prevents it from revolving, while the square operating in the plate and the square shoulder or portion l on the bolt prevents the bolt from turning in the plate. By passing the bolt G through the arbor or axle, the interior of the casing is left free and clear for the location of the grinding-rings therein. The bolt is located at the point where the least inconvenience will arise from its use, and where its action will be the most effective in drawing the parts together with a single bolt. Its location is one where the space which it occupies is not required for any other purpose, and does not weaken the construction, and by its use the securing of the mill together is greatly simplified, requiring only a single bolt for the purpose.

The caps or plates J J', in addition to furnishing bearings for the bolt G, also form covers to protect the ends of the journals, and prevent the entrance of dirt, dust, and other substances.

The lever J has its arm, or portion to which the attachment is made for giving it a reciprocating movement, located outside of the periphery of the main casing, and this arm or portion is bent or turned inward or toward the center of the mill, to bring its outer end in line with the center ring or burr, or nearly so, and have the power by which it is reciprocated act in a direct line and in a parallel plane with the center ring, preventing side-pressure on the arm or lever, which feature is very desirable, as such side-pressure is liable to cause binding of the actuating devices for the center ring, produce uneven wear of the parts to a greater or less degree, and injure or affect their operation, and require the employment of additional force in operating the mill. The head J' of this lever corresponds in diameter to or nearly to the diameter of the ring or drum E, against the edge of which the inner face of the head bears when the parts are in position for use. This head J' at its center is provided with a hub or secondary head, J'',

having on opposite sides thereof curved projections or walls *i*, between which and the face of *J'* openings are formed for the reception of the heels of pawls *h*, the journals or pivots *j* of which pass through suitable openings, *j'*, in the head *J'*. The outer end of each pawl *h* engages with serrations or notches *h'*, formed on the interior face of the drum *E*, at each forward movement of the lever *J*; but on the return movement of this lever the pawls do not engage the serrations or notches, but ride thereover, giving the drum *E* an intermittent rotary movement for driving the center ring or burr. The outer end of each pawl is projected and held so as to engage the serrations *h'* on the forward movement and left free to ride over them on the return movement by a spring, *k*, arranged and located as shown in Fig. 13, and kept in position by means of the sockets *k'*, formed on *J'*, which they enter, and these pawls *h* are so arranged and located with reference to the serrations *h'* and the movements of the lever and drum that the forward movement of the lever will leave the drum in such position that the outer end of the pawls will alternately be in position when the lever is returned to engage the serrations at the commencement of the forward movement, thereby preventing any lost motion and insuring an engagement at the beginning of the stroke.

The main body of the casing is annular in form and larger in diameter than the rings or burrs, as shown. The main body is formed from plates *K K'*, of cast metal or other suitable material, a single plate forming one side of the body, and the hopper is formed by side plates, *L L'*, which are continuations or extensions of the plates *K K'*, respectively, each plate *L L'* having end or edge flanges or walls meeting at the center, and one overlapping the other to make the hopper tight and inclosed on all sides.

Each plate *K K'* has on each side or edge where the hopper-plate begins an inwardly-projecting wall or flange, *P*, the walls on each side meeting at the center and closing the main case at that point, and on the edge of each plate *K K'*, below the center, are other inwardly-projecting walls or flanges, *O*, meeting at the center and one overlapping the other, the overlapping wall or flange having a lip, *s*, by means of which the plates of the casing are locked and side-swing prevented. Between the walls or flanges *O* the edges of the plates are left clear and free to form an opening, *Q*, for the discharge of the ground material, and between the walls or flanges *O* and *P*, on each side, is an opening to enable access to be had to the interior, each opening being closed by a removable plate or cover, *M*, the ends of which rest on the ends of the walls *O P*, and the sides on the edge of the plates. Each cover is held and locked in place, when inserted, by notched lugs *o*, formed on the edge of the plates, beneath which the edges of the

cover can pass, the edges of the cover having openings *p* to permit the cover to be placed in position and moved in the proper direction to cause the edges thereof and the notched lugs *o* to interlock.

