(No Model.) 3 Sheets—Sheet 1.

# J. N. EASTWOOD.

## FEED MILL.

No. 545,461. Patented Sept. 3, 1895.

Fig. 1.

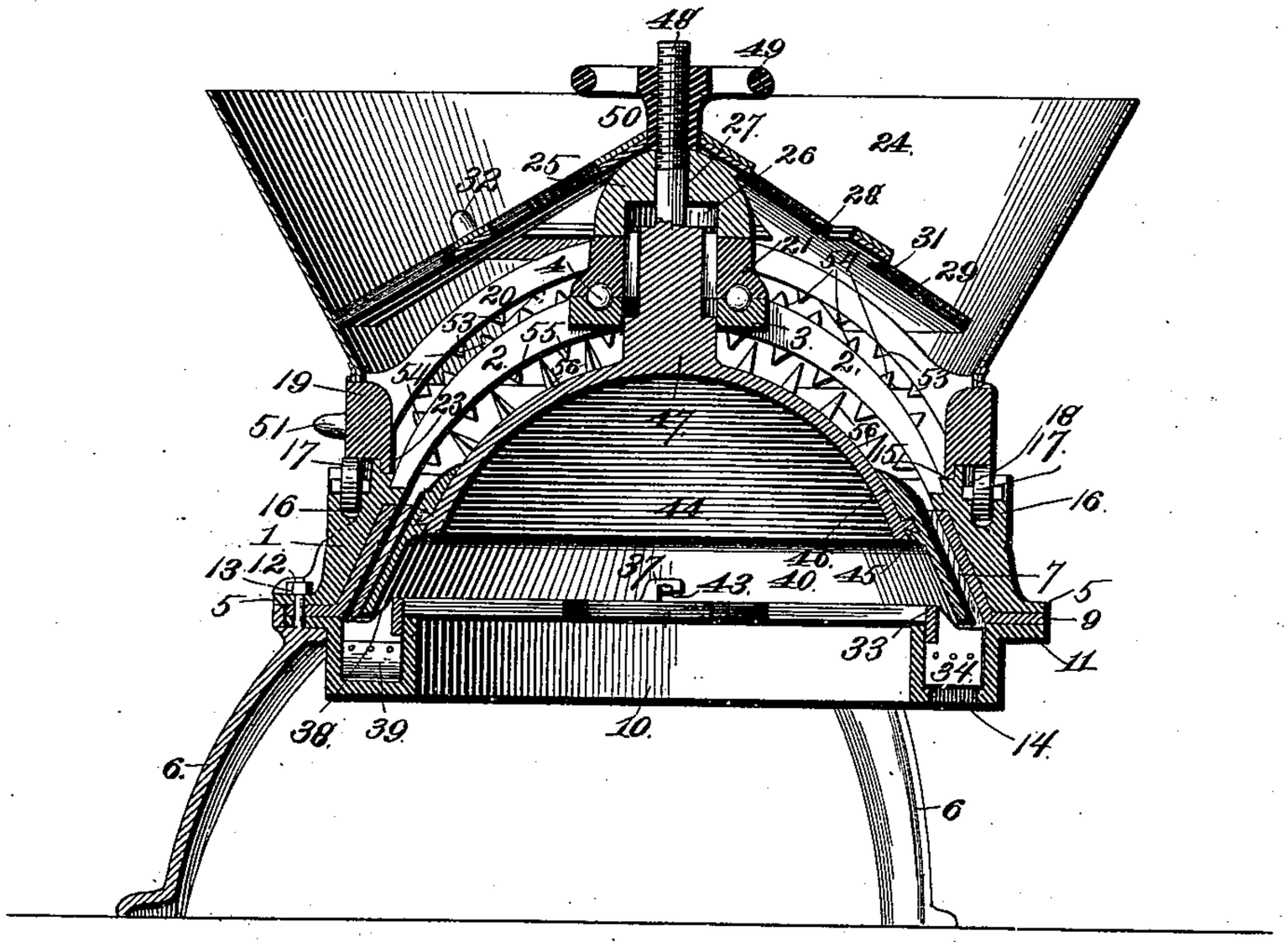
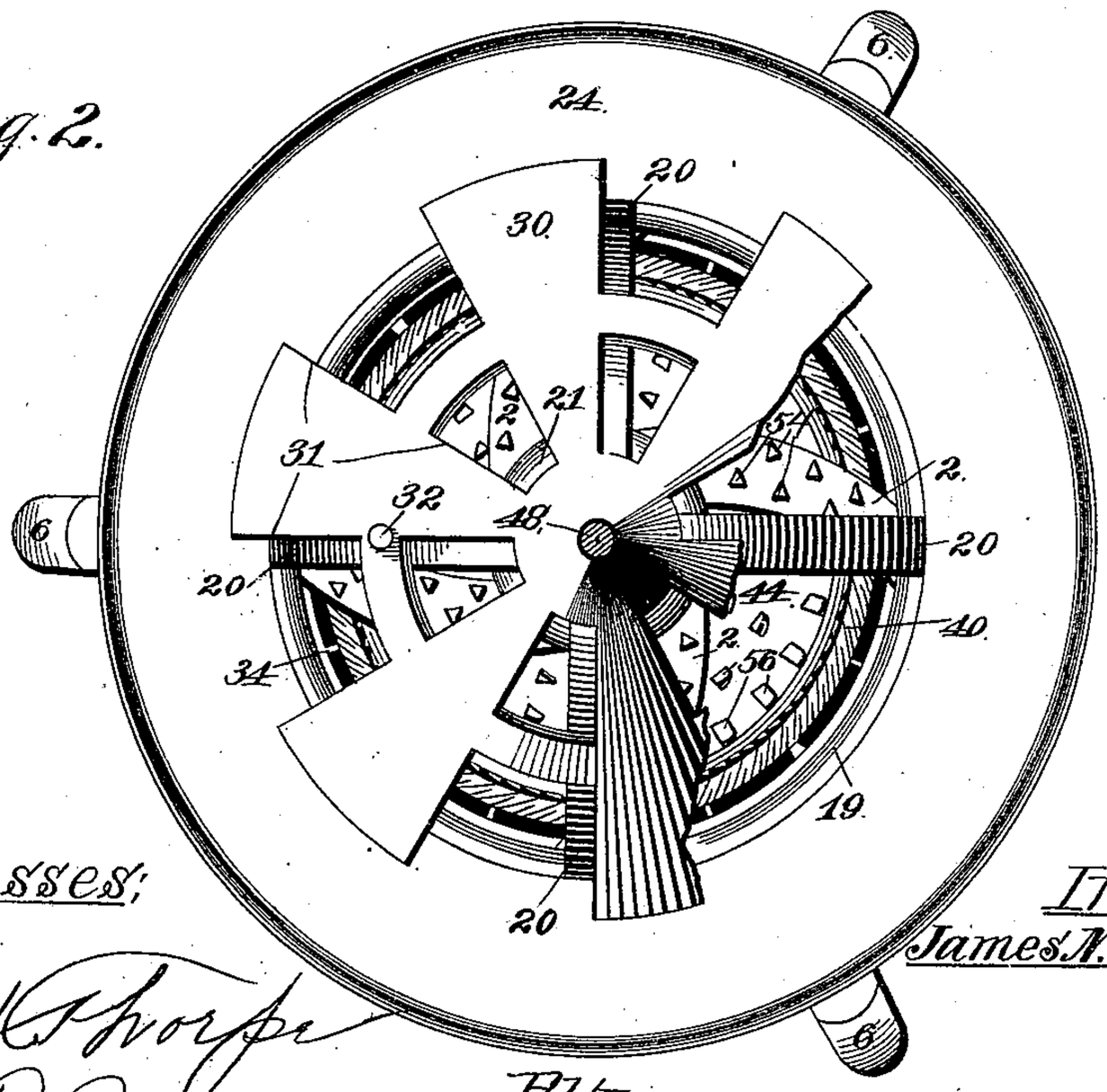



