(No Model.) 2 Sheets—Sheet 1.

T. CASCADEN, Jr.

GRINDING MILL.

No. 604,853. Patented May 31, 1898.

Fig. 1.

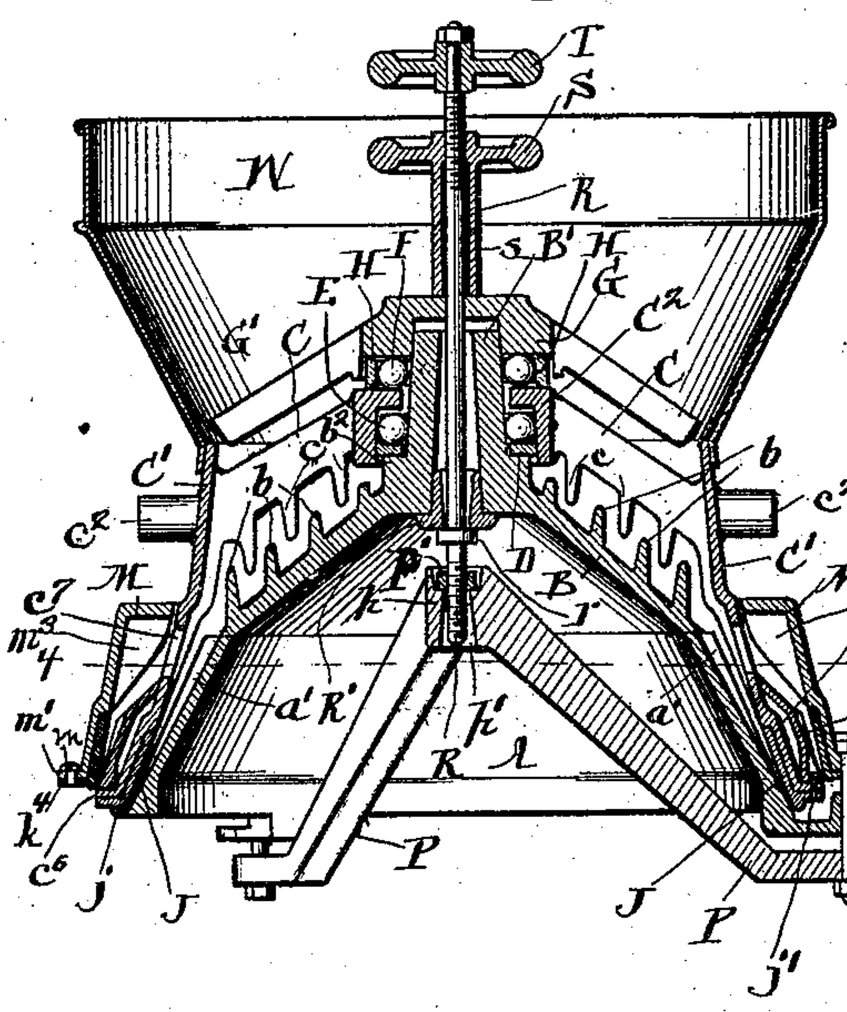


Fig. 2.

