No. 689,892. Patented Dec. 31, 1901.

A. M. LEFFLER & J. F. HAZEL.

GRINDING MILL.

(Application filed Nov. 6, 1900.)

(No Model.) 2 Sheets—Sheet 1.

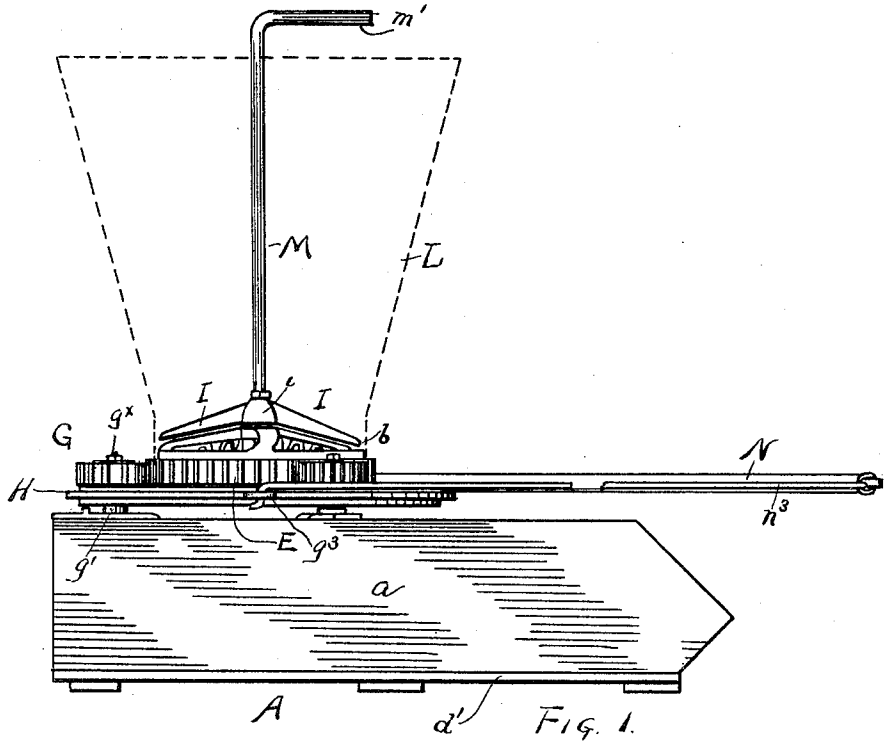

FIG. 1.

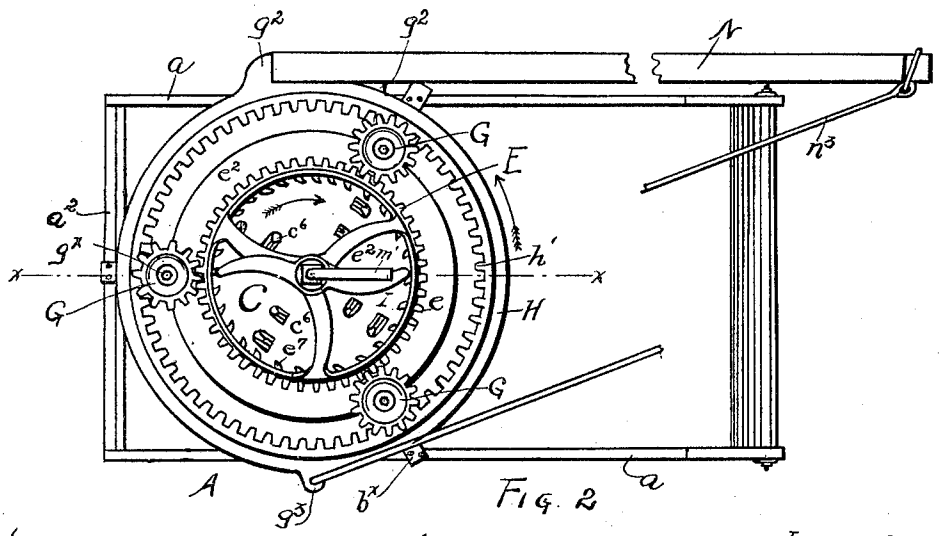

FIG. 2.

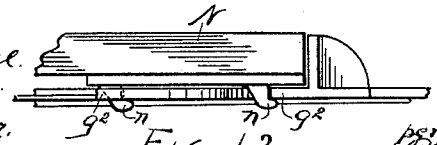

FIG. 12.