Fig. 2.




Witnesses;
C. H. P. Remley.

Inventor;
James N. Eastwood,
By Higdon & Higdon
Attys.

(No Model.) 3 Sheets—Sheet 2.

# J. N. EASTWOOD.

## FEED MILL.

No. 545,461. Patented Sept. 3, 1895.

Fig. 3.

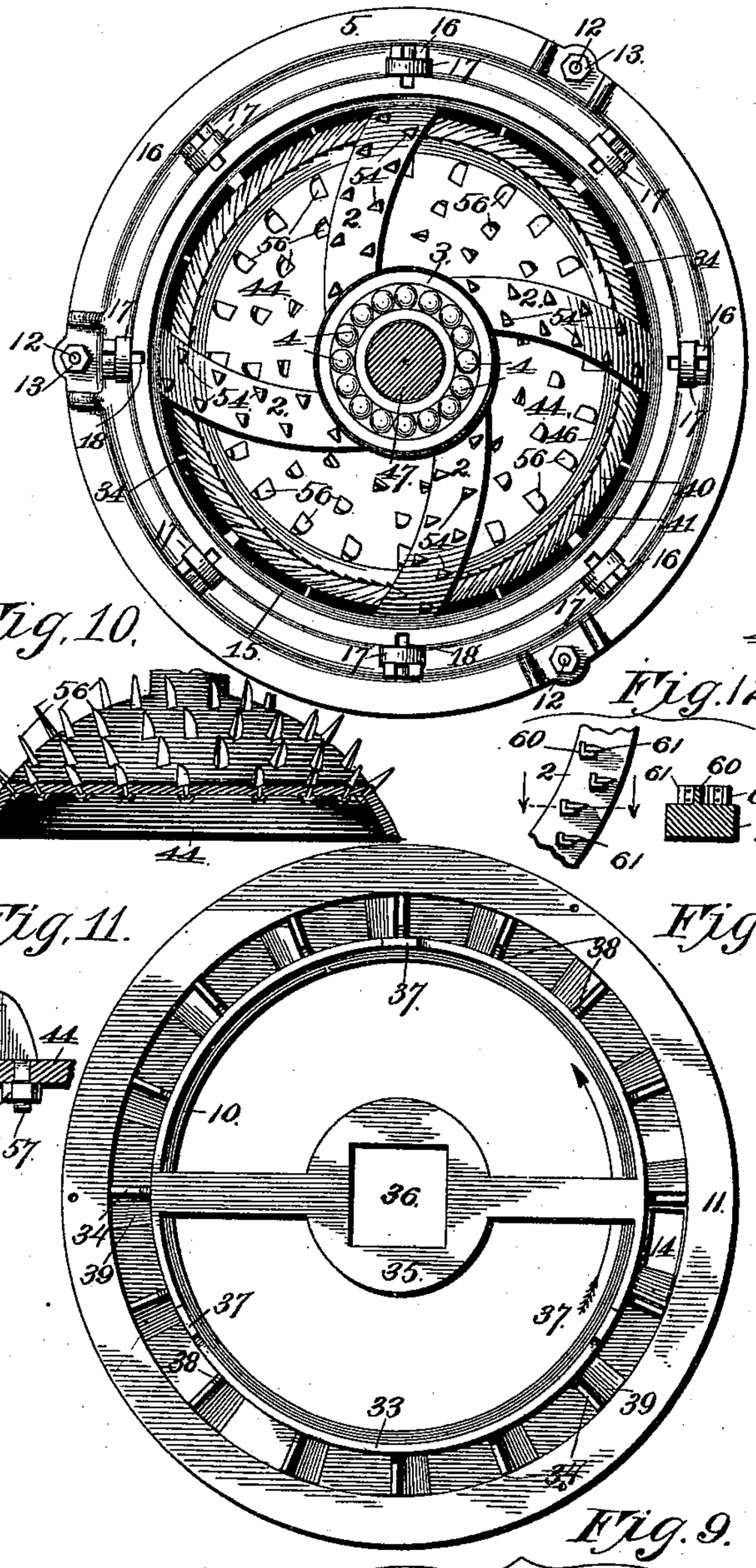



Fig. 10.




