No. 814,114. PATENTED MAR. 6. 1906.

N. BURR.

FEED MILL.

APPLICATION FILED FEB. 4, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

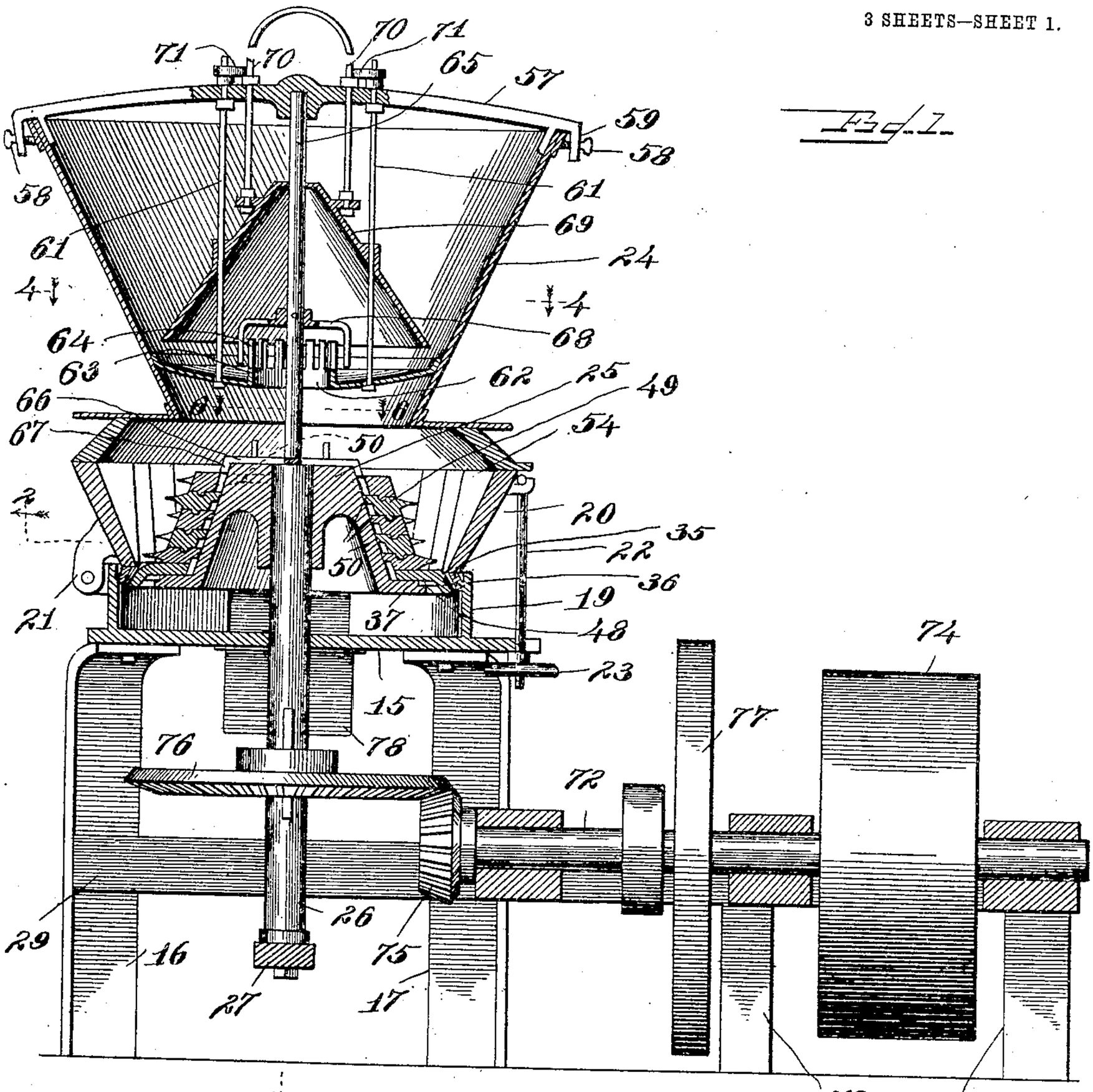
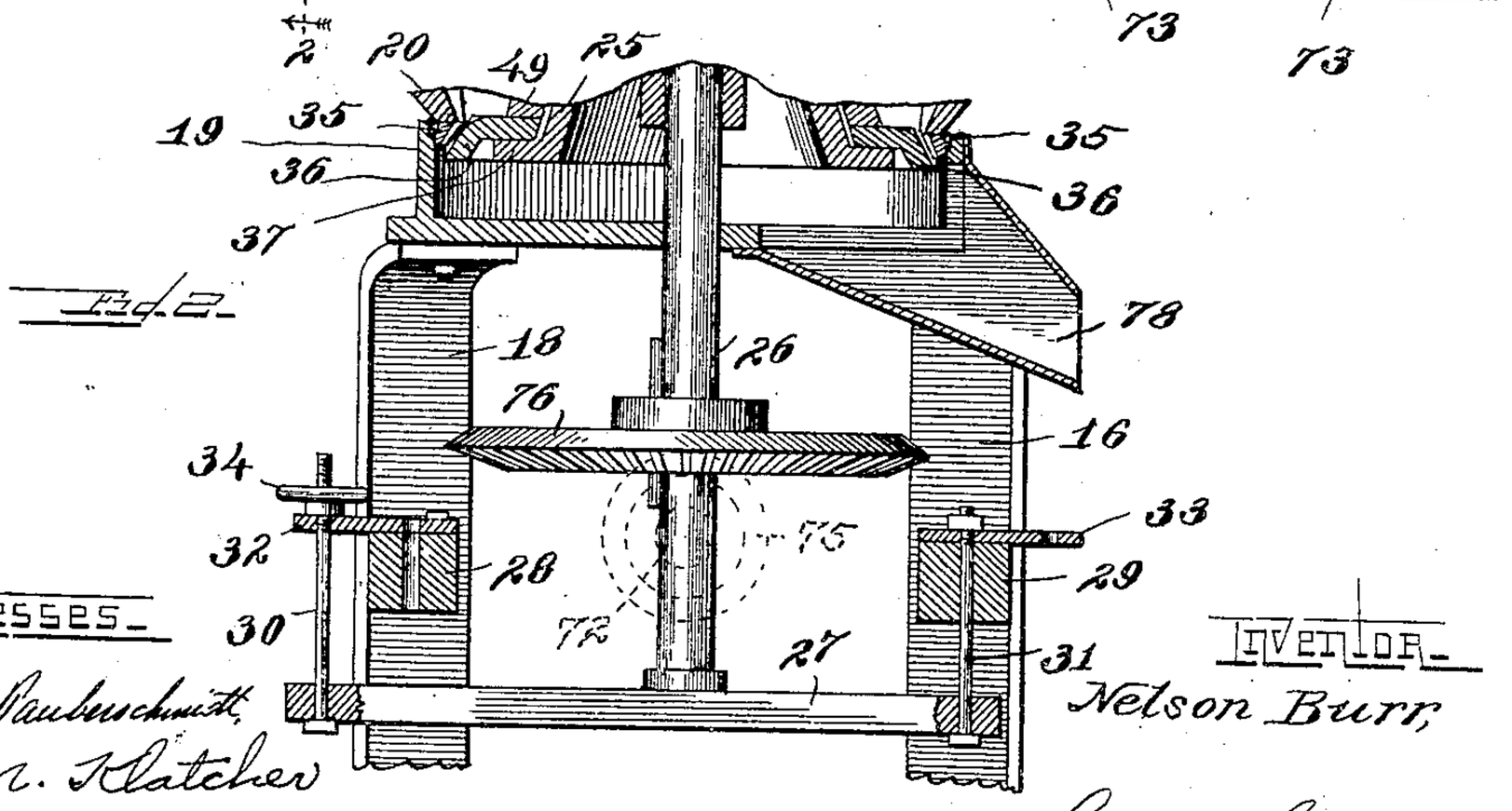


