(No Model.) 3 Sheets—Sheet 1.

# G. & A. RAYMOND.

## GRINDING MILL.

No. 295,049. Patented Mar. 11, 1884.

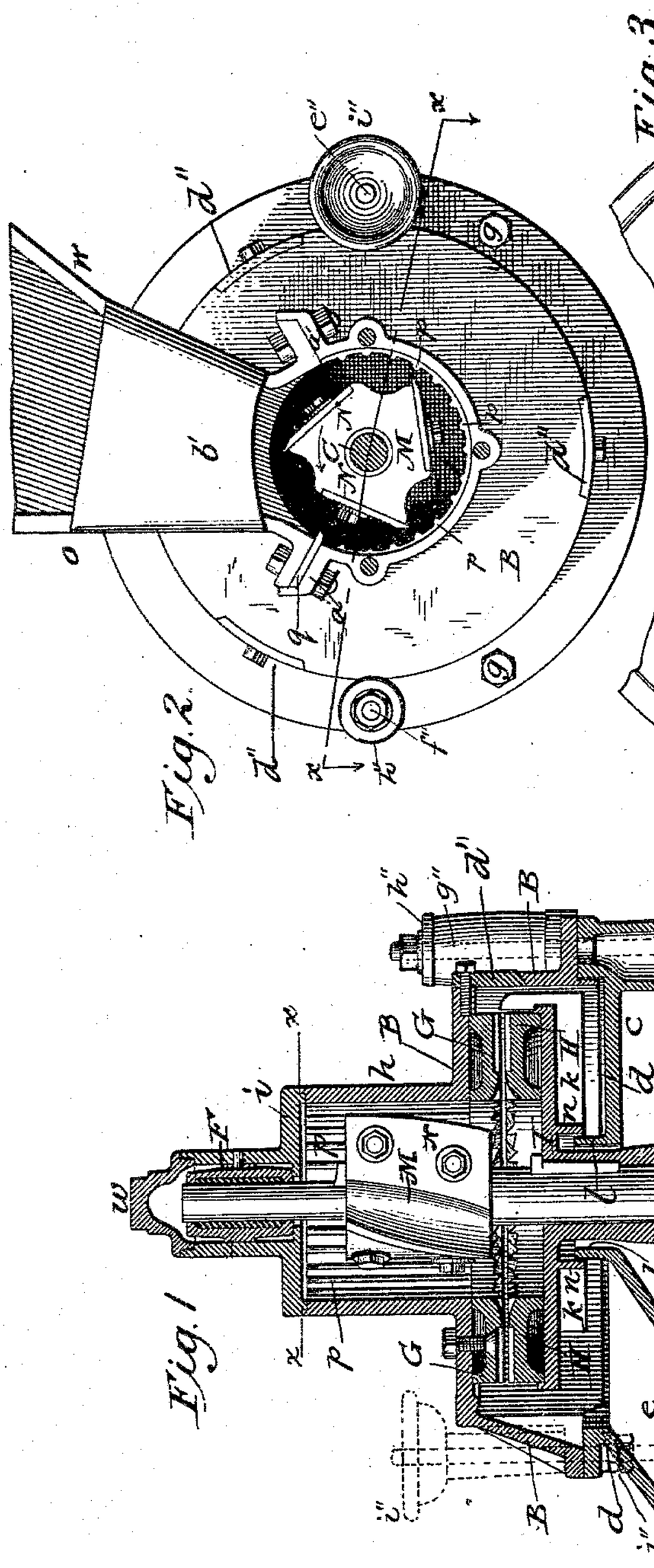

Fig. 2.