Fig. 11.







Fig. 9.

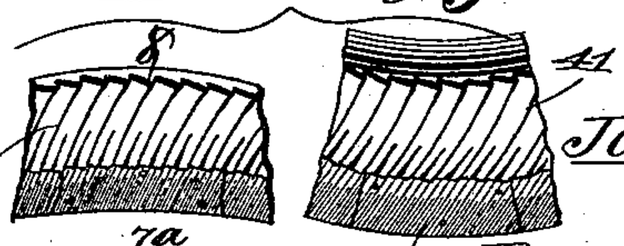



Fig. 5.

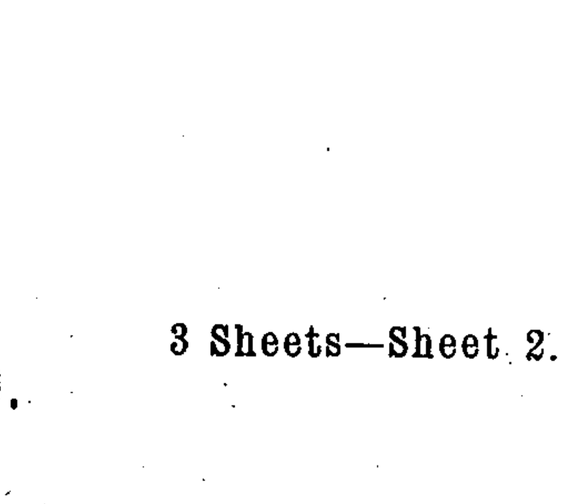



Fig. 6.

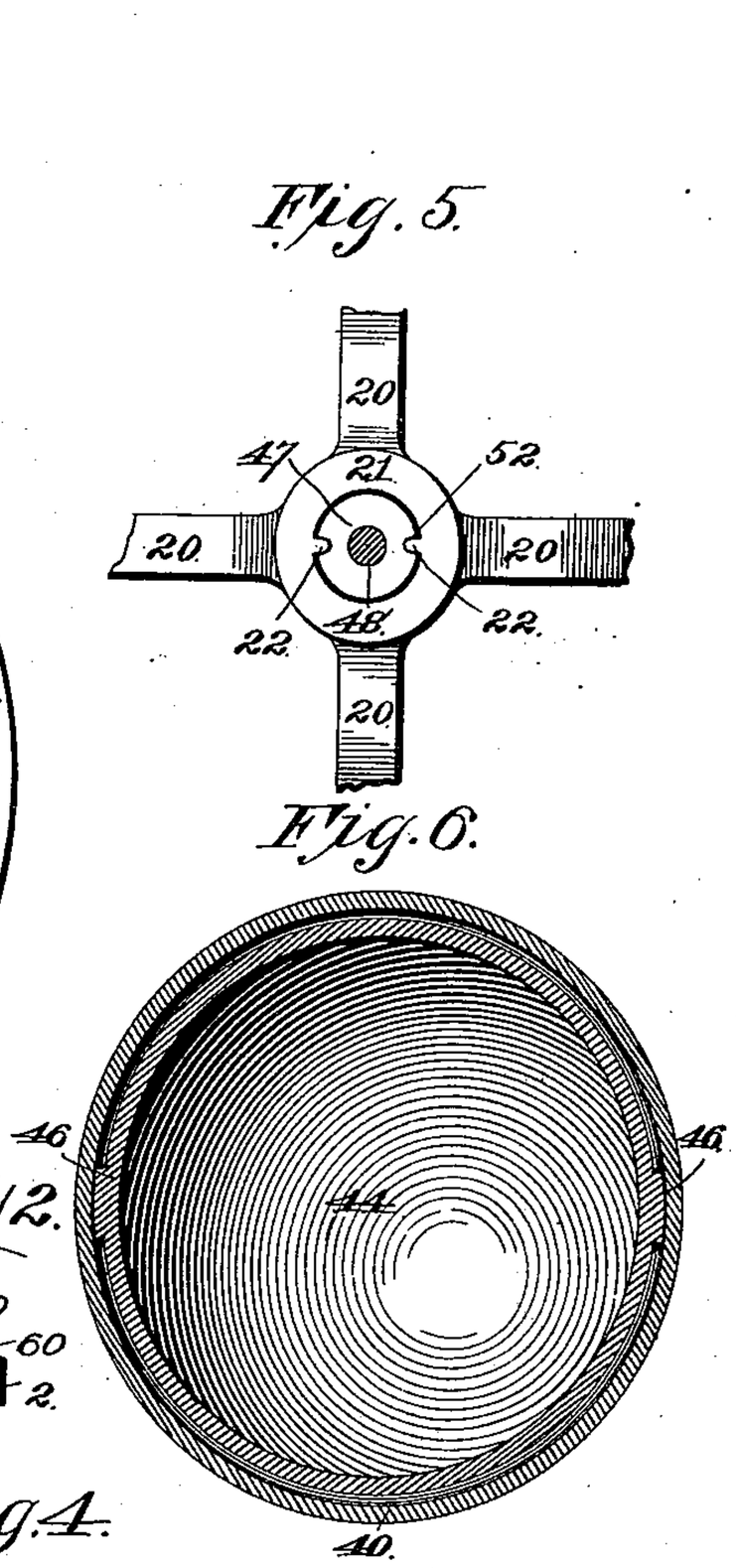



Fig. 12.




Fig. 4.

Fig. 7.

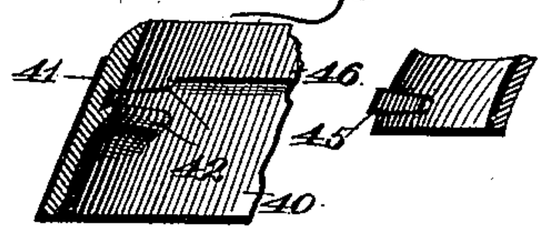
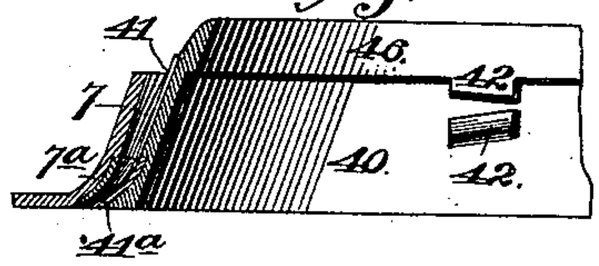



Fig. 8.