Fig. 2.



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No. 814,114. PATENTED MAR. 6, 1906.

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3 SHEETS—SHEET 2.

Fig. 3

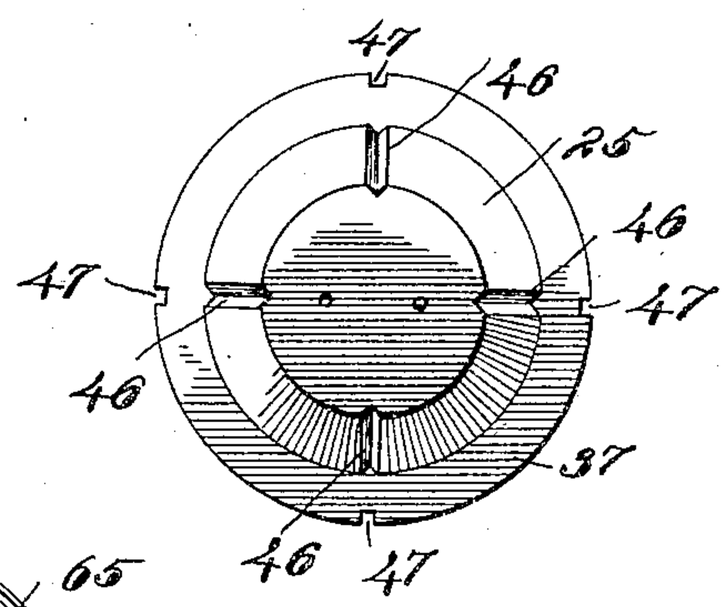


Fig. 4

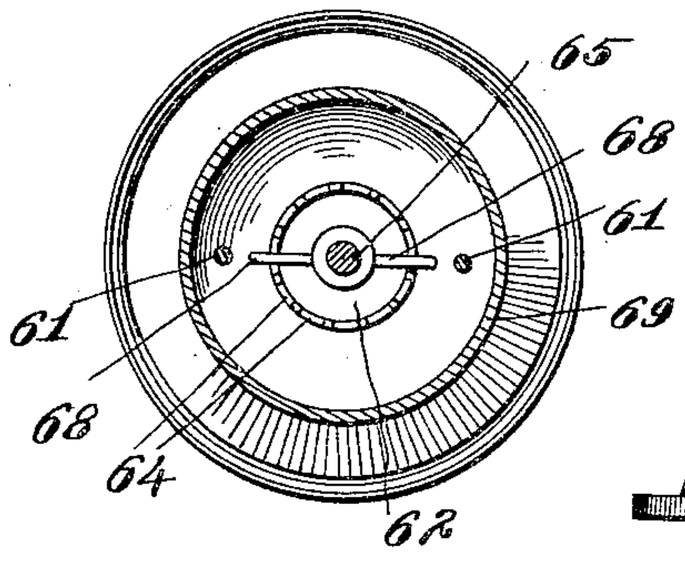


Fig. 5

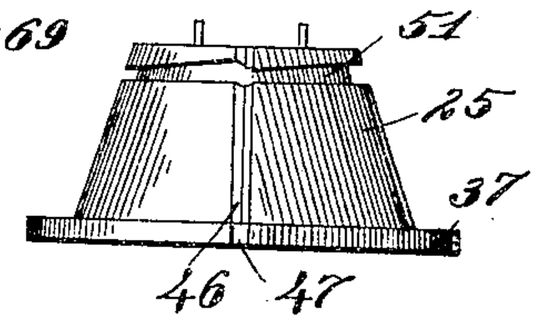


Fig. 6

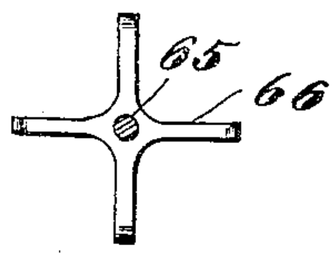
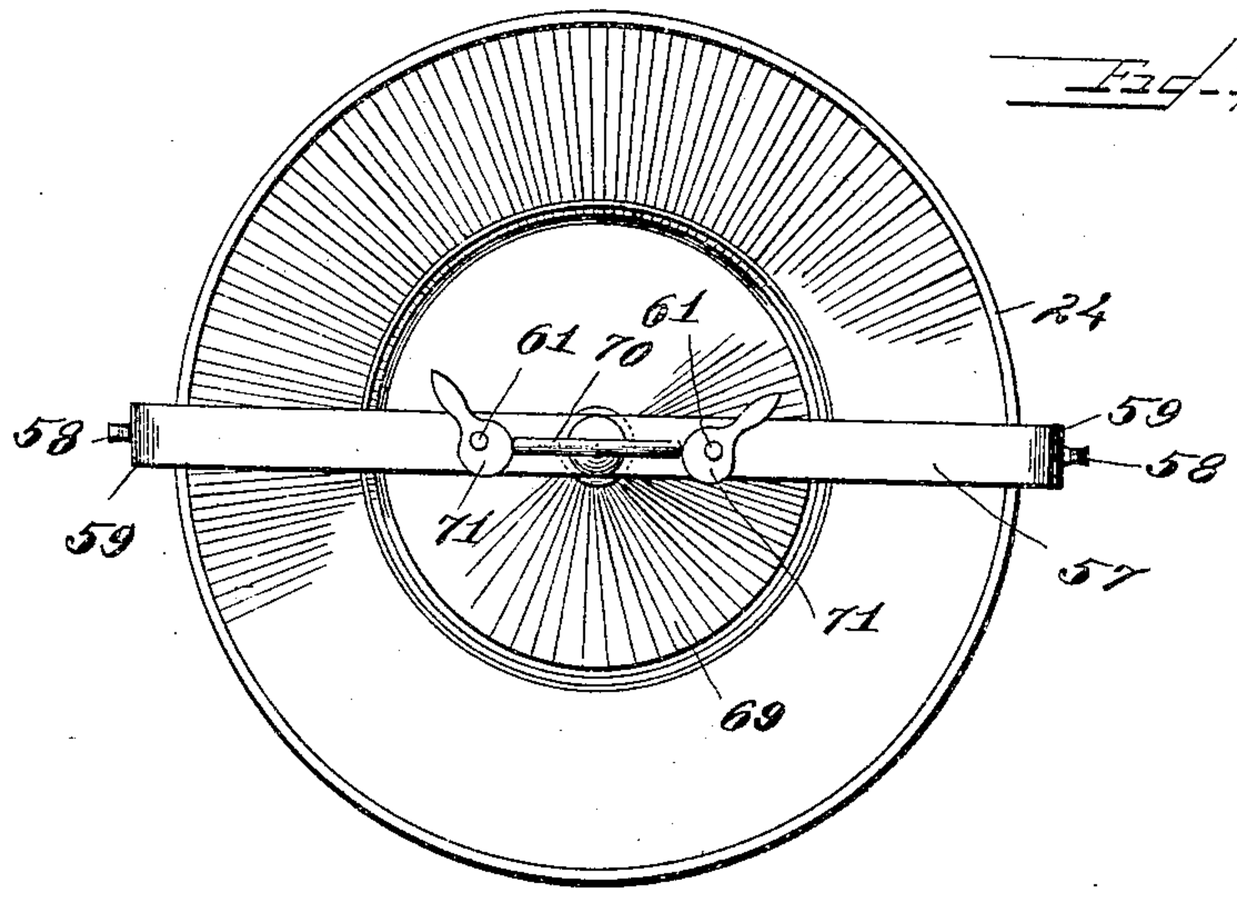


Fig. 7



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No. 814,114. PATENTED MAR. 6, 1906.