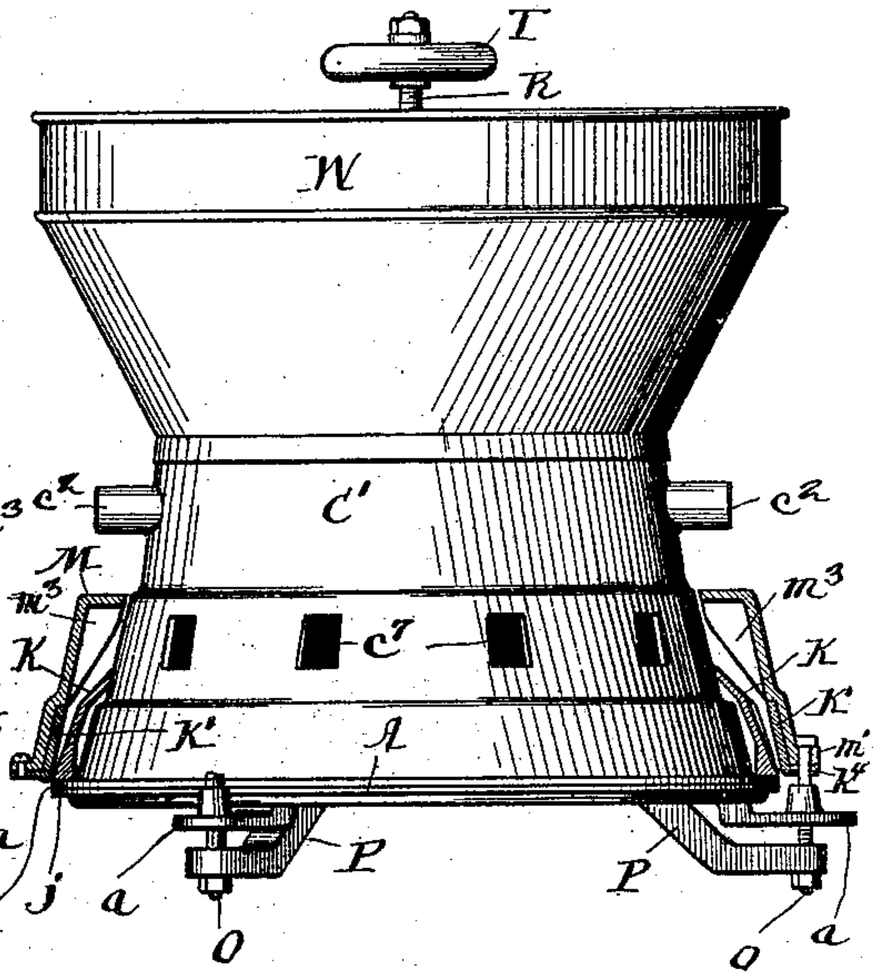
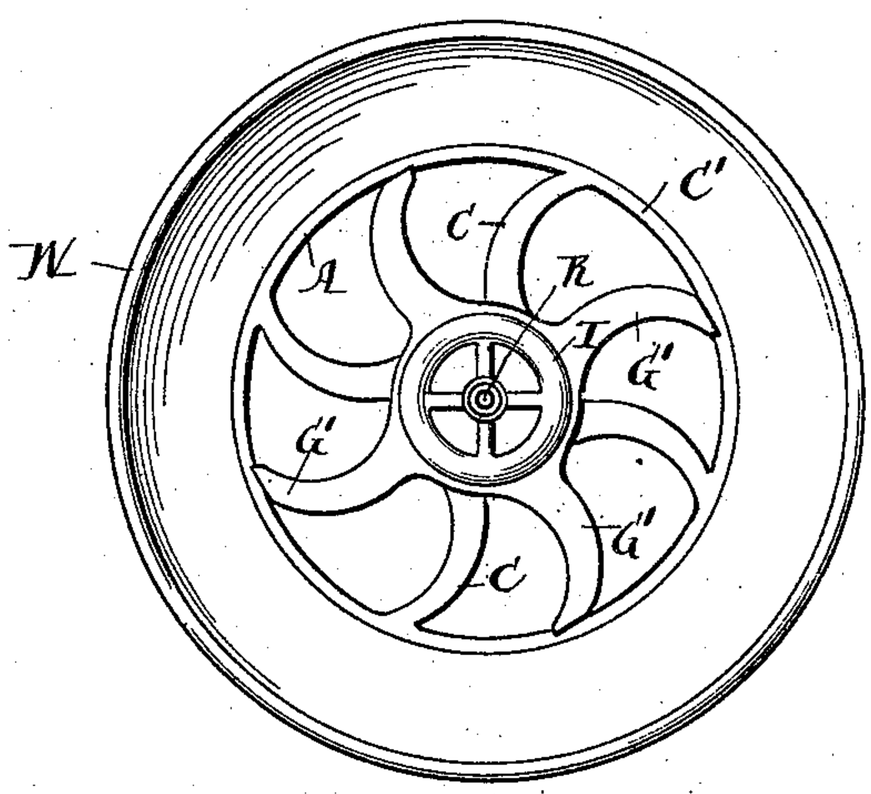


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

T. CASCADEN, Jr.

GRINDING MILL.

No. 604,853. Patented May 31, 1898.

Fig. 4.