Witnesses:
G. H. Thorpe
W. R. Remley.

Inventor:
James N. Eastwood,
By Higdon & Higdon
Atty's.

(No Model.) 3 Sheets—Sheet 3.

# J. N. EASTWOOD.

## FEED MILL.

No. 545,461. Patented Sept. 3, 1895.

Fig. 13.

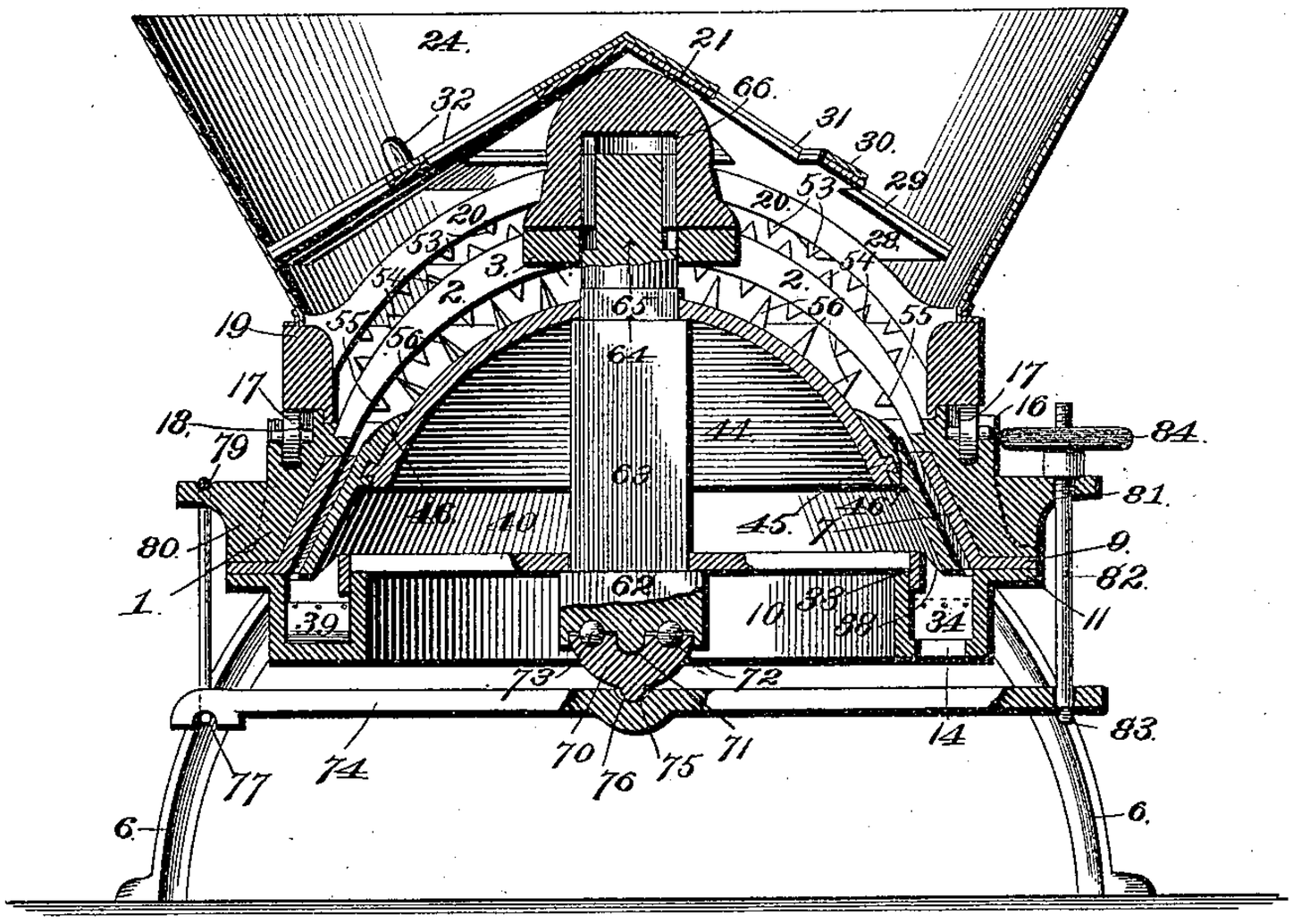
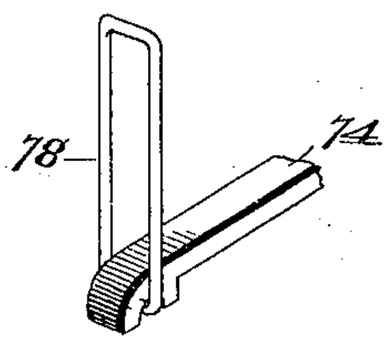



Fig. 14.

Fig. 15.



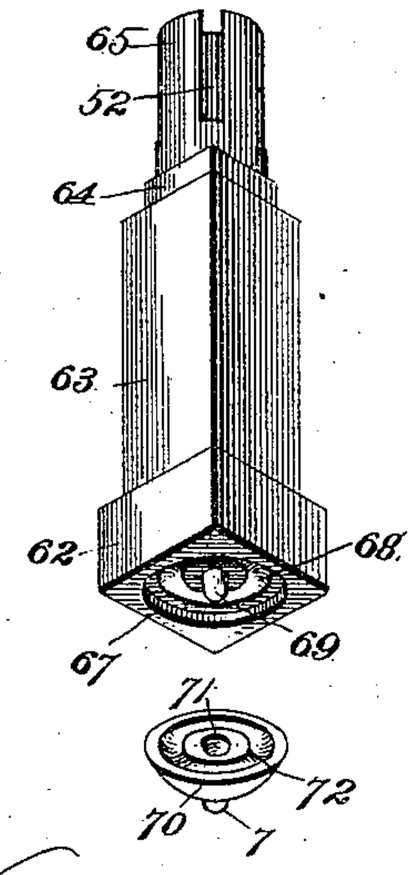
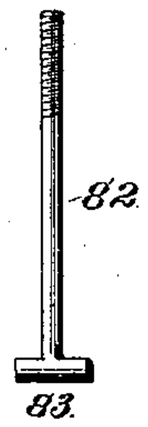




Fig. 16.