The agitator is located in the hopper at the proper distance above the mouth thereof to have its beaters or arms act on the material and force it into the mill. These beaters or arms *d* have their outer ends curved or bent, to present a surface of considerable length for acting on the material, producing, by reason of the curvature, a better acting face, and one which will be more direct and positive in its action. The curvature of these beaters or arms *d* is a backward one in action—that is, when revolving in the direction indicated by arrows in Fig. 3 of the drawings the commencement of the curve will enter or engage the material and be withdrawn therefrom first, and its terminus or the end of the beater will be the last to enter and be withdrawn—by which arrangement it will be seen that there is not much possibility of the beaters catching and retaining the material, so as to interfere with their action. The natural tendency of the curvature in the backward direction to their movement is for the material to slip off by reason of such curvature and movement. The beaters enter the material easily, and are withdrawn therefrom readily and quickly, and by their use the winding of corn-silks, husks, &c., around the beaters and their shaft will be prevented, as such materials, if caught at all, will be drawn from the beaters in their passage through the material and withdrawal therefrom, so that in their action these beaters are self-clearing and will do their work in an effectual and reliable manner. These beaters are secured one at each end of a revolving shaft, *e'*, which shaft has its bearing in side pieces or plates, *e e'*, one of which, *e*, has a flange, *e''*, which extends over the edge of the other plate, *e'*. These plates are located lengthwise of the hopper in a vertical plane with the center ring or burr, and their ends are formed to fit the sides of the hopper, and they are held and retained in position by lugs or projections *f*, formed on their ends, which enter suitable openings, *f'*, formed in the hopper, one-half of each opening *f'* being formed in each end wall or flange of the plates *L L'* of the hopper. Between these plates *e e'* on the shaft *e'* is located a wheel, *c*, having cogs or leaves *b'*, which mesh with cogs or leaves *b* on the periphery of the center ring or burr, *B*, so that at each advance of the ring or burr *B* the wheel *c* will be given a rotary movement, imparted directly from the burr, revolving the shaft *e'* and driving the beaters *d*, the operation not being a continuous one, but an intermittent one, coincident with that of the ring or burr and dependent thereon, the result being that the beaters and ring or burr act in conjunction and in the proper relation to each other for both to perform their respective work in the most reliable

ble and satisfactory manner, the beaters to force the material from the hopper and the ring or burr to effect the grinding thereof, and by making the movement of the beaters dependent on the advance of the ring or burr the material forced from the hopper by the action of the beaters will be carried between the grinding-surfaces by the ring as fast as received, preventing the mouth of the hopper from becoming clogged or choked by an excess of material, as would be likely to be the case if the beaters acted continuously and independent of the ring or burr.

The ring or burr B travels through the ground material, and the spaces between the cogs or leaves *b* are liable to become filled with such material, so that the ring and pinion *c* will bind and prevent the ring from rotating. To obviate this objection and prevent the spaces from becoming filled up, the cogs or leaves *b'* are beveled on each outer side at the point, so as to act as a wedge, and to cut the material and force it sidewise, keeping the spaces clear and free and the parts in good working condition.

In putting the parts together, the rings A A' are secured to their respective plates K K'. The head J' of the lever, with the pawls *h* thereon, is inserted beneath the cross-bar N, so that the opening through it and the hub or head J'', which opening corresponds in diameter to the diameter of the journal or shaft F, will be in line with the opening of the journal H on the bar N. The journal or shaft is then passed through these coinciding openings, the edge of the drum E coming in contact with the face of the head J', and its body in position for the outer ends of the pawls *h* to engage the serrations *h'*. The ring B is then placed in position on the plate C, which plate goes with the shaft, the pins *g* of the plate entering the openings *g'* in the web of the ring. The other plate, K', of the casing is then slipped onto its end of the journal F, the washer I placed in position on its journal-bearing H, and the bolt G passed through the opening G' of the shaft F, and the washer I' placed in position on the projecting end thereof and over the journal-bearing, when, by screwing the nut *m* down to place, the several parts will be secured together and held in place by this single bolt, as before described. The covers *m* are then to be placed in position, when the mill is ready for use.