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APPLICATION FILED FEB. 4, 1904.

3 SHEETS—SHEET 3.

Fig. 8.

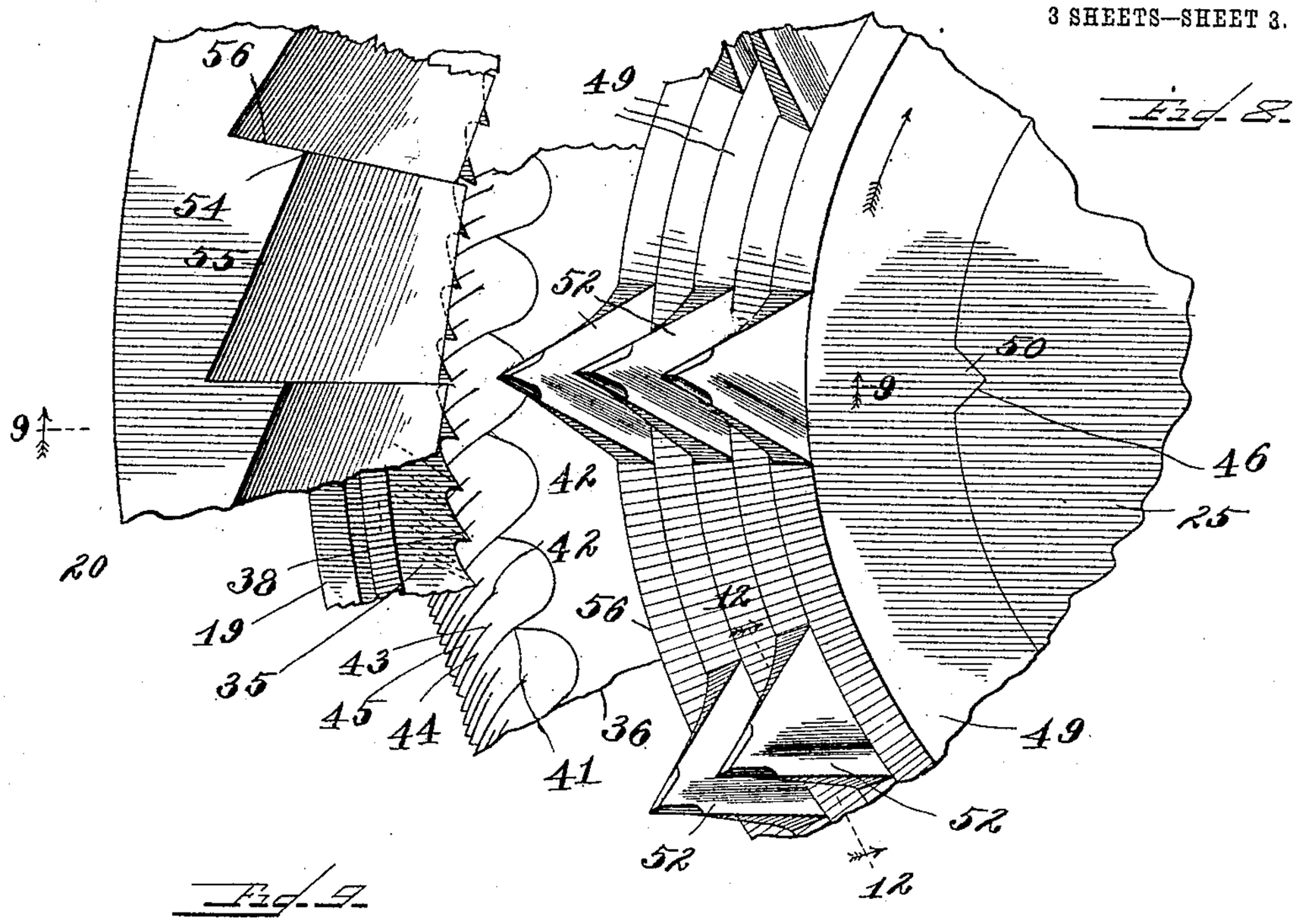

Fig. 9.