Witnesses;

C. F. Cooper

W. R. Remley.

Inventor;

James N. Eastwood,

By Hyde Lon & Hyde

attys.

# UNITED STATES PATENT OFFICE.

JAMES N. EASTWOOD, OF KANSAS CITY, MISSOURI.

## FEED-MILL.

SPECIFICATION forming part of Letters Patent No. 545,461, dated September 3, 1895.

Application filed November 5, 1894. Serial No. 527,927. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES N. EASTWOOD, of Kansas City, Jackson county, Missouri, have invented certain new and useful Improvements in Feed-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to feed-mills, and the primary objects of the same are to provide a feed-mill wherein friction is reduced to the minimum and wherein the operating parts may be adjusted easily and expeditiously, so that the feed may be ground as fine as required.

With these objects in view and others of secondary importance the invention consists in certain novel and peculiar features of construction and combinations of parts, as will be hereinafter described and claimed.

In order that the invention may be fully understood, I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 represents a vertical section of a feed-mill embodying my invention. Fig. 2 represents a top plan view of the same, partly broken away and with the threaded portion of the center post in section. Fig. 3 is a plan view of that portion of the mill below the rotating spider and shows the center post in section. Fig. 4 is plan view of the feed-pan and conveyer. Fig. 5 is a view showing a portion of the rotating spider and the center post. Fig. 6 is a sectional view of the cone and the inner burr carried thereby in inverted position. Fig. 7 is a detail sectional view of said cone and burr to show more clearly the wedge-joint by which they are secured together. Fig. 8 is a vertical section of a modified form of the inner burr and the outer burr or shell. Fig. 9 is a perspective view of a portion of the inner burr and a portion of the outer burr or shell. Fig. 10 is a view, partly in elevation and partly in section, of the cone to show more clearly the manner of securing the cutting-knives in position. Fig. 11 is a sectional view of a portion of the same enlarged. Fig. 12 is a plan and sectional view of a portion of the stationary spider to show a modified form of the cutting-knives. Fig. 13 is a vertical section of the feed-mill provided with a modified form of mechanism for adjusting the operating parts. Fig. 14 is a perspective view of the center post and ball-bearing mechanism. Fig. 15 is a perspective view showing a portion of the bridge or cross-bar and the swinging link which supports one end of the same. Fig. 16 is a view of the adjusting-bolt which supports the opposite end of the cross-bar.

In the said drawings, a stationary spider comprises the frustum-shaped body portion 1 and the arched arms 2, which are united at their upper ends to form the table 3, which is annularly grooved in its upper surface to receive the balls 4 and is provided with a central aperture concentric with said groove. The annular body portion 1 is provided with a horizontal base-flange 5 at its lower end, which is bolted as shown, or secured in any other suitable manner upon the supporting-legs 6, which in operative position are adapted to be bolted or otherwise secured upon a platform or base. This frustum-shaped portion 1 is provided with a lining in the form of a correspondingly-shaped shell 7, the inner surface of which is serrated or roughened, as shown at 8, to form a grinding surface or burr, and said shell is provided at its lower end with the outwardly-projecting base-flange 9, which fits against the under side of the base-flange 5. An annular pan 10 to receive the ground feed is arranged below the shell 7, and is supported in such position by the outwardly-projecting flange 11, which is interposed between the upper end of said supporting-legs 6 and the flange 9 of said shell.

To make the relation between the flanges 5, 9, and 11 permanent and rigid the legs are preferably formed with upwardly-projecting stems 12, which extend through registering apertures or holes in said flanges, and are engaged at their upper ends by clamping-nuts 13, or said flanges may be secured by ordinary bolts and nuts or in any other suitable manner. I prefer the manner shown, however. The feed-pan 10 is provided with a discharge-opening 14. The body portion or annulus 1 is provided at its upper and inner margin with the annular groove 15 and externally at suitable intervals with the upwardly-projecting arms 16. These arms are notched in their inner ends to receive one