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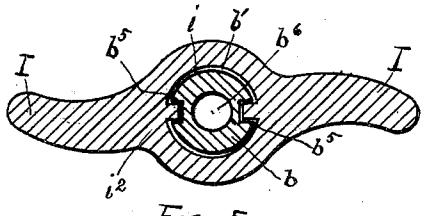

Fig. 5

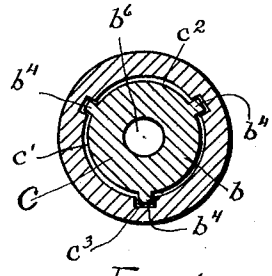

Fig. 6.

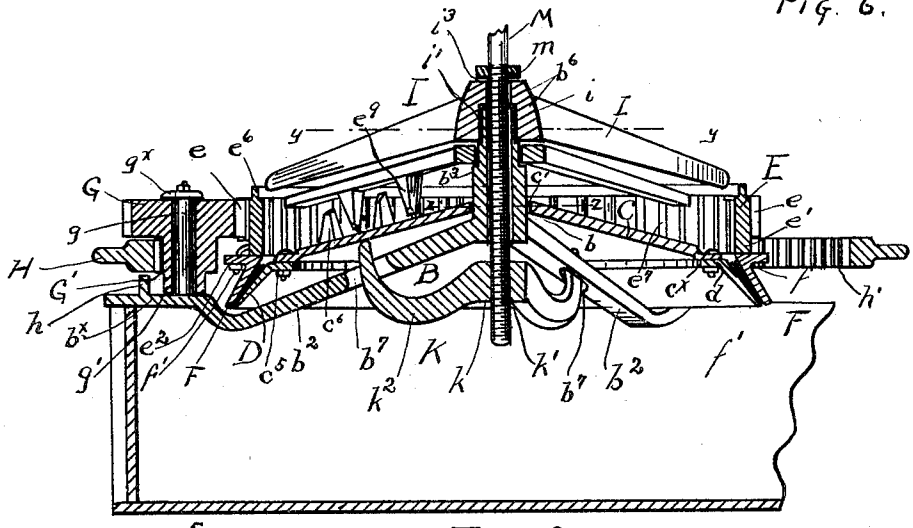

Fig. 3.

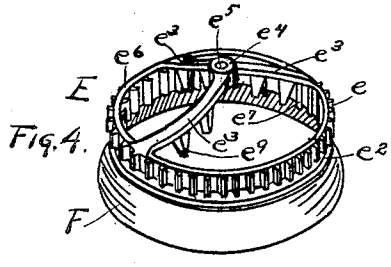

Fig. 4.

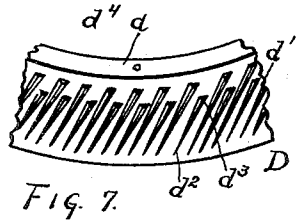

Fig. 7.

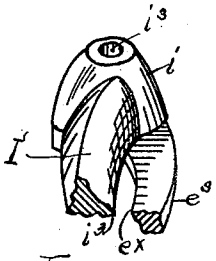

Fig. 11.

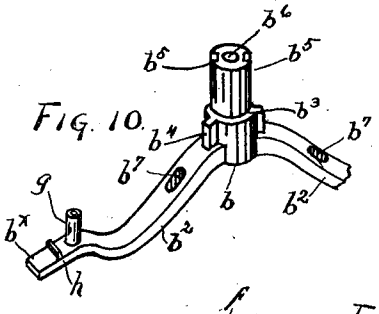

Fig. 10.

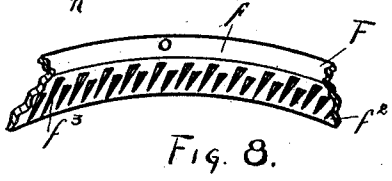

Fig. 8.

Fig. 9.

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UNITED STATES PATENT OFFICE.

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GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 689,892, dated December 31, 1901.

Application filed November 6, 1900. Serial No. 35,701. (No model.)

To all whom it may concern:

Be it known that we, ALBERT M. LEFFLER and JAMES F. HAZEL, citizens of the United States of America, residing at Carrollton, in the county of Carroll and State of Missouri, have invented certain new and useful Improvements in Grinding-Mills; and we do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The objects of our invention are, first, the grinding of the corncob conjointly with the corn and the thorough mixing of the meal; second, to insure a positive forced feed to the ground cereal between the grinding-surfaces of the mill; third, the transmission from the power applied to operate the mill of increased degrees of speed to the grinding devices; fourth, to prevent clogging within the hopper and present the cob in a position for the action of the cob-breakers and teeth, and, fifth, to preserve the evenness of the grinding-surfaces in the adjustment of the burs.