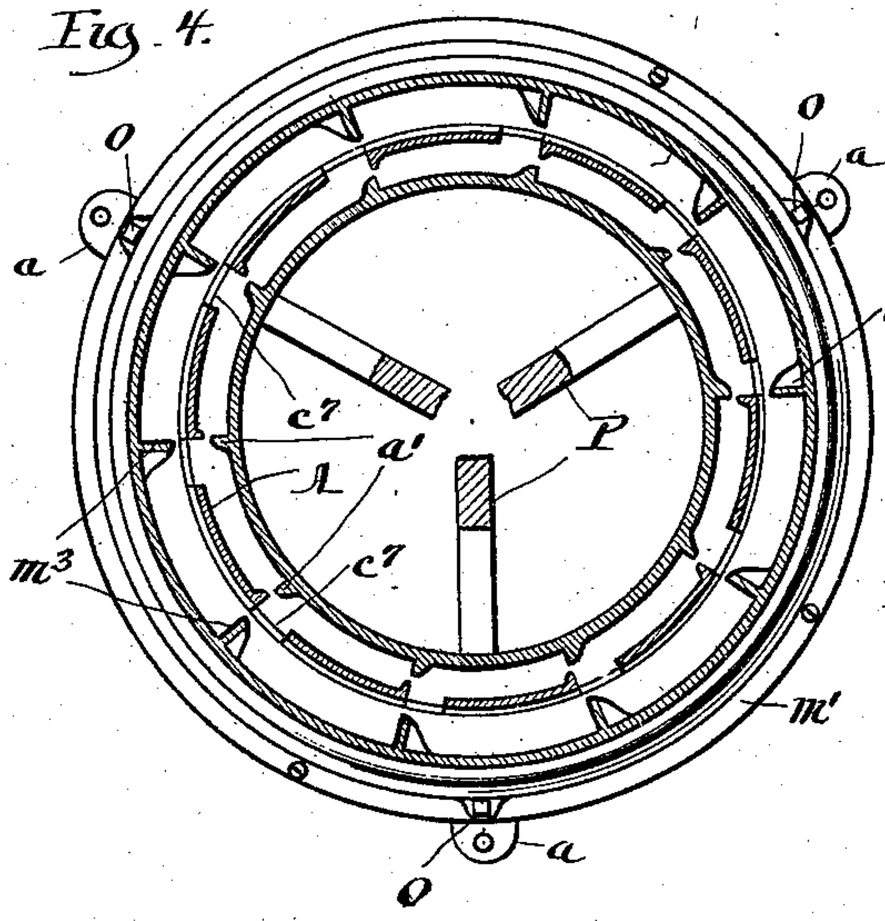


Fig. 6

Fig. 5.