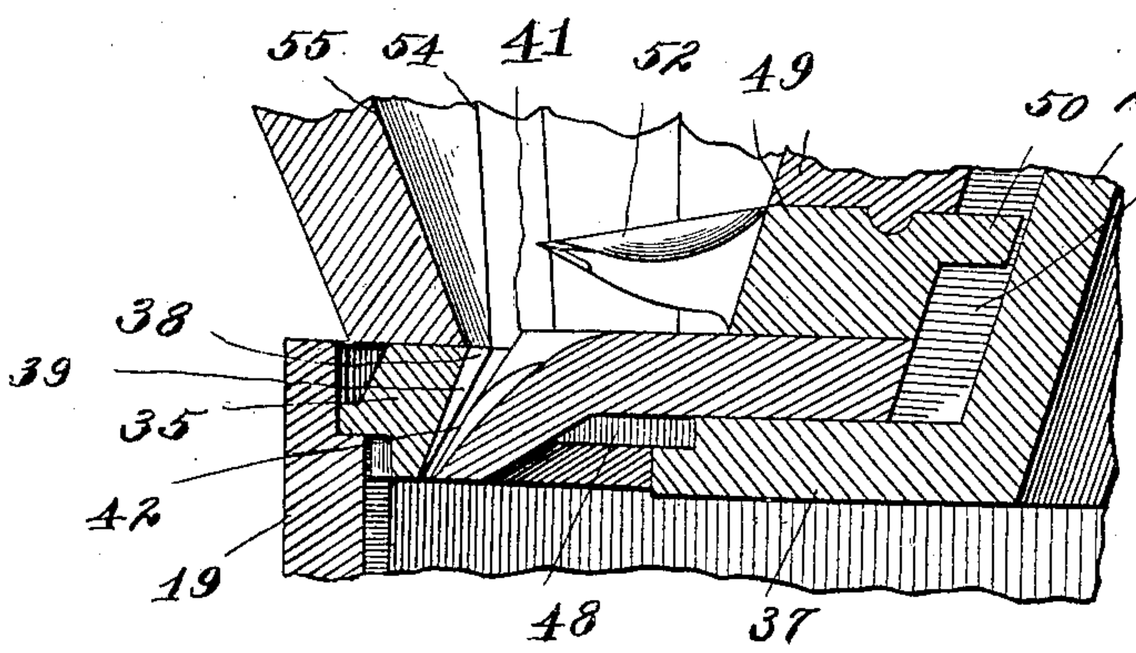

Fig. 10.

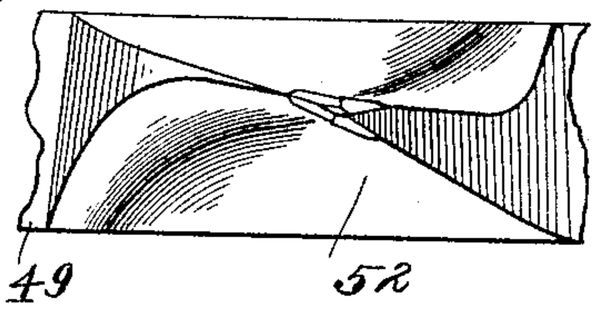

Fig. 12.

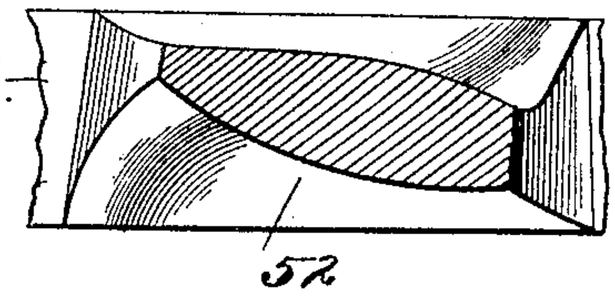

Fig. 11.

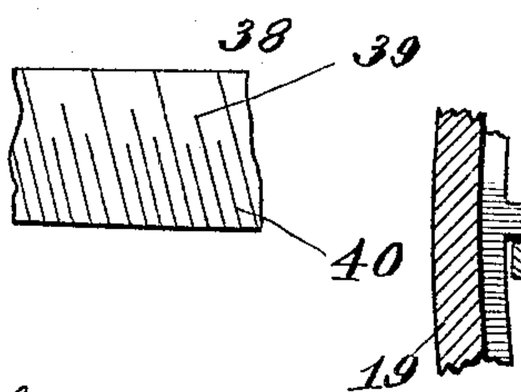

Fig. 13.

Witnesses.

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UNITED STATES PATENT OFFICE.

NELSON BURR, OF BATAVIA, ILLINOIS.

FEED-MILL.

No. 814,114. Specification of Letters Patent. Patented March 6, 1906.

Application filed February 4, 1904. Serial No. 191,990.

To all whom it may concern:

Be it known that I, NELSON BURR, a citizen of the United States, and a resident of Batavia, county of Kane, and State of Illinois, have invented certain new and useful Improvements in Feed-Mills, of which the following is a specification and which are illustrated in the accompanying drawings, forming a part thereof.

This invention relates to feed-mills, and particularly to mills adapted for the grinding of corn, either shelled or with the cob, the objects of the invention being to provide improved means for separating out particles of metal which may be intermixed with the shelled corn, to provide for the initial reduction of the material by a piercing action, and to provide improved means for accomplishing the final reduction of the meal.