The invention consists in the novel construction and combination of parts, such as will be first fully described, and specifically pointed out in the claims.

In the drawings, Figure 1 is a side view of the improved grinding-mill, the hopper being shown in dotted lines. Fig. 2 is a plan view as seen in Fig. 1. Fig. 3 is a vertical sectional view taken upon the line $x\ x$ of Fig. 2. Fig. 4 is a detail view in perspective of the rotating hopper-supporting and bur-carrying plates. Fig. 5 is a horizontal sectional view through the stationary arms in the hoppers, taken upon the line $y\ y$ of Fig. 3. Fig. 6 is a horizontal sectional view taken upon the line $z\ z$ of Fig. 3. Fig. 7 is a view of a broken portion of the stationary grinding-plate, showing the burs on the outer side of the plate. Fig. 8 is a view of a broken portion of the rotating grinding-plate, showing the burs on the inner side of the plate. Fig. 9 is a view of a broken portion of the rotating and stationary grinding-plates, showing the position of the burs on each plate. Fig. 10 is a detail view in perspective of a broken portion of the main supporting-frame, showing the openings in the radial arms. Fig. 11 is a broken detail view in perspective of one of the stationary arms in the hopper and the cap and the movable supporting-arms of the movable grinding-plate, showing the cutting edges. Fig. 12 is a detail view of the inner end portion of the draft-pole, showing the connection with rotating ring.

Similar letters of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings, A represents the box or bin for the reception of the ground cereal, consisting of the upright sides $a\ a$, bottom a', and ends $a^2\ a^2$, the upper portion of one of said ends being removed in order to conveniently reach the bottom of the bin.

B represents the mill-supporting base-frame or spider, which consists of a central axis or post b, from the outer side and lower end portion of which is connected rigidly one end of the separate radial arms $b^2\ b^2\ b^2$, the other ends of which arms are inclined downwardly at an oblique angle to the sides of the casting b and in the direction of the inner sides $a\ a$ of the box or bin A and also toward one of the ends a^2 horizontally in line with the upper edges of the sides $a\ a$, and the extreme outer ends $b^\times$ of said arms are bent upwardly in a horizontal plane and removably secured to said upper edges of the sides and end of the box. The axis or casting b extends in an upward direction from the point of connection of the arms b^2 a considerable distance, and about one-half of the distance upwardly from said arm the circumference of the post b is reduced in size, forming a shoulder b^3. Upon the circumference of the post b beneath the shoulder b^3 are radial flanges $b^4\ b^4\ b^4$. (See Fig. 6.) In the circumference of the post above the shoulder b^3 are vertical grooves $b^5\ b^5$. (See Fig. 5.) Through the post b in a vertical direction extends the opening b^6. In each arm b^2 a considerable distance from the post b is an elongated opening b^7, the ends of which incline downwardly in opposite directions to form a larger entrance upon the under side of the arms.

C represents the stationary disk supporting the lower grinding-plate, which is circular in form. Said disk extends outwardly and is inclined downwardly from the post b and is provided with a central opening c', which opening is of the proper size to fit the lower end of the post b, and in the sides of said opening are vertical grooves c^3, adapted to receive the radial flanges b^4 on said post and key the disk in position. The outer edge of disk C, which extends the proper distance from the post b, is bent upwardly in a horizontal position, as seen at $c^\times$ in Fig. 3.

D represents the lower circular grinding-plate, upon the inner side and at the upper edge of which is the annular flange d, which is detachably secured by the bolts c^5 to the outer edge of the disk C. The grinding-face d' of the plate D extends downwardly from the outer edge of the disk C and is inclined outwardly at an oblique angle to the flange d. Upon the grinding-face d' are the burs d^2. The said burs consist of a series of projections on the grinding-face arranged at an oblique angle to the axis of the disk C and at short distances apart. The sides of the projections extend outwardly from the grinding-face d' of plate D and incline toward each other and form a sharp edge d^3, and from the upper ends of said projections in the direction of the lower ends the projection or bur gradually decreases in width, being of slight thickness at the lower ends. In the series of projections or burs which extend around the plate D the burs alternate in length, first a long bur, then a short bur, the short bur leaving a space d^4 in the series of equal graduation in the direction of the upper edge of the grinding-plate, the longer burs extending nearly to the annular flange d.