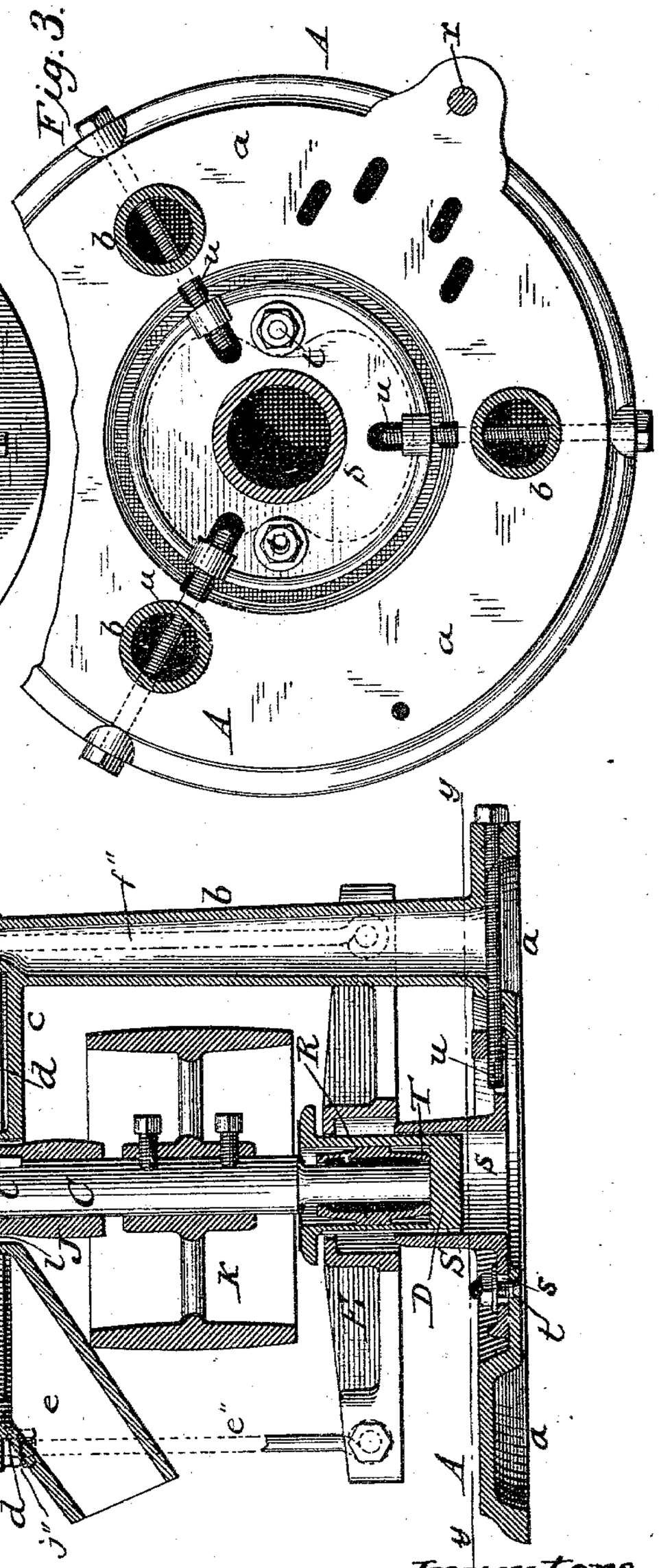

Fig. 3.



Fig. 1

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Fig. 7.

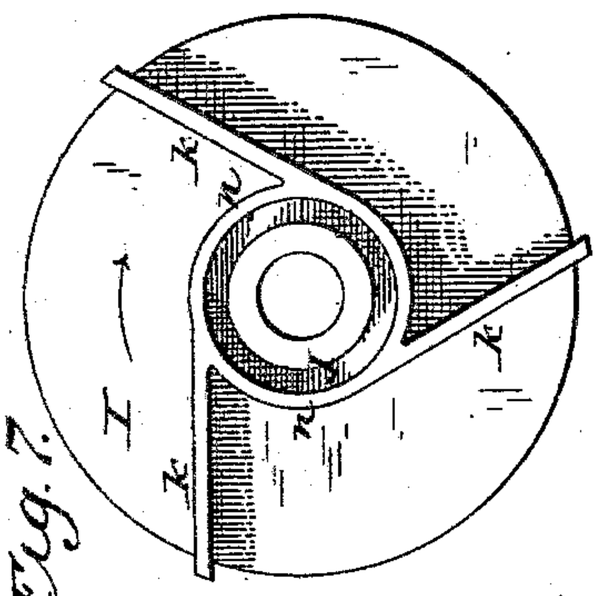


Fig. 4.