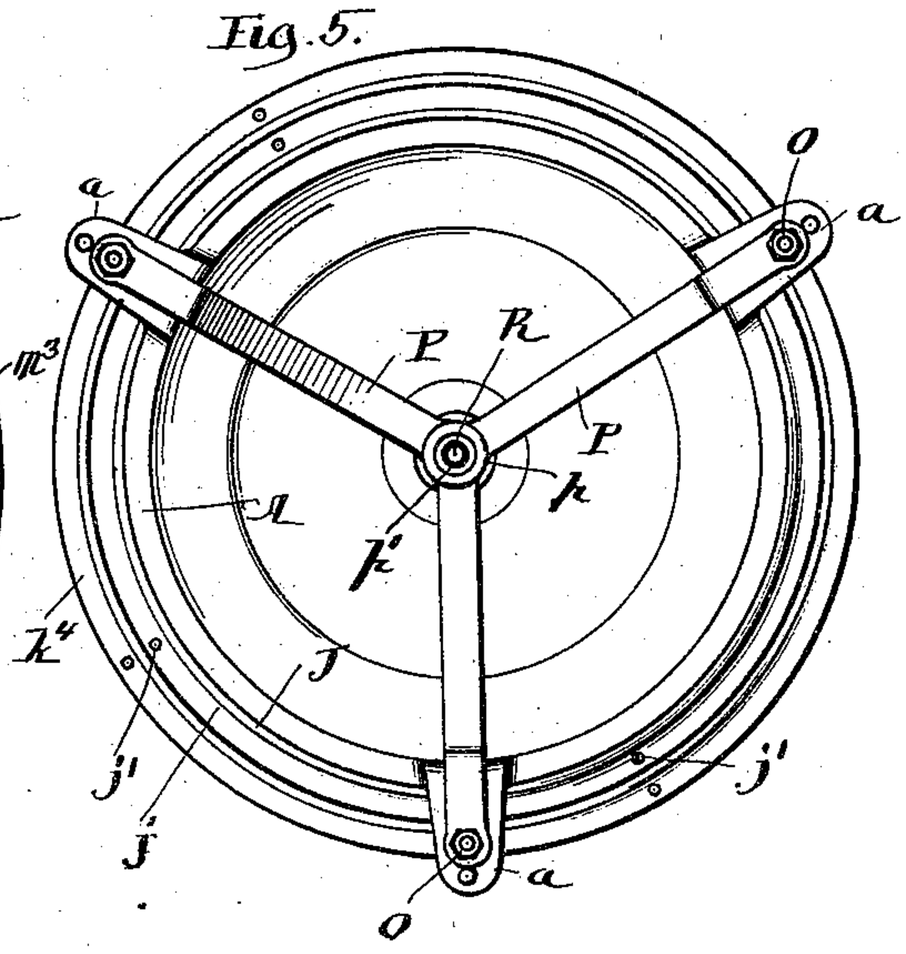


Fig. 9.

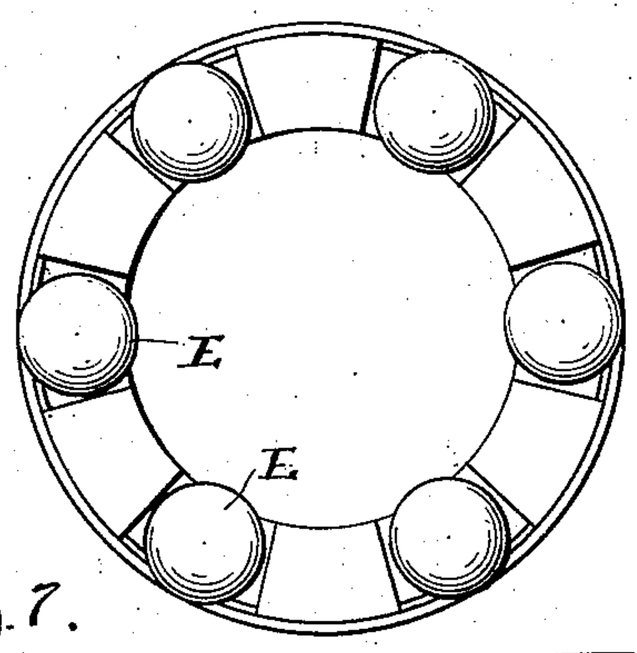


Fig. 7.

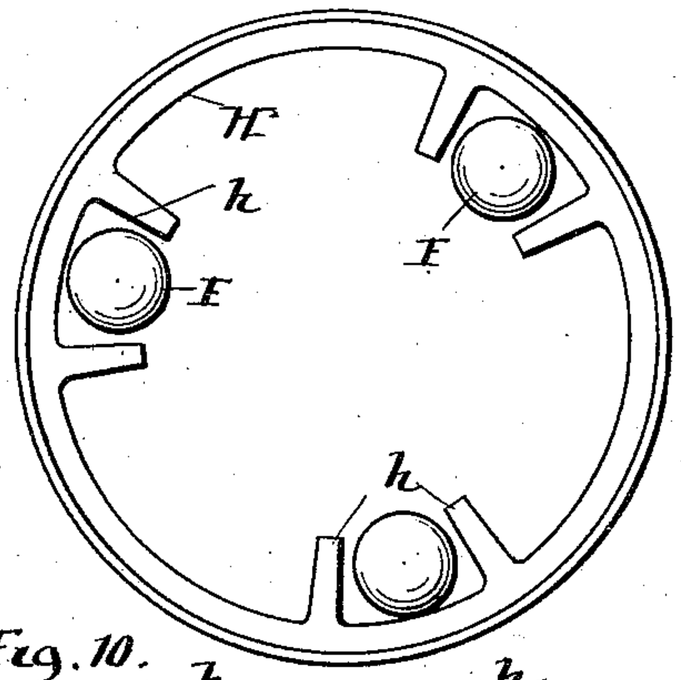


Fig. 10.