E represents the rotating power-actuated wheel supporting the upper grinding-plate, which is larger in circumference than disk C. Extending around the circumference of wheel E is the cog-gear e, between which gear and the lower edge of the wheel is an annular space e'. The wheel E is supported in position by the curved arms e^3 e^3 e^3. The upper ends of said arms are rigidly connected with a circular plate or disk e^4, which is provided with a central opening e^5 of the proper size to slip over the contracted portion of the post b and bear in rotation upon the shoulder b^3. The lower ends of the arms e^3 e^3 e^3 extend in a downwardly-inclined plane and are connected rigidly with the upper edge of the wheel E. The inner curved side of the arms e^3 are obliquely inclined, leaving an upper cutting edge $a^\times$. Upon the upper edge of the wheel E is an upwardly-extended flange e^6, to which the hopper is secured. With the under side of flange e^2 on the lower edge of the wheel E is detachably connected the upper circular grinding-plate F. Said plate has upon its upper edge a horizontal annular flange f, which is secured to the flange e^2 on the wheel E by the bolts f'. The grinding-plate F extends downwardly and is inclined outwardly at an angle to flange f, the inner grinding-surface f^2 being close in position to the grinding-surface d' of the grinding-plate D, the angle of the plate F being slightly more acute than the angle of the plate D, so as to permit the closer contact of the lower grinding-surfaces of the said plates. Upon the inner side of the plate F are the projections or burs f^3, which are precisely the same in construction as the burs d^2 on plate D, the position of the burs f^3 on plate F, however, being arranged in opposite inclined planes, as seen in Fig. 9, so the ground cereal will be forced downwardly by the action of the burs.

Upon the upper horizontal portion $b^\times$ of each arm b^2 of the frame or spider B is a stud or post g. Upon post g are the gear-wheels G G', which are cast or rigidly connected with each other and turn freely upon the stud. The upper gear G is about twice the size of the gear G' and meshes with the cog-gear on the wheel E. Upon the upper end of stud g is a removable cap $g^\times$. The lower gear G' is supported by a journal g' upon the stud g, which maintains the gear G in the same horizontal plane as the cog-gear e in the wheel E.

h h h are vertically-extended lugs on the upper side of the horizontal portions $b^\times$ of the arms b^2 and a short distance from the studs g toward the extreme outer ends of said arms. Upon said lugs, which extend the same height as the washers g', is mounted the circular driving-power ring H, upon the inner side of which ring are the teeth or gear h', said ring extending around the series of gear G' G' G', the teeth h' meshing with said gear.

Upon the inner side of the wheel E are the teeth e^7, which extend in series around the said wheel and arranged in vertical lines a short distance apart, the edge of the teeth being extended forwardly in a curved line, as shown, in order to stir up the cobs and throw them toward the cob-breaking teeth. Upon the upper side of the disk C are the stationary cob-breaking teeth c^6, which extend upwardly a short distance and are arranged in series in separate radial lines, the sides of each tooth increasing gradually in width in the direction of the upper end. Upon the under side of each arm e^3 are cob-breaking teeth e^9, which extend downwardly in position toward the disk C and alternately in respect to the distance between the teeth c^6 on disk C, the construction of said teeth e^9 being nearly the same as the teeth c^6. In the arrangement of the teeth c^6 on the disk C it will be observed that the series of teeth in the radial lines are such that during the rotation of the arms e^3 the teeth upon one arm only are in direct line with the teeth c^6, so that the resistance to the breaking of the cobs is met by a single arm, and thus reducing the power ordinarily required to operate the mill.

i represents a circular casing or cap on the upper end of post b, in which is an opening

i', which receives the upper end of said post and is provided with the vertical flanges i^7 i^7 to enter the grooves b^5 b^5 on said post. (See Fig. 5.) Through the upper end of cap i extends in a vertical line with the opening b^6 the opening i^3.

I I are the stationary arms in the hopper and directly above the arms c^3, the inner ends of which arms are connected rigidly with the sides of the cap i^2, the outer ends being inclined downwardly in position corresponding in degree to the inclination of the arms c^3, said arms being curved and the inner side inclined toward a lower cutting edge i^3.

L represents the rotating hopper, which is circular in form, the lower end b of which hopper being secured to the flanges e^6 on the upper edge of the rotary wheel E.

K represents the adjusting device on the under side of the spider or frame B and which consists of a disk k, in which is a central screw-threaded opening k'. With the sides of the disk k are connected the inner ends of the radial arms k^3 k^2 k^3, the outer ends of which arms are extended in an upwardly-curved line through the openings b^7 in the stationary arms b^2 of the spider B and contact with the under side of the disk C, which is movable upwardly a short distance or so far as is necessary to cause the grinding-plates to come into closer position.