Fig. 9.




Fig. 8.




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## GRINDING MILL.

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*Fig. 5.*

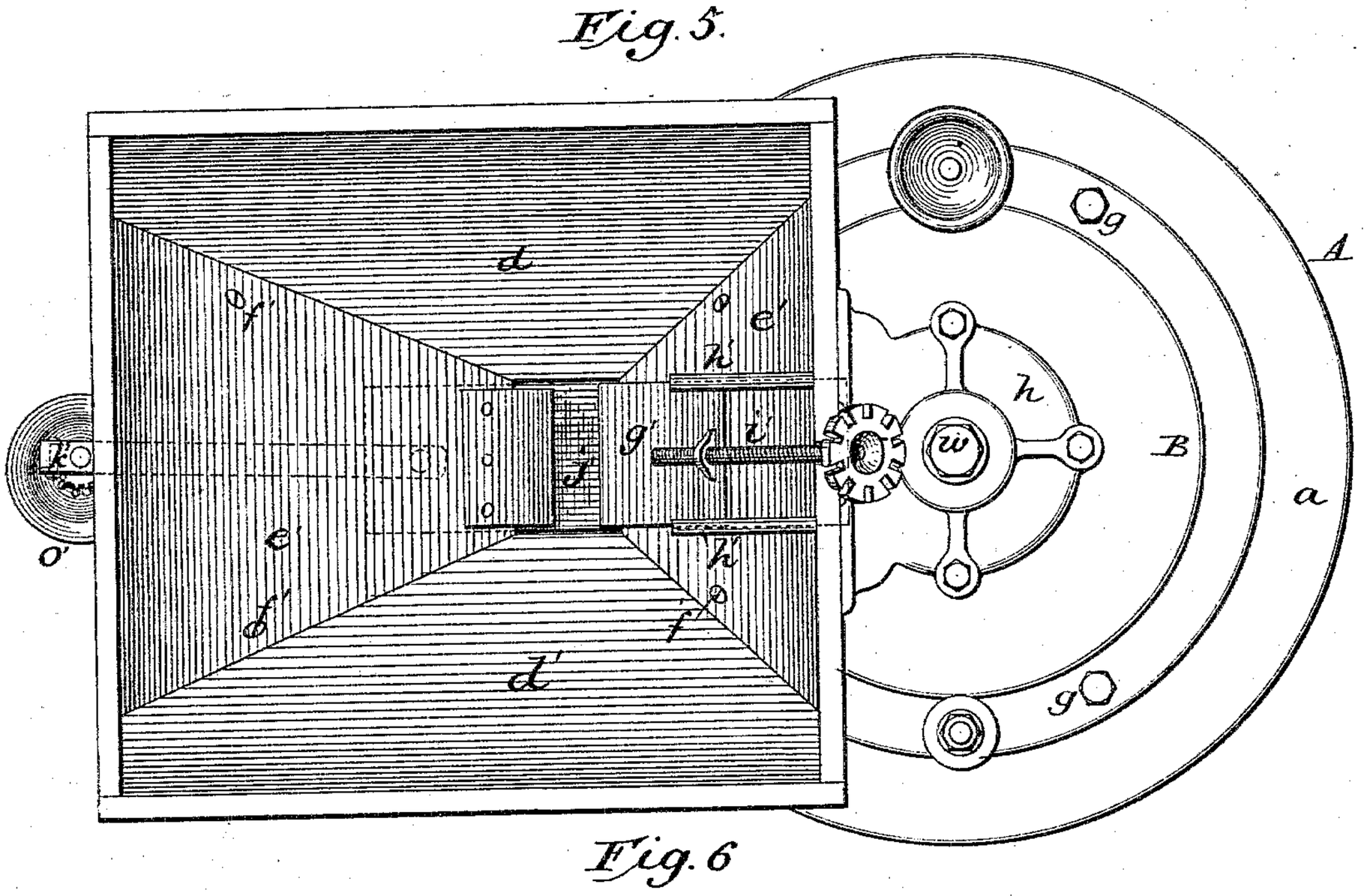
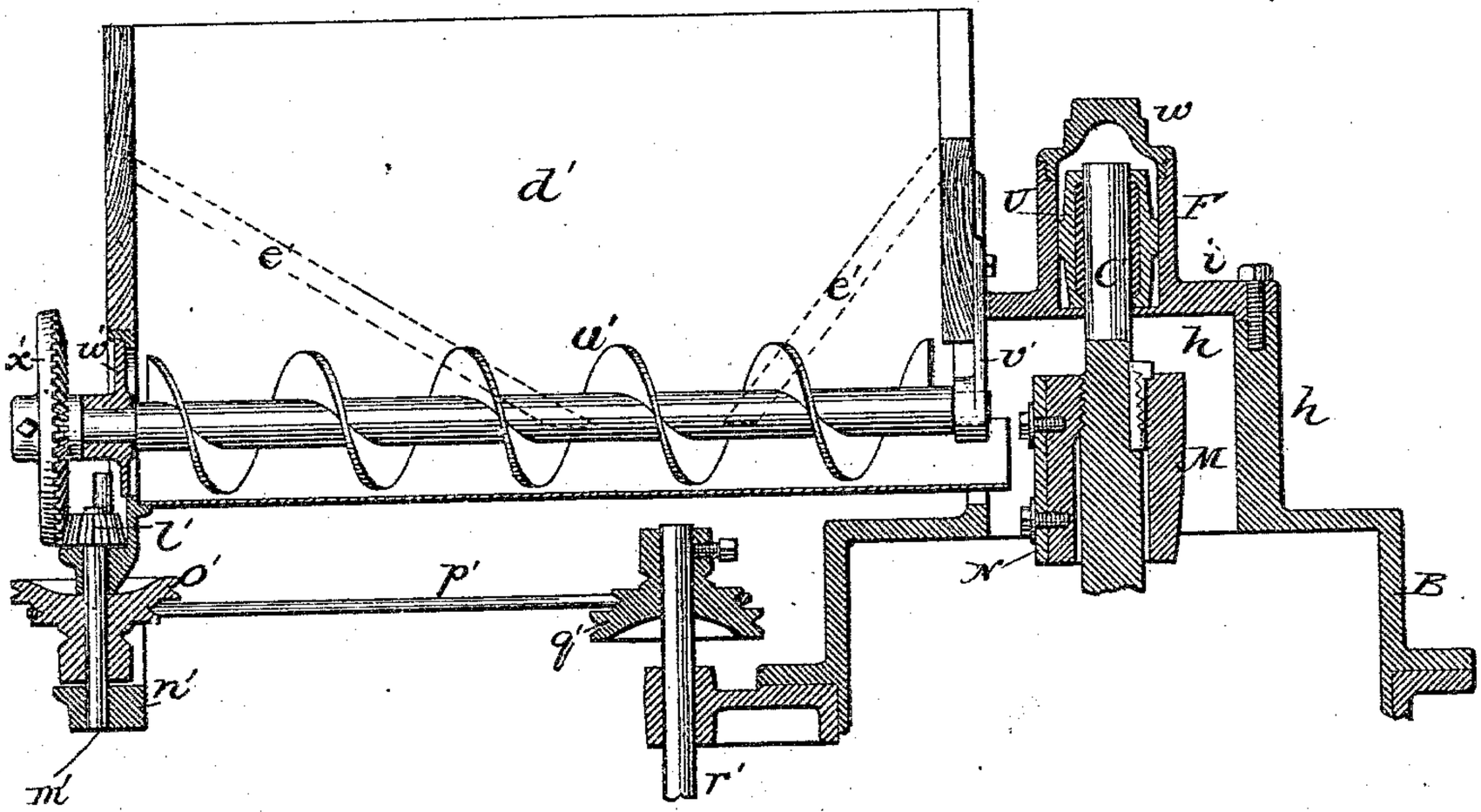



*Fig. 6*

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# UNITED STATES PATENT OFFICE.