The invention consists in the structure hereinafter described and which is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical central section of the machine. Fig. 2 is a detail vertical central section on a plane perpendicular to that of the plane of Fig. 1. Fig. 3 is a detail plan view of the grinding-head. Fig. 4 is a detail plan section on the line 4 4 of Fig. 1. Fig. 5 is a detail side elevation of the grinding-head. Fig. 6 is a detail section on the line 6 6 of Fig. 1. Fig. 7 is a detail plan view of the machine. Fig. 8 is a detail plan view of the grinding mechanism. Fig. 9 is a detail section on the line 9 9 of Fig. 8. Fig. 10 is an end view of one of the teeth of the primary grinding-rings. Fig. 11 is a detail of the face of the outer grinding-ring. Fig. 12 is a sectional detail on the line 12 12 of Fig. 8, and Fig. 13 is a sectional detail showing the stop-lugs for locking the outer grinding-ring against rotation.

The base-plate 15 of the mill is supported on legs of any suitable form or number, of which three (designated 16, 17, and 18) are shown in the drawings. A casing 19, constituting the wall of the grinding-chamber of the mill, is secured to and preferably cast integrally with the plate 15, as shown, and the shell 20 hinged thereto, as shown at 21, resting upon the outer grinding-ring 35, a link 22 pivotally attached to the shell at the opposite side from the hinge being provided with a hand-nut 23, adapted to engage the under face of the plate 15 for locking the parts together. The feed-hopper 24 rests upon and is secured to the shell 20 by any suitable means.

The grinding-head 25 is conical in shape and is located within the shell 20 and is fixed upon the upper end of a vertical shaft 26, having a stepped bearing on a cross-bar 27, carried by the supporting-frame of the plate 15. For convenience of adjustment the bridge-tree 27 is supported from cross-bars 28 29, secured to the legs of the mill, links 30 31, pendent from the cross-bars 28 29, carrying the bridge-tree 27. One of these links, as 30, is provided with a hand-nut 34, by means of which the vertical adjustment of the shaft 26 is accomplished.

In order to better adapt the machine for various situations in which it may be desirable to set it, I make the links 30 and 31 interchangeable, suspending them from wear-plates 32 33, secured to the cross-bars 28 29 and projecting laterally therefrom. The link 30 is set through the plate 33 and the cross-bar 29, while the link 31, carrying the adjusting means, is set through the lateral extension of the plate 32. In order to reverse the position, the link 31 will be transferred to the bar 28 and set through the aperture shown therein, while the link 31 will pass through the aperture in the lateral extension of the plate 33.

The outer grinding-ring is shown at 35 and is carried by the case 19, resting upon an annular shoulder 19^a on the inner face thereof, lugs 35^a on the lower face of the ring engaging instanding ribs 19^b on the ring to hold the latter against turning. The inner grinding-ring 36 projects somewhat above the outer ring 35 and rests upon an annular radially-projecting foot 37 of the grinding-head 25. The outer ring 35 is provided with a series of teeth 38, which are directed backwardly relatively to the direction of rotation of the grinding-head and recede into the body of the ring at their lower ends. Minor intermediate teeth 39 extend upwardly from the bottom of the ring, but not to the top thereof, these teeth being of increasing depth from their bottoms upwardly. Intermediate of the teeth 38 39 there may be still other and shorter teeth 40, as shown, projecting upwardly from the bottom of the ring and also being of greater depth toward their upper ends. This arrangement of the teeth results in a grinding-face of increasing fineness from its top to its bottom. The grinding-face of the inner ring 36 has the major teeth 41 and several series of minor intermediate teeth of different heights, 42, 43, 44, and 45. The

teeth 41 are directed forwardly relatively to the direction of rotation of the head, their front faces being quite abrupt, and the floor of the interspace between said teeth is inclined—that is to say, the depth of the teeth rapidly diminishes from their upper ends downwardly. By reason of this conformation of the floor of the interspace a wide but shallow pocket or radial channel is formed for the reception of the particles reaching the grinding-rings, and the inclination of the bottom of this pocket is such as to throw the particles against the points of the teeth of the outer ring, as the inner ring extends above the outer ring, so that the floor of the channel or pocket between the teeth 41 leads to apexes of the teeth 38. As the inner ring advances the material is forced against the apexes or ends of the teeth 38 by the front faces of the teeth 41. By thus crowding the material against the point of the teeth 38 it is pierced thereby, and thus reduced. The teeth 38 are more numerous than the teeth 41, as shown, being double their number.