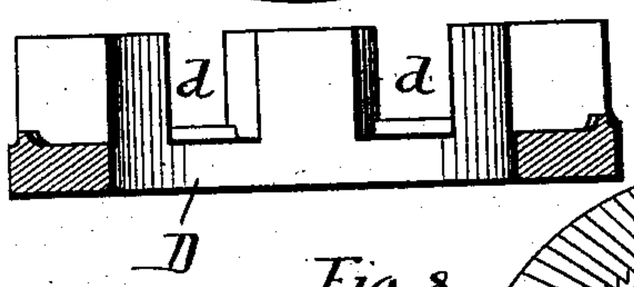
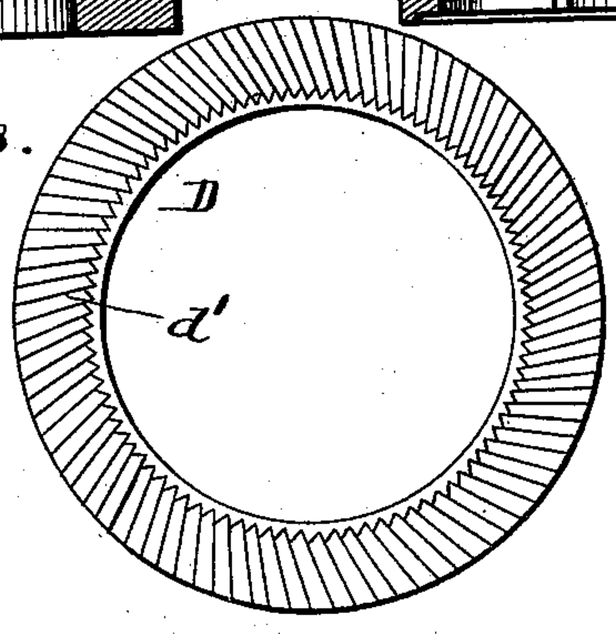


Fig. 8.



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UNITED STATES PATENT OFFICE.

THOMAS CASCADEN, JR., OF WATERLOO, IOWA, ASSIGNOR TO THE DAVIS GASOLINE ENGINE WORKS COMPANY, OF SAME PLACE.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 604,853, dated May 31, 1898.

Application filed June 21, 1897. Serial No. 641,557. (No model.)

To all whom it may concern:

Be it known that I, THOMAS CASCADEN, Jr., a resident of Waterloo, in the county of Black Hawk, State of Iowa, have invented certain new and useful Improvements in Grinding-Mills, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The present invention has relation more particularly to improvements in that class of grinding-mills commonly known as "feed-grinders," such mills being more especially adapted for the grinding of corn or other grain to be used as food for stock.

The invention has for its objects to so improve the construction of the mill that the friction of the parts shall be reduced to a minimum, to increase the capacity, efficiency, and durability of the mill, to provide improved means whereby the grinding rings or surfaces of the mill shall be more completely under the control of the operator, and in other respects to render the mill more effective and durable than any other construction of feed-grinding mill with which I am familiar.

With these objects in view the invention consists in the various novel features of construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a view in central vertical section through a grinding-mill embodying my invention. Fig. 2 is a view of the mill in side elevation, the outer grinders at the base of the mill being shown in vertical section. Fig. 3 is a plan view. Fig. 4 is a view in horizontal section on line 4 4 of Fig. 1. Fig. 5 is an inverted plan view. Fig. 6 is an enlarged detail view showing the manner of holding the lower set of antifriction-balls in place. Fig. 7 is a view in central vertical section through Fig. 6. Fig. 8 is an inverted plan view of the ring whereon the lower set of antifriction-balls are sustained. Fig. 9 is a plan view; and Fig. 10 is a view in vertical cross-section upon an enlarged scale, showing the manner of holding the upper set of antifriction-balls.