GEORGE RAYMOND AND ALBERT RAYMOND, OF CHICAGO, ILL., ASSIGNORS OF ONE-HALF TO ORVILLE H. TOBEY, OF SAME PLACE.

## GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 295,049, dated March 11, 1884.

Application filed January 17, 1883. (No model.)

*To all whom it may concern:*

Be it known that we, GEORGE RAYMOND and ALBERT RAYMOND, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a specification.

The object of the invention is to produce a simple and cheaply-constructed mill adapted for the reduction of grain, oats, and other granular substances, and which may also be adapted at will for dividing cornstalks, cane, or similar material into short lengths, and subsequently reducing the same by grinding.

To this end the invention relates to an improved construction of the grinding apparatus, as hereinafter explained in detail, and to the combination therewith of a mechanism of a peculiar construction to effect the division or partial reduction of the stalks and similar material previous to their entering the grinding mechanism proper; also, to the peculiar construction and arrangement of interchangeable feed mechanism for use in operating upon different materials.

Referring to the accompanying drawings, Figure 1 represents a vertical central section through our improved mill on the line *x x* of Fig. 2. Fig. 2 is a top plan view of the mill with the upper shaft-bearing and the covering of the cutter-head removed to expose the cutter-head and co-operating parts to view. Fig. 3 is a horizontal section on the line *y y* of Fig. 1. Fig. 4 is a side elevation of the mill, one of the standards of the main frame being broken away to expose the pulleys for driving the feed mechanism. Fig. 5 is a top plan view of the mill and the hopper with the reciprocating feed devices therein. Fig. 6 is a vertical section of the same with the reciprocating feed devices replaced by a feed-screw or worm. Fig. 7 is a bottom plan view of the plate by which the lower grinding-disk is carried. Fig. 8 is an end view of the devices employed upon the hopper to sustain the feed screw, crank-shaft, and driving-pulleys. Fig. 9 is a perspective view of one of the duplicate boxes or bearings in which the main shaft or spindle is sustained.

A represents the main frame, preferably cast complete in one piece, consisting of a flat base-plate, *a*, three tubular standards, *b*, thereon, and a horizontal top plate, *c*, sustained by the standards. This top plate, *c*, is constructed with a central opening to permit the passage of the driving-shaft, and with an annular recess or depression, *d*, in its upper side to form a meal-chamber, the meal being delivered from this chamber through a delivery-spout, *e*, extending downward from the under side, as plainly represented in Fig. 1.

Upon the top plate, *c*, of the main frame we mount a hollow curb or casing, B, designed to cover and inclose the grinding-disks, this casing consisting of a circular top plate having at its periphery a depending rim, the lower flanged edge of which is seated upon and bolted to the top plate, as shown. The curb B has formed upon its center a hollow upright head or turret, *h*, designed to receive a cutter-head, hereinafter described, this turret being covered by a cap-plate, *i*, bolted firmly thereon, as shown, and being provided in one side with a mouth or inlet-opening, through which the materials are introduced into the mill.

C represents the main shaft or spindle of the mill, located centrally and vertically in the main frame, with its lower end seated in a step or bearing, D, supported by a bridge-tree, E, the details of which will be hereinafter described. At its upper end the shaft is sustained in a box or bearing, F, supported in a central hub or enlargement on the cap-plate, as clearly shown in Fig. 1. It will be observed that the main shaft is thus sustained at its two extremities, whereby it is given a better support and greater rigidity when in action than those shafts which have the grinding-disk attached to the end overhanging the bearing. The boxes or bearings of the shaft are constructed, as shown in Fig. 9, of a spheroidal form on the exterior, and are seated loosely in cylindrical recesses, this construction permitting the boxes to adjust themselves in exact alignment with the shaft.