In use power is applied to the arm or lever J, and the lever given a reciprocating movement, each advance of the lever through the pawls *h* rotating the drum E, as before described, and giving the ring B a corresponding movement to grind the material between the grinding-surfaces of the rings or burrs A A' B in the usual manner. The beaters, with their housing or support, are inserted in the hopper after the ring B is in place and before placing the plate K' in position, the plate, when in position, locking and holding the housing or support firmly by means of the

lugs *f*. This means of attachment allows the beaters to be readily removed when desired by loosening the bolt G sufficiently to allow the plate K' to be raised, so that the lugs *f* can be withdrawn from their openings *f'*. The cross-bar N furnishes additional strength and forms a backing for the head J' of the lever. The mill is secured to a suitable support by the ears N' in the usual manner.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a grinding-mill, the combination of a shaft or arbor provided with a longitudinal opening, G', a backing or supporting plate secured to said shaft, a revolving ring or burr on said shaft, and supported by said backing-plate, and a clamping-screw passing through the opening in the shaft, substantially as described.

2. In a grinding-mill, the combination of the shaft formed with a longitudinal opening, G', a backing-plate, D, carried thereby, the burr supported by said plate, the bolt G, passed through the opening G', the nuts to said bolt, and the journal-bearings H, whereby the parts are drawn and clamped together by the use of a single bolt, substantially as described.

3. In a grinding-mill, the combination of the shaft formed with a longitudinal opening, G', a backing-plate, D, carried thereby, the burr supported by said plate, the bolt G, having a square end, *l*, end plate, I, having a square opening, plate or washer I', having a circular opening, draw-nut *m*, and journal-bearings H, substantially as described.

4. In a grinding-mill, the ring or burr B, backing or supporting plate C, drum E, having serrations *h'*, and shaft or bar F, in combination with the lever J, having a head, J', provided with hub J'', having curved walls *i*, and the pawls *h*, engaging the serrations *h'*, substantially as described.

5. In a grinding-mill, the ring or burr B, having its web C' provided with openings *g'*, backing or supporting plate C, provided with pins *g*, drum E, formed with the plate C, and having internal serrations, *h'*, shaft or arbor F, having the longitudinal opening G', bolt G, and journal-bearings H, in combination with an actuating-lever, J, having head J', carrying pawls *h* to engage the serrations *h'* and operate the ring or burr B, all substantially as and for the purposes specified.

6. The combination of the feed-hopper, the plates *e e'*, removably secured within the hopper, and the shaft *e'*, journaled in plates *e e'*, and carrying beaters *d*, whereby the plates and beaters can be readily removed from the hopper, substantially as described.

7. The combination of the feed-hopper, the plates *e e'*, forming a housing when brought together, and removably secured within the hopper, and the pinion *c*, supported within the housing formed by the plates, whereby the pinion is protected and can be readily removed, substantially as described.

8. The combination of the feed-hopper, the

plates *e e'*, forming, when brought together, a housing, and removably secured within the hopper, a shaft, *e'*, carrying a pinion, *e*, and a ring or burr, *B*, having cogs or leaves in its periphery meshing with the pinion for operating the pinion directly from the burr, substantially as described.

9. The ring or burr *B*, having its periphery provided with cogs or leaves *b*, in combination with the pinion *e*, having cogs or leaves *b'*, beveled on each side to form points, which act as wedges to cut and force the material

from between the cogs or leaves *b*, substantially as and for the purposes specified.

10. The plates *K K'*, having the partial walls or flanges *O P*, and provided with the locking-lugs *o*, in combination with the covers *M*, having the openings *p*, substantially as and for the purposes specified.

LEVI M. DEVORE.

Witnesses:

EDWARD P. BARTEN,
HENRY M. BARNUM.