The base A of the mill is provided with suitable lugs or feet *a*, whereby it may be bolted to the receiving-box or other convenient support. The outer surface of the base A, which is of conoidal shape, constitutes the inside ring of the inner set of grinders, and from the base A rises the cone B, from the apex of which extends the post B′, the post B′ being preferably cast in piece with the cone B. The upper surface of the cone B is formed with crushing-teeth *b* in suitable number and arrangement and adapted to coöperate with corresponding teeth *c*, that depend from the arms C, that are preferably formed integral with and extended inwardly from the outer shell C′ of the mill, these arms C being inclined in correspondence with the inclination of the cone B. To the top of the shell C′ is connected the hopper W, into which will be placed the material to be ground. The inner ends of the arms C are united and preferably integral with a ring C^2, that encircles the cone-post A′. At the base of the cone-post B′ is formed a shoulder b^2, upon which rests a ring D, that is preferably formed with pockets or open spaces *d* (see Fig. 7) to receive the bearing-balls E, these balls E being of such diameter as to extend outside the pockets of the ring D and bear against the outer face of the cone-post B′ and against the inner face of the ring C^2, that encircles the cone-post. The purpose of the balls E is to avoid the friction incident to the weight of the shell C and connected parts, and as well, also, of the sweep that will be attached to the shell by means of the laterally-projecting studs c^2 in manner well understood in the art. One function of the ring D which I prefer to employ, but which is not essential to the broad features of my invention, is to so space the balls that the necessity is avoided for providing balls around the entire base of the cone-post, thus making it possible to use comparatively few balls. Another function of the ring D is to guard the bearings of the balls E against access thereto of the body of grain within the machine. By preference the under surface of the ring D is formed with a series of teeth *d*′, preferably of the shape shown in Fig. 8 of the drawings, these teeth

serving to carry outward any fine dirt, feed, or the like that may collect around the cone-post over the shoulder b^2 at the base of the cone-post and deliver it onto the surface of the cone B, whence it will pass to the grinding-rings, as will hereinafter more fully appear.

The ring or hub C^2 at the inner ends of the arms C has a portion extending over the balls E, and upon this portion of the ring C^2 rest the bearing-balls F, upon the upper surface of which balls bears a ring or hub G, from which extends the cob-crushing arms G′, the hub or ring G being formed with a square or like polygonal socket to fit over the correspondingly-shaped upper part of the cone-post B′, so that the ring G and arms G′ will remain stationary or rigid with the cone-post. Preferably the balls F are held within pockets formed by arms *h*, (see Fig. 9,) that project inwardly from a ring H, that rests upon the upper face of the ring or hub C^2, the purpose of this ring H being to so space the balls F that the necessity of employing a great number of balls is avoided, and, furthermore, to prevent the passage of the feed or grain onto the surface of the balls and their bearings. The outer surface of the cone-base A is formed with a series of vertically-disposed grinding-teeth a', opposite the lower portions of which is set the grinding-ring J, that will coöperate with the inside teeth a' in grinding grain. Preferably the grinding-ring J is set within an annular recess c^5, formed around the lower portion of the shell C, the bottom of the shell and the bottom of the ring J being provided, respectively, with outwardly-extending flanges c^6 and *j* to receive the bolts *j*′, whereby the ring J is held in place. On the outside of the shell C, at its base, is mounted the inner ring K of the outer grinders, this ring K being preferably of the shape shown and having its lower edge connected by the bolt *j*′ with the flanged base of the shell C. The outer surface of the ring is formed with teeth that coöperate with teeth formed upon the inner surface of the outer ring K′ of the outer grinder. This outer ring K′ is connected to the lower portion of its annular casing M by bolts *m*, that pass through the flanges *m*′ and k^4 at the base of the casing and of the ring K′, and through these flanges extend the bolts O, that connect with the bracket P, whereby the adjustment of the outer grinding-ring is effected. The bolts O extend loosely through holes formed in the feet *a*. The shell C is provided with a series of openings c^7, by which grain will pass outward into the space between the rings K and K′ of the outer grinder.