G and H represent the two horizontal grinding-disks, constructed in an annular form, and in ordinary cases duplicates of each other, with grinding-teeth of any approved form upon their opposing faces. The upper disk, G, is bolted firmly to the under side of the curb or casing D, as shown in Fig. 1, and remains rigidly in position therein. The lower

disk, H, on the contrary, is bolted to a horizontal plate, I, clearly represented in Figs. 1 and 7, which is keyed or otherwise secured firmly to the main shaft within the curb or casing immediately above the top plate, *c*, of the main frame, so that the rotation of the main shaft imparts a corresponding motion through the plate I to the grinding disk or ring H. The parts are so proportioned relatively to one another that the meal flowing from the margin of the lower grinding-disk may pass freely into the meal space or chamber *d* beneath the plate I, and thence through the delivery-spout.

To facilitate and insure the delivery of the meal, the disk I has depending arms or blades *k* formed on its under side, as shown in Figs. 1 and 7, the outer ends of these blades being extended upward past the outer edge of the lower grinding-disk.

For the purpose of preventing the escape of the meal around the central shaft or its contact therewith, the top plate, *c*, of the frame is provided with an upturned flange, *l*, encircling the shaft and extending upward within a corresponding annular flange, *n*, formed on the under side of the plate I.

As a means of imparting motion to the spindle or shaft, we secure thereon a driving-pulley, J, which is preferably cast in one piece with the disk I, as shown in Fig. 1, this construction causing the power to be applied directly to the disk, and also giving to the disk increased stability and stiffness.

The parts above described constitute a complete disk-action grinding-mill. Material introduced into the shaft of this mill through the turret will pass centrally downward through the upper grinding-disk G, and thence outward between the surfaces of the two disks, being delivered to the spout, as before explained.

In order to adapt the mill for reducing corn-stalks, sugar-cane, corn upon the ear, and similar materials which cannot be reduced by the action of grinding-disks alone to the form of flour or meal, we provide an auxiliary cutting mechanism to act upon the materials previous to their entrance between the disks. This cutting mechanism consists, essentially, of a spiral fluted head, M, secured upon the upper portion of the main shaft C within the head or turret *h*, and provided with a series of upright spiral blades or knives, N, which are bolted firmly thereto, with their edges exposed at the periphery in such manner as to co-operate with a fixed upright blade, *q*, bolted to the interior of the head *h* at one side of the feed mouth or inlet, as plainly represented in Figs. 1 and 2. The edge of the knife *q* extends slightly within the turret or chamber in such position that the edges of the knives N pass closely thereby, the knives being thus adapted to act with a shearing action upon the stalks or other materials introduced between them. The position of the inlet-mouth, as shown in Fig. 2, is such that the materials enter the chamber or turret at one side, owing to which fact, and to the direction in which the knives revolve, the mill tends to draw or feed the material inward automatically.

In order to arrest or check the inward motion of the stalks, so that they may be properly divided by the knives, and for the purpose of retarding or retaining the pieces after their severance from the stalk in such manner that they may be further reduced by the rotary knives, the turret is constructed with upright ribs or teeth *t* upon its interior surface, as clearly shown in Figs. 1 and 2.

While it is not absolutely necessary that the knives N shall be placed spirally upon the head M, this arrangement is provided for the reason that they then act as feeders to assist in carrying the material down between the grinding-disks, thus avoiding the necessity for special devices for the purpose.

Having described the leading features of the mill, we will now describe certain minor features, which may be considered of importance.