end of the trunnions of the antifriction-rollers 17, the opposite end of said trunnions resting in grooves or notches in the body portion of the annulus, as shown at 18. The rollers 17 are of size to project slightly above the plane of the upper surface of said annulus. A second spider-frame consists of the annular rim 19, the arched arms 20, and the depending hub portion 21, which unites said arms at their upper ends. Said hub portion is provided in its lower surface with an annular groove to receive the balls 4, carried by the table 3, and is provided with a circular and centrally-disposed opening which registers with the opening of said table. One or more vertical ribs 22 project radially inward of said opening. The annular rim 19 rests rotatably upon the antifriction-rollers 17 and is provided at its inner margin with a depending annular flange 23, which engages snugly the groove 15 of the annulus 1 to prevent dust or particles of the feed being ground escaping between said stationary and rotating annuli. An upwardly-flaring and circular hopper 24 rests upon the rotatable annulus 19 and is secured thereto in any suitable or preferred manner, and resting upon the hub portion 21 is a cap 25, which is provided with a cylindrical socket or cavity 26 in its lower face, which registers and corresponds in size with the opening of said hub. Said cap is also provided with a central aperture 27. A stationary cone 28 is secured within the hopper in the position shown, in any suitable manner and is provided with a series of openings or apertures 29. A similar cone 30 fits snugly upon the cone 28 and is also provided with a series of apertures 31, corresponding in size and location with the apertures 29, and said cone is also provided with one or more apertures or handles 32, by which it may be grasped when it is necessary to cause the apertures 31 to register with the apertures 29, or when it is desired to close the apertures 29 and prevent foreign substances from accidentally entering the mill and injuring or breaking the same when in operation. These cones also have registering apertures vertically above the center of the cap 25. A conveyer consists of the circular rim 33 and the vertically-depending spades or shovels 34. This rim when in operative position depends within the feed-pan 10, fitting snugly against the inner wall thereof, and the spades or shovels 34 come into frictional contact with the bottom of said pan. A cross-bar 35 extends diametrically of the rim 33 and is enlarged at its center and provided with a squared aperture 36. The rim is also provided with a number of upwardly-projecting hooks 37. As the rim projects above the upper margin of the feed-pan, and therefore above the lower edge of the inner grinding shell or burr, (to be hereinafter described,) it is manifest that the upper edges of the spades or shovels must not come in contact with, but must conform to, the lower edge of said burr. Therefore they are beveled downwardly and outwardly, as shown at 38. As the conveyer will occupy varying positions relative to the bottom of the pan when grinding the feed more or less fine, it is necessary that the spades or shovels be made to extend or contract, and it is desirable that this extension or contraction of said spades takes place automatically. To accomplish this, I secure by rivets, as shown, or in any other suitable manner, the spring-plates 39 to the spades or shovels in such manner that they bear with a yielding pressure upon the bottom of the pan and extend at an angle to the vertical spades or shovels. By this construction it will be apparent that as the tendency of said spring-plates is to move downward at all times the elevation of the conveyer will simply bring the said spades to a position nearer the vertical, but will not raise their lower margins or ends from the bottom of the pan, and that the depression or lowering of the conveyer will only cause said plates to exert a greater pressure upon the bottom of the conveyer. An annular burr 40, (hereinafter termed the "inner burr,") is frustum-shaped in cross-section, and its outer serrated or roughened surface 41 is parallel, or approximately so, with the inner and serrated face of the shell or "outer burr" 7, as it will be hereinafter termed, and said burr 40 is provided at two or more points upon its inner side with the converging lugs 42, so as to form a wedge-shaped space therebetween. Projecting inwardly from said burr and in number and location corresponding to the hooks 37 of the conveyer are the pins 43, which, in conjunction with said hooks, form a bayonet-joint between said conveyer and said burr. A cone 44, in diameter at its lower margin approximately corresponding to the internal diameter of the burr 40, near its upper margin, is provided externally near its lower margin with the wedge-like projections 45. To place in operative position, this cone is inserted upwardly through the burr 40 until it comes in contact with the inner side of the flange 46 of said burr and can move no farther in that direction. It is then rotated in the proper direction until the wedge-like lugs 45 enter the wedge-shaped spaces formed by the lugs 42 of the burr, and thereby lock the same together.

Cast integral with or secured to the cone and projecting upwardly from the center of the same is the cylindrical center post 47, the body portion of which projects through the apertures of the table 3 and the hub portion 21, and into the socket or recess of the cap 25, and the threaded or bolt extension 48 of said center piece projects through the aperture 27 of the cap 25, and through the registering-apertures of the cones 28 and 30, and is engaged by a hand-wheel 49, which is provided with an extended hub 50, which projects through the said apertures of the said cones and bears upon the upper side of the cap 25 so

as to clamp the same firmly down upon the hub portion 21 of the rotatable spider-frame and thus support the center post and therefore the parts carried thereby—viz., the cone, the inner burr, and the conveyer—at any point in its adjustment. It will thus be seen that the whole weight of the rotating portions of the machine is supported upon the ball-bearing and upon the antifriction-rollers 17. In order that the said spider-frame may be rotated, it is provided with the outwardly-projecting lugs 51, to which the sweep (not shown) of ordinary construction is attached, and in order that the center post may be rotated also the body portion is provided with the vertical grooves 52, which are engaged by the ribs 22, projecting inwardly from said hub portion 21.

From the above construction it will be apparent that the rotation of the upper spider-frame causes the center post, the cone carried thereby or forming a part thereof, the inner burr carried by the cone, and the conveyer carried by the inner burr to rotate in the same direction and at a corresponding speed. In order that the feed of whatever description may be thoroughly ground, the arms 20 of the spider-frame are provided with the depending projections or teeth 53, and the arms 2 of the stationary spider-frame are provided with the upwardly-projecting and opposing teeth 54. These teeth perform the preliminary operation of breaking or crushing into smaller particles the feed placed within the mill, which is inserted through the registering-apertures 29 and 31 of the cones 28 and 30, respectively. To further crush and cut the feed before the final grinding, which takes place between the inner and outer burrs hereinbefore described, I provide the arms 2 with the depending teeth or projections 55 and the cone with the external and opposing teeth or projections 56. All of the teeth or projections are preferably triangular in cross-section, as shown more clearly in Figs. 2 and 3, so as to present a sharpened edge toward the feed being operated upon. The teeth or projections 56 of the cone may be cast integral therewith, but preferably are secured detachably thereto, so that an entire set of teeth may be replaced by a new set, if found necessary, without requiring an entire new cone, as would be the case if a set of teeth cast with the cone were injured to any great extent. The teeth 56 are provided near their front ends with the threaded stems 57, which project through apertures in said cone and are engaged at their projecting ends by the nuts 58, which clamp the teeth firmly upon the cone. These stems depend from said teeth near their front margins, so as to form or provide a horizontal shoulder 59 in rear thereof, which by the action of the nuts are clamped firmly down upon the cone and thereby, when advancing in the direction indicated by the arrow, Fig. 11, relieve the stems 57 of a part of the strain incident to the crushing operation of the feed. It may be found more desirable, because cheaper, to provide or form the spider-arms with integral lugs 60 and to secure to said lugs detachably the plates or teeth 61, as shown in the modified form, Fig. 12.