The grinding-head 25 is in the form of a truncated cone, as shown in detail in Fig. 5, and is provided with vertical V-shaped channels, as 46, its radial foot-flange 37 being provided with similar recesses 47. The latter recesses receive lugs 48, formed on the under side of the instanding flange of the ring 36, thereby locking it to the grinding-head. A plurality of rings, as 49, fit upon the head 25, one above the other, the lower one resting upon the ring 36, and are locked to the head, so as to rotate therewith, by means of instanding V-shaped lugs 50, which engage the channels 46. A cam-groove 51 encircles the head 25 near its top, receiving the lugs 50 of the top ring 49. As this ring is turned upon the head it is crowded down by the inclined upper wall of the channel 50, thereby securely binding the several rings 49 together. These rings interlock by means of annular grooves and ribs in their meeting faces, so that in case of the fracture of a ring its fragments are held in place. The V shape of the channels 46 and ribs 50 insures the true centering of the rings as soon as work is commenced, as the resistance causes the inclined faces of the lugs to slide along the inclined seats provided for them until all are properly seated, if by accident in assembling the rings have not been properly adjusted. I regard the right-angle form of the grooves and lugs as most efficient for this purpose. Each of the rings 49 is provided with a plurality of radially-projecting teeth 52, (shown in detail in Figs. 8, 9, 10, and 12,) the outer ends of which teeth are sharpened or lance-pointed, as shown at 53 in Fig. 10.

The inner walls of the shell 20 are vertically ribbed, as shown at 54, the ribs taking the form of ratchet-teeth having one long face, as shown at 55, and one short and more abrupt face, as shown at 56, the long face being directed backwardly with reference to the direction of rotation of the grinding-head. As material of any considerable size, such as an ear of corn, descends from the hopper it is caught by the teeth 52 and carried against the incline 55 of the ribs 54, so that the points of the teeth 52 are forced into it, effecting its reduction.

When the mill is used for grinding small grain, such as shelled corn, mechanism is provided for regulating the feed and for eliminating any foreign substances, such as particles of iron, which not uncommonly find their way into material of this character. For this purpose a bridge 57 is thrown across the top of the hopper, being secured thereto by any suitable means, as the clamping-screws 58, passed through pendent lugs 59 at the end of the bridge and bearing against the wall of the hopper. A diaphragm is placed across the hopper, near its bottom, and supported by means of rods 61, pendent from the bridge 57. This diaphragm is centrally apertured, as shown at 62, the aperture being surrounded by an upstanding annular flange 63, the upper edge of which is preferably toothed or serrated, as shown at 64. A shaft 65 is secured to the top of the grinding-head 25 by means of a spider 66, having the ends of its arms turned downwardly, as shown at 67, so as to engage the vertical grooves 46, the upper end of the shaft being journaled in a suitable socket in the bridge 57. Upon this shaft there are secured cross-arms 68, as shown, two in number, which have their ends turned downwardly, so as to inclose between them the upper portion of the flange 63. A hood 69, conical in form, is placed within the hopper and adjustably supported above the diaphragm 60, so as to regulate the discharge of the grain thereupon. This hood is carried by a pair of rods 70, which project upwardly through the bridge 57 and are engaged and secured by cams 71, which may for convenience be mounted upon the upper ends of the rods 65. As shown, the rods 70 comprise a single piece bent to U form for convenience in effecting the adjustment of the hood. When the mill is employed for the reduction of ear-corn, this feed-regulating and metal-extracting mechanism, including the shaft 65, is entirely removed from the hopper.

The mill is driven by means of a shaft 72, journaled in suitable floor-hangers 73 73 and carrying a belt-pulley 74 for receiving the driving-belt and a beveled gear 75, which intermeshes with a beveled gear 76, fixed upon the shaft 26. A balance-wheel 77 is shown as mounted upon the shaft 72, though ordinarily in a mill constructed as herein described such an appurtenance is unnecessary.

A delivery-spout 78 is shown as leading from the chamber inclosed by the case 19.

The operation of the mill is as follows:

When used for reducing ear-corn, the hopper is left entirely open and the material is fed thereto in such quantities as desired. The ears fall into the grinding-chamber and are caught by the teeth 52 and forced against the inclined wall 55 of the ribs 54 and carried up the incline thereof until pierced and reduced by the teeth 52. This action being by the sharp lance-point of the tooth is effected without the expenditure of the power heretofore required in reducing ear-corn by breaking the ears or cutting them, as with a blade. The cobs being reduced to small particles fall with the kernels onto the floor of the shallow pocket or interspace in the ring 36 and are guided by the inclined floor of the latter ring into contact with the teeth of the former and are arrested thereby, receiving the thrust of the apex of the teeth of the outer ring, so that the reduction of these particles is accomplished by a piercing action analogous to that performed by the teeth 52 and with the expenditure of comparatively little power. As the material is comminuted and descends into the more restricted portion of the grinding-chamber this action is repeated, the edges of the teeth of the two rings cutting into the material by pressure exerted in a radial direction. The meal descends into the chamber below the grinding-head and is discharged thence through the spout 78.

It has been found in practice that the capacity of this mill relatively to the power required for its operation is greatly in excess of any of the standard mills now in use, and the explanation of its efficiency seems to be found in the fact that the reduction is accomplished almost wholly by a cutting or piercing action exerted in a radial direction.