By reference to Figs. 1 and 4 of the drawings it will be seen that casing M is provided upon its interior with a series of wings m^3, the purpose of these wings being to receive the grain as it passes through the opening c^7 and force it downwardly between the rings K and K′ of the outer grinder. The hub *p* of the bracket P is provided with an opening *p*′, at the top of which is formed a seat to receive a threaded nut P′, through which passes a temper-screw R, this screw R being provided with an annular shoulder *r*, adapted to bear against a flanged collar R′, that enters and bears against the central opening formed through the cone-post B′. The upper portion of the temper-screw R is screw-threaded to receive a hand-wheel S, that is provided with the depending collar *s*, that bears against the upper face of the hub or ring G, and at the upper end of the temper-screw R is fixed a hand-wheel T, whereby the screw may be turned.

From the foregoing description the operation of my improved mill will be seen to be as follows—viz., the material to be ground (such as ear-corn or the like) will be placed within the hopper W and rotation will be imparted to the arms C from the sweep that will be attached to the studs c^2 in the usual manner. Inasmuch as the cob-breaking arms G′ are fixed to the cone-post B′, these arms G′ remain stationary, while the arms *c* beneath them are revolved and cobs or like coarse material will be crushed and broken between the arms G′ and C and will pass down onto the face of the cone B. The preliminary crushing or grinding of the material will occur between the teeth upon the under side of the arms C and the corresponding teeth upon the upper face of the cone B, and a portion of the material will then pass downward between the inner and outer rings of the inner grinder, while a portion of the material will pass through the holes c^7 and down between the inner and outer rings K and K′ of the outer grinder. As the material passes through the hole c^7 it will be forced downward by the wings or deflectors m^3, and after passing between the inner and outer grinders the material will descend into the receiving box or bin beneath the mill.

By means of the temper-screw R and hand-wheels S and T an independent adjustment of the inner and outer grinders can be effected. By turning downward the hand-wheel S, the sleeve *s* of which rests upon the top of the cob-breaker, the cob-breaker, the arms C, and the shell C′ will be forced downward, thereby bringing the outer grinding-ring J of the inner grinder nearer to the inner ring of the inner grinder, thereby causing the inner grinder to more finely grind the material. On the other hand, by turning upward the hand-wheel S the grinding-ring J can be lifted, so as to separate the inner and outer rings of the inner grinder in order to permit a coarser grinding by such rings. By turning downward the hand-wheel T the temper-screw R can be forced downward, thereby causing the outer casing M and the outer grinding-ring K′ to approach nearer to the inner grinding-ring K of the outer grinder and cause a finer grinding of the material at such point, and when the

hand-wheel T is thus turned to adjust the outer grinder the hand-wheel S should be turned with it, so as to avoid disturbing the adjustment or relation of the rings of the inner grinder. It is obvious that if the hand-wheels T and S be oppositely turned the outer ring of the outer grinder will be loosened, thereby permitting it to be raised by the force of the grain being crushed.

It will be observed that the inclination of the grinding-rings of the inner and outer grinders is different—that is to say, the rings of the outer grinder more nearly approach the vertical or axis of rotation than the rings of the inner grinder, and hence it is seen that in this way the outer grinding-rings can be forced together sufficiently for fine grinding or can be allowed to spread open for coarse grinding without materially affecting the adjustment of the inner grinder. If the rings of the outer grinder were set upon the same angle as the rings of the inner grinder, there would be danger of the pressure on the outer grinder forcing the rings of the inner grinder together, which by my construction is entirely avoided.

Inasmuch as there is a tendency of the grinders to open and separate in grinding, by reason of the hardness of the grain that is being crushed, these grinders must be held firmly and forcibly together, and in prior constructions of mills this has caused a great amount of friction, requiring much more power in the operation of the mill and much more severe wear of parts than with my improved mill, since by my present invention the bearing-balls E and F relieve the parts between which they are interposed from friction incident to holding the parts firmly together and incident to the pressure caused by the lateral strains of the sweep whereby the rotation of the mill is effected.

It is manifest that the details of construction above set out may be varied within wide limits without departing from the spirit of the invention and that features or portions of the invention, may be adopted without the employment of the invention as an entirety. I do not wish, therefore, that the invention should be understood as restricted to the precise details, except where such details are specifically recited in the claims; nor do I wish the improvements understood as confined to the specific type of mill hereinbefore described. Thus, for example, antifriction-balls may be used in continuous series around the cone-post instead of being interspaced, although I regard the latter as the preferred construction. So, also, the rings arranged around the cone-post for preventing the access of the material being ground to the bearing-surfaces is a feature of advantage regardless of the peculiar construction of such rings. So, also, while I prefer to use antifriction-balls I regard the use of antifriction-rolls when properly disposed as the mechanical equivalent thereof, and so in many other respects modifications within the scope of my invention may readily suggest themselves to the skilled mechanic.