In the construction shown in all of the figures except Fig. 8 it will be apparent that considerable vertical adjustment must take place before the feed can be ground very fine—that is, to meal. To obviate this extended adjustment I preferably flare externally the inner burr at its lower end and flare outwardly the lower and opposing surface of the outer burr 7, as shown in Fig. 8. These flared surfaces will be upon curved and downwardly-converging lines, so that they will be nearly in contact, in a full-sized machine, for a distance of about half an inch. In this connection I will preferably cast the lower or flared portions of said burrs in sections $7^a$ and $41^a$, and secure them to the outer and inner burrs, respectively, by rivets or by other suitable means.

In all mills, particularly those grinding small grain or grinding grain to meal, the greatest wear comes upon the burrs near their lower or discharge end, and in a comparatively short space of time they are worn smooth at this point and it is necessary to replace the burr with a new one. It is therefore much cheaper to cast the grinding-surfaces or those which must do most of the work in sections, besides making it possible to more thoroughly grind the feed, as these detachable grinding-surfaces of the burr may be replaced cheaply when worn sufficiently to affect a thorough grinding of the feed, while with the burr cast in one continuous piece the owner would not be apt to buy an entire new burr as soon as the one in use became slightly worn.

Referring now to Sheet 3 of the drawings, it will be apparent that I dispense with the threaded or bolt extension of the center post, and the hand-wheel for adjusting said post and the parts carried thereby. In lieu of this construction I employ a center post comprising the rectangular portions 62, 63, and 64 of successively diminishing size, and a cylindrical portion 65 corresponding to the cylindrical portion 47 illustrated in the figures upon Sheets 1 and 2. The portion 65 is also provided with the vertical grooves 52. When in operative position the rectangular portion 64 of this post projects through the correspondingly-shaped opening in the cone 44, and the rectangular portion 63 projects through the rectangular opening 36 of the cross-bar 35 of the conveyer. The upper end of the section 63 bears against the under side of the cone so as to elevate the same when the post is elevated, and the portion 62, which may be rectangular, as shown, or cylindrical, bears against the under side of the cross-bar 35 so as to elevate the conveyer also when the post is raised, while the cylindrical portion 47 projects up

into the cavity 66 of the hub of the rotatable spider-section. In this case the cap 25 is dispensed with and the upper end of said hub closed so as to prevent grain or any substance entering between said hub and the center post, as will be understood. The lower end of the post is provided with a circular recess so as to form the depending flange 67, the annular groove 68 axially of said post, and the depending and centrally-disposed tongue or projection 69. A cup-shaped casting 70, fitting snugly at its upper margin within the depending flange 67, is provided with a central cavity 71, engaged by the depending tongue or projection 69, and is also provided with the annular groove 72 opposite the groove 68 of the post and interposed between said post and cup, and occupying said registering or opposing grooves are the balls 73. Extending diametrically of the mill and below the feed-pan is a bridge or cross-bar 74, which is provided with a segmental cavity 75 in its upper side, in which is centered the rounded projection 76 depending centrally from the cup 70. Said bridge at one end is formed with a cavity 77 in its under side which is engaged by the lower end of a swinging link 78. The upper end of said link engages the cavity 79 in an arm or projection 80 of the annulus 1. A similar arm or projection 81 at the opposite side of the annulus is provided with an aperture, through which extends the bolt 82. The lower end of said bolt extends through an aperture in the corresponding end of the bridge 74 and is provided with a head 83 at its lower end, upon which said bridge rests, and is engaged at its upper end with the hand-wheel 84.

When it is desired to elevate or raise the center post and thereby cause the inner burr to approach nearer the outer burr, the hand-wheel 84 is turned in the proper direction to elevate the bolt 82 and the corresponding end of the bridge 74, said bridge pivotally operating upon the link 78. By thus raising the bridge it will be apparent, as the post is raised, that the rounded projection 76, engaging the concave or segmental recess, adjusts itself therein so as to permit the post and the cup 70 to maintain the same relation to each other at all times. If a construction to permit said cup to adjust itself in the cross-bar were not provided, it would be apparent that as the bridge was elevated or lowered beyond a horizontal plane the cup would be thrown at a slight angle to the post, so that the same would rest or bear more heavily upon the balls occupying the higher horizontal plane, as will be understood, and therefore make the machine practically inoperative. The depending flange 67 of the post embracing externally the cup assists the lug or tongue 69, engaging the cavity 71, to maintain its proper relation to the cup, and also prevents the access of dust and foreign particles to the ball-bearing, making it practically dust-proof. In this construction the whole weight and pressure of the operating mechanism is sustained by the cross-bar, which in turn is supported from the stationary portion of the machine. It will be apparent in the construction illustrated in Fig. 1 that when the post is lowered, so as to increase the distance between the burrs the feed may be more coarsely ground, the inclined or beveled edges 38 of the spades assist in maintaining the post in its vertical position, because, should the bearing between the post and the table 3 and hub 21 become slightly loose by wear and consequently permit a slight swinging motion of the post, thereby causing the inner burr in its descent to come in contact with the said beveled edges, it would be deflected outwardly, so as to properly center the said post and the parts carried thereby. In the construction shown in Fig. 13, the rim 33 embracing the inner wall of the pan will prevent any swinging motion of the post, so that the same is properly centered at all times.

In the operation of the machine the feed is ground, as hereinbefore explained, and drops into the pan 10, and is scooped or carried by the spades or their spring-plate attachments around until the discharge-opening 14 is reached and the feed drops therethrough into a suitable receptacle placed below for the purpose of receiving the feed.

From the above description it will be apparent that I have produced a feed-mill wherein friction is reduced to the minimum, thereby diminishing the draft and increasing the capacity, wherein the operative parts may be adjusted relative to each other, so as to vary the fineness of the product easily and expeditiously, wherein the conveyer at all points in its adjustment is in a proper position to gather the feed deposited in the pan, and wherein the feed-supply openings may be exposed or covered at will.