When the mill is employed in grinding shelled corn, the feed-regulating and metal-extracting mechanism is placed within the hopper. The hood 69 is adjusted, so as to regulate the feed relatively as to the power at command. The shelled corn descends upon the diaphragm 60 and overflows the flange 63. The arms 68, rotating with the grinding-head, encountering any foreign substance of greater weight than the corn will throw it out by centrifugal action and prevent it from entering between or over the teeth 64, and any such foreign substances will accumulate upon the diaphragm.

The hinging of the shell 20 upon the grinding-shell 19 provides means for opening up the mill without disturbing the relation of the grinding-rings or rendering their adjustment dependent upon the proper fit of the hinge. The outer ring rests upon the grinding-shell 19, so that when the shell 20 is swung back on its hinge this ring may be lifted out.

It will be seen that all or the grinding is accomplished by the rings 35 and 36, the function of the toothed rings 49 and super shell 20 being the reduction of the material to a size suitable for grinding.

I claim as my invention—

1. In a feed-mill, in combination, a rotatable head having lance-pointed radial teeth, and a shell having instanding ribs the rearward faces of which are inclined in the direction of rotation of the head from the wall of the shell to the apex of the rib.

2. In a feed-mill, in combination, a rotatable head having radiating lance-pointed teeth, and a shell having instanding ribs transverse to the direction of rotation of the head.

3. In a feed-mill, in combination, a rotatable head, a plurality of rings seated upon the head and having lance-pointed teeth, and a shell having ribs with faces inclined in the direction of rotation of the head from the wall of the shell to the apex of the rib.

4. In a feed-mill, in combination, a rotatable tapering head having vertical grooves, a plurality of rings seated upon the head and having instanding lugs engaging the grooves, lance-pointed teeth radiating from the rings, and a shell having ribs with faces inclined in the direction of rotation of the head from the wall of the shell to the apex of the rib.

5. In a feed-mill, in combination, a rotatable head having vertical grooves and a circumferential cam-groove, a plurality of rings seated upon the head and having instanding lugs engaging the grooves, pointed teeth radiating from the rings, and a shell having ribs with faces inclined in the direction of rotation of the head.

6. In a feed-mill, in combination, a rotatable head having lance-pointed teeth, and a shell having instanding ribs inclined in the direction of rotation of the head.

7. In a feed-mill, in combination, a fixed casing having an annular seat; a rotatable grinding-ring within the casing and having its peripheral face toothed; a stationary grinding-ring concentric with the rotatable ring and having its inner face toothed, such last-named ring being seated within the fixed casing; and an upper grinding-casing hinged to the fixed casing and opening thereto.

8. In a feed-mill, in combination, a fixed casing having an annular seat; a rotatable shaft projecting upwardly through the casing; a grinding-head on the upper end of the shaft; a grinding-ring fixed to the shaft within the casing and having its periphery toothed; a stationary grinding-ring concentric with the rotatable ring and having its inner face toothed, such last-named ring being seated within the fixed casing; and an upper grinding-casing hinged to the fixed casing and opening thereto.

9. In a feed-mill, in combination, a shell, a rotatable head therein, a feed-hopper, a diaphragm crossing the hopper and having a central aperture and an upstanding flange

surrounding the aperture, and a hood adjustably carried above the aperture.

10. In a feed-mill, in combination, a shell, a rotatable head therein, a feed-hopper, a diaphragm crossing the hopper and having a central aperture and an upstanding flange surrounding the aperture, and a rotatable beater above the flange.

11. In a feed-mill, in combination, a shell, a rotatable head therein, a feed-hopper, a diaphragm crossing the hopper and having a central aperture and an upstanding flange surrounding the aperture, and a rotatable beater above the flange having its end turned down to overlap the same.

12. In a feed-mill, in combination, a pair of concentric grinding-rings having transverse teeth on their opposed faces, the inner ring being rotatable and extending above the outer ring, and having teeth of unequal height extending upwardly from the lower margin of its rim face, the backward inclination of such face being increased above the lower teeth.

13. In a feed-mill, in combination, a rotatable grinding-ring having its rim face increasingly inclined from the horizontal backwardly from its lower edge, and having teeth crossing the face of its rim, and intermediate teeth of less height extending upwardly from the lower margin thereof; and an outer grinding-ring, concentric with and of less height than the first-mentioned ring and having teeth transverse to the direction of rotation thereof.

14. In a feed-mill, in combination, an outer grinding-ring having backwardly-directed teeth, pointed at their upper ends, and an inner grinding-ring concentric with and extending above the outer ring and having forwardly-directed teeth, the floor of the interspaces between the teeth of the inner ring being increasingly inclined from the vertical from below upwardly.

15. In a feed-mill, in combination, a pair of concentric grinding-rings having opposed circumferential grinding-faces, the teeth of one of said rings having upstanding pointed ends, and the other ring having radial feed-channels in its upper face leading to such pointed teeth.

16. In a feed-mill, in combination, a pair of concentric grinding-rings having opposed circumferential faces; the outer ring being stationary and its teeth having upstanding pointed ends; the inner ring being rotatable and having teeth extending above the teeth of the outer ring, and having radial feed-channels in its upper face leading to the spaces between its teeth.

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