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

1. In a grinding-mill the combination of an inner cone or crushing surface having a central post rising above the same, a ball-support around said post, an outer shell provided with arms extending over said cone or crushing surface and provided also with a vertical ring or hub to which said arms are joined and antifriction-balls interposed between said post and the vertical inner surface of said ring or hub.

2. In a grinding-mill the combination of a cone or crushing surface having a post rising above the same, an outer shell having inwardly-extending arms and sustained from said post, a ring or hub for said arms having its interior formed with vertical and horizontal bearing-surfaces, antifriction-balls interposed between said cone-post and the vertical bearing-surface of said ring or hub and beneath the horizontal bearing-surface of said ring or hub, said balls serving to receive the strain from said ring or hub in both vertical and lateral directions.

3. In a grinding-mill the combination of an inner cone or crushing surface provided with a raised central post, an outer shell having inwardly-extending crushing-arms, a ring or hub for said arms encircling the cone-post, antifriction-balls interposed between said ring or hub and the cone-post and a ring arranged beneath said balls and serving to guard the same against the mass of material being ground.

4. In a grinding-mill the combination of an inner cone or crushing surface provided with a raised central post, an outer shell having inwardly-extending crushing-arms, a ring or hub for said arms encircling the cone-post, antifriction-balls interposed between said ring or hub and the cone-post and a ring arranged beneath said balls and serving to guard the same against the mass of material being ground, said ring having teeth upon its under surface.

5. In a grinding-mill the combination of an inner cone or crushing surface, an outer shell having arms extending above said cone or crushing surface, a hub for said arms encircling a post rising from said cone, a cob-breaker mounted upon said cone-post and antifriction-balls interposed between the cob-breaker and said hub and a ring serving to close the space between the cob-breaker and the hub beneath it and being provided with pockets whereby said antifriction-balls are retained in place.

6. In a grinding-mill the combination of an inner cone or crushing surface, an outer revoluble shell having inwardly-extending crushing-arms provided with a hub, a post rising from said cone and passing through said hub,

a stationary cob-breaker upon said hub, antifriction-balls interposed between said cob-breaker and said hub and a ring for guarding said antifriction-balls against the material being ground.

7. In a grinding-mill the combination of an inner cone or crushing surface, a revoluble shell mounted over said cone or surface, inner and outer grinders at the base of said shell, a bracket located beneath said inner cone and provided with a series of arms extending outwardly and connected with the outer ring of the outer grinder and a screw for adjusting said bracket.

8. In a grinding-mill the combination of an inner cone or crushing surface, an outer revoluble shell, inner and outer grinders at the base of said shell, a bracket connected with the outer ring of the outer grinder, and an adjusting-screw leading from said bracket centrally upward through said cone and provided with hand-wheels.

9. In a grinding-mill the combination of an inner cone or crushing surface, an outer revoluble shell, inner and outer grinders at the base of said shell, a post rising centrally from the top of said cone and having an opening therethrough, an adjusting-screw passing through said cone-post and a bracket connected with said adjusting-screw, said bracket being connected also with the outer grinder and a hand-wheel mounted upon said adjusting-screw.

10. In a grinding-mill the combination of an inner cone or crushing surface provided with a central post rising above the same, an outer shell provided with inwardly-extending arms having a hub encircling said post, a cob-breaker fixed to but vertically movable upon said central post, inner and outer grinders at the base of said shell, a bracket connected with the outer grinder, an adjusting-screw leading from said bracket up through the cone-post and cob-breaker and means substantially as shown for effecting the adjustment of said screw.

11. In a grinding-mill the combination with an inner cone or crushing surface, an outer revoluble shell provided with openings therethrough for the passage of grain, the inner and outer grinders at the base of said shell, said outer grinder comprising a vertically-adjustable casing extending above the openings in the shell and provided at its base with a grinding-ring and a bracket connected with said vertically-adjustable casing and a screw for adjusting said bracket and said casing leading upward centrally through the cone.

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