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

1. In a feed-mill, the combination with a stationary spider frame provided with a lining in the shape of an annular burr or friction-surface, of a center-post extending rotatably through said spider-frame and supported upon a ball-bearing, a burr supported from said center-post so as to be elevated when the post is raised and to descend when the post is lowered, and operating in conjunction with the first-mentioned burr, a rotatable spider-frame above the stationary spider-frame and slidingly and rigidly, (with reference to rotary motion) mounted upon the said center-post, and a hopper carried by said rotatable spider-frame, substantially as set forth.

2. In a feed-mill, the combination with a stationary spider-frame, comprising the annular portion, the table having a central opening and the arms connecting said annular portion and the table and provided with upwardly projecting and depending teeth, and having a lining in the shape of a burr,

which is rigidly secured to said annular portion, of a center-post mounted upon a ball-bearing and extending rotatably through the opening of said table, a cone provided with external teeth carried by said center-post, and a burr carried by said cone and adapted to operate in connection with the first-mentioned burr, a rotatable spider-frame, comprising an annular portion, a hub portion, which is mounted slidingly and rigidly, (with reference to rotary motion) upon the center-post, and the arms connecting the annular and hub-portions and provided with depending teeth, and a hopper carried by said rotatable spider-frame, substantially as set forth.

3. In a feed-mill, the combination with a stationary spider-frame, comprising the annular body-portion, the table having a central opening, and the arms connecting said annular portion and table, and provided with upwardly projecting and with depending teeth, and provided also with a lining in the shape of a burr, and an annular stationary feed-pan supported below said burr and provided with a discharge opening, of a center-post extending rotatably through the opening of said table and mounted upon a ball-bearing, a cone carried by said post and provided with external teeth adapted to act in conjunction with the depending teeth of said spider-frame, a burr carried by said cone and adapted to act in conjunction with the first-mentioned burr, a conveyer operatively connected to rotate with the center-post, having a circular rim or body-portion, and spades which depend within the feed-pan, a rotatable spider-frame, comprising an annular portion, a hub-portion mounted slidingly and rigidly, (with reference to rotary motion) upon the center-post, and the arms connecting said annular and hub-portions and provided with depending teeth adapted to act in conjunction with the upwardly projecting teeth of the first-mentioned or stationary spider-frame, a hopper carried by said rotatable spider-frame, and means to vertically adjust the center-post and the parts carried thereby, substantially as set forth.

5. In a feed-mill, the combination with a stationary spider-frame, comprising the annular body-portion, the table having a central opening, and the arms connecting said annular portion and table, and provided with upwardly projecting and depending teeth, and provided also with a lining in the shape of a burr, and an annular stationary feed-pan supported below said burr and provided with a discharge opening, of a center-post extending rotatably through the opening of said table and mounted upon a ball-bearing, a cone carried by said post and provided with external teeth adapted to act in conjunction with the depending teeth of the said spider-frame, a burr carried by said cone and adapted to act in conjunction with the first-mentioned burr, a conveyer operatively connected to rotate with the center-post, having a circular rim or body-portion, and spades which depend within the feed-pan, spring-plates secured to said spades and bearing with a yielding pressure upon the bottom of the pan, a rotatable spider-frame, comprising an annular portion, a hub-portion mounted slidingly and rigidly, (with reference to rotary motion) upon the center-post, and the arms connecting said annular and hub portions and provided with depending teeth adapted to act in conjunction with the upwardly projecting teeth of the first-mentioned or stationary spider-frame, a hopper carried by said rotatable spider-frame, means to vertically adjust the center-post and the parts carried thereby, an apertured cone secured rigidly within the hopper, and a similar apertured cone mounted rotatably upon the first-mentioned cone, substantially as set forth.

6. In a feed-mill, the combination with a stationary spider-frame, provided with a grooved table carrying balls, and with teeth projecting upwardly from the arms of said spider-frame, of a rotatable spider-frame provided with a grooved hub-portion also mounted upon said balls, so as to constitute a ball-bearing connection between said spider-frames, and a hopper carried by said rotatable spider-frame, substantially as set forth.

7. In a feed-mill, the combination with a stationary spider-frame, provided with a grooved table carrying balls, and provided also with teeth projecting upwardly from the arms of said spider-frame, and antifriction-

rollers rotatably journaled in and supported by the annular portion of the said spider-frame and projecting slightly above the upper surface thereof, of a rotatable spider-frame comprising an annular portion resting upon said antifriction-rollers, a hub-portion grooved in its under side and resting upon the said balls, and arms connecting said annular and hub-portions and provided with depending teeth, and a hopper carried by said rotatable frame, substantially as set forth.

8. In a feed-mill, the combination with a stationary spider-frame, comprising the annular portion provided with an annular groove in its upper inner margin and with a lining in the form of a burr, a table provided centrally with a cylindrical aperture and grooved in its upper side concentric to said aperture and carrying balls in said groove, and the arms connecting the annular portion and the table and provided with upwardly projecting and with depending teeth, antifriction-rollers journaled rotatably in said annular portion of the spider-frame and projecting slightly above the upper surface thereof, an annular stationary feed-pan carried below said burr and provided with a discharge opening, and legs supporting said spider-frame, of a second spider-frame, comprising the annular portion resting rotatably upon said antifriction-rollers and having a depending flange engaging the groove of the first-mentioned spider-frame, the hub-portion provided with an annular groove in its under side, engaged by said balls, and with a central opening, and vertical ribs projecting inwardly thereof, and the arms connecting said annular and hub portions and provided with depending teeth, a hopper carried by said rotatable spider-frame, a cap resting upon the hub-portion of the rotatable spider-frame and provided with a cylindrical recess or cavity registering with the opening of said hub, a center-post mounted rotatably within said table and provided with vertical grooves engaged by the ribs of said hub-portion, and with the threaded or bolt extension which extends through and above the cap, a cone carried by said post; provided externally with teeth, a burr carried by said cone, a conveyer consisting of a rim detachably connected to the burr, and spades depending vertically within the annular feed-pan and provided with spring-plate extensions, and a hand-wheel threaded internally and engaging the threaded or bolt extension of the post and bearing upon the upper side of the said cap, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

JAMES N. EASTWOOD.

Witnesses:
G. Y. THORPE,
M. R. REMLEY.