In the hopper L is an adjusting-rod M, one end of which rod extends downwardly through the opening i^3 in the cap i, thence through the opening b^6 in the post b, and is screw-threaded upon the lower end and said screw-threaded portion fitted within the threaded opening k' in the disk k. Upon the rod M directly above the cap i is rigidly secured a washer m, which bears upon the said cap in the rotation of the rod M. The upper end of the rod M, which extends above the plane of the upper edge of the hopper L, is bent at right angles to form a crank arm or handle m'.

N represents the draft-pole, one end of which is secured to the outwardly-extended lugs g^2 g^2 on the outer edge of the rotating ring H. Said inner end of the draft-pole is provided with downwardly-extended plates n n, which are bent at right angles, so as to extend beneath the lugs g^2 and form a detachable connection for the pole. With the other end of the pole is connected one end of a stay-rod n^3, the other end of which rod is connected with an eye g^3 on the other side of the ring H from that having the lugs g^2 g^2.

In the operation of the mill the box or bin A is first firmly secured or stayed in position upon the ground. The corn upon the cob is then placed within the hopper L in the proper quantity. Power being applied to the draft-pole N, rotation is imparted to the ring H in the direction of the arrow, the teeth h' causing a rotation of the gear G G' and the gear-wheel E, with the hopper L, is caused to rotate with an increased degree of speed to that of the ring H and in a contrary direction, the triple gear affording a rapid movement of the grinding-plate in the comparatively slow movement of the draft-pole. In the rotary movement of the wheel E the grinding-surface of the upper grinding-plate F is caused to move past the grinding-surface of the stationary grinding-plate D. The corn in the hopper is first broken by the shear cut of the cob-breaking arms I and e^3, falls upon and is moved over the surface of the disk C by the teeth c^9 on the arm c^2, the broken cob meeting the stationary teeth c^6 on disk C, and the cob is broken into smaller particles, which pass with the corn removed by the shock from the particles of the cob toward the grinding-burs on the grinding-plates D and F, the portions of the cob entering the space d^4 between the long burs, and is ground by the long burs on the grinding-surface of the plate F. The corn and cob, which are thus ground simultaneously, pass as meal from one series of burs to another, the inclination of the opposing series of burs having a tendency to force down the meal toward the lower edge of the grinding-plates, while the tapered or inclined surfaces of the sides of the burs remove all resistance to and facilitate the fall of the meal into the bin or box A. In order to increase the degree of fineness of the meal, the arm m' on the adjusting-rod M is turned so as to cause the disk k on said rod and radial arms k^3 to move the disk C upwardly a short distance, which action brings the grinding-face on the plate D close in position to the grinding-face of the plate F, the lower edges of each plate being consequently, from the slight difference in the angle of said plates, in closer proximity without danger to the burs coming into actual contact. The teeth e^7 on the inner side of the wheel E act to throw the cobs from the side of the wheel toward the breaking-arms and into a position parallel with the series of teeth on the disk C, while the stationary arms I I during the rotating of the hopper insure breaking of the corncob in the hopper. The arms k^2, which extend through the opening b^7 in the arms b^2, are thereby enabled to adjust the position of the lower grinding-plate without moving laterally or being turned by the adjusting-rod M.

The invention provides a mill of larger grinding capacity and operated with a minimum degree of power, the rotation of the hopper serving to agitate the whole bulk of the corn the entire depth of the hopper and affords rapid delivery of the cereal to the grinding-burs. The grinding-plates F and D, being detachable, provide for the interchangeable employment of grinding-plates for others of more or less fineness in the size of the burs.

Having fully described our invention, what we now claim as new, and desire to secure by Letters Patent, is—

1. In a grinding-mill the combination with a frame or spider having arms provided with

guide-openings of a center post with which said arms are connected having an opening extending therethrough an upper rotating grinding-plate and a lower non-rotating grinding-plate means for rotating said upper grinding-plate and an adjusting-rod extending through said post having a screw-threaded lower end, an adjusting-nut upon said rod bearing upon said center post, a disk having a threaded opening upon said rod and arms connected therewith at one end and having the other ends extending through the openings in the arms of said spider and contacting with the lower grinding-plate.

2. In a grinding-mill the combination with a frame or spider having arms provided with guide-openings of a center post, with which said arms are connected, having an opening extending therethrough an upper rotatable grinding-plate and a lower non-rotating grinding-plate, means for rotating said upper plate and a disk supporting said lower plate having a central opening and vertical grooves therein lugs upon the said center post extending within said grooves an adjusting-rod extending through the opening in said post having a screw-threaded lower end and an adjusting-nut on said rod bearing upon said center post a disk having a threaded opening upon said rod and arms connected with said disk at one end and having the other ends extending through the openings in the arms of said spider and contacting with the lower grinding-plate.

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