Referring first to the means of sustaining the lower end of the main shaft, attention is directed particularly to Figs. 1 and 3. The bridge-tree E is provided with a central opening to receive the lower portion of a cup or socket, R, in which the shaft-box or bearing proper is mounted, the upper end of the cup being provided with a peripheral flange, supported by knife-edge bearings on the two sides of the bridge-tree, as usual, this arrangement permitting the socket to remain vertical as the bridge-tree is adjusted. The lower end of the cup or socket R is seated and arranged to slide vertically in a tubular sleeve or hub, designed to hold the socket from moving laterally, and thus keep the shaft in exact alignment without being adjusted. The socket is provided with an enlarged flange or base-plate, mounted upon the base-plate of the machine in such manner as to be adjustable laterally, in order to move the lower end of the shaft, as may be required. In order to bring the faces of the grinding-disks parallel with each other, the base-plate of the socket rests upon the base-plate *a* of the main frame, and is provided with radial slots *s* to receive clamping-bolts *t*, as plainly represented in Figs. 1 and 3.

As a means of effecting the lateral adjustment of the socket-plate and securing the same in position, a series of horizontal screws, *u*, are inserted through the base-plate of the main frame from its outer edge inward, their inner ends being threaded into lugs formed for the purpose on the edge of the socket-plate, as represented in Figs. 1 and 3. In effecting the adjustment of the plate S, the clamping-bolts *t* are first loosened, after which the screws *u* are turned in a proper manner to effect the movement of the plate, which is then secured by tightening the bolts *t*. The box or bearing F at the upper end of the main shaft is dropped loosely into a socket formed for the purpose on the top of the cap-plate, as before

described, and is covered by a plug secured therein, above, as shown in Fig. 1, the detachment of this plug, affording access to the bearing and permitting its removal at will.

In order to adapt the mill, constructed as above, for the treatment of the different materials for which it is adapted, it is necessary to provide a convertible feed mechanism, which will now be described. The turret or feed-chamber *h* at the top of the mill is provided at the edges of its openings with vertical flanges *a'*, plainly represented in Figs. 2 and 4. When the mill is to be employed for cutting and grinding cane and similar material, we make use of an inclined flaring spout or trough, W, open at its outer end to admit of the cane being passed endwise through the same. The inner end of this hopper is provided with a metal mouth or throat, *b'*, adapted to be bolted to the flanges *a'*, as represented in Figs. 2 and 4, this mode of attachment holding the hopper firmly to the mill and sustaining it in position thereon. When the mill is to be employed for reducing grain and similar materials which require a hopper to hold them, the spout or trough W is removed and a hopper, such as represented in Figs. 5 and 6. applied in its place. As shown in Fig. 5, this hopper is constructed with inclined sides *d'*, converging at the bottom, and provided with removable inclined end boards, *e'*, secured therein by screws *f'*. When these end boards are in position, the hopper inclines inward from all sides to the narrow throat or opening at the bottom; but when they are removed the ends of the hopper are vertical and the sides only inclined, a long trough or channel being formed at the bottom. One of the removable end boards *e'* is provided with a sliding gate, *g'*, seated at its edges in guides *h'*. A hand-screw, *i'*, serves, by raising and lowering the gate, to regulate the size of the outlet-opening, and thereby the rate of feed. A horizontal slide, *j'*, is provided with an operating-pitman, *k'*, and connected to a crank-pin on a pinion, *l'*, secured, as shown in Fig. 6, on the upper end of a vertical shaft, *m'*. This shaft is sustained in a metal bracket, *n'*, attached to the outer end of the hopper, and is provided with a cone-pulley, *o'*, driven by a belt, *p'*, from a corresponding pulley, *q'*, on the upper end of a vertical shaft, *r'*. The last-mentioned shaft is seated in bearings in the main frame, as shown in Figs. 3, 4, and 6, and is driven by means of pulleys and a belt, *s'*, from a central pulley on the main shaft, as shown. By this arrangement the feed-slide is caused to reciprocate beneath the throat of the hopper, its end serving to drive the material forward therefrom into the head of the mill. The inner end of the hopper is provided with a flanged head or casing, *t'*, adapted to be bolted to the head or turret, whereby the hopper is maintained in position.

The above-described arrangement answers a good purpose in feeding those materials which will flow downward in front of the slide; but in other classes of materials it is necessary to provide a feed screw or worm to move the material steadily forward into the mill. When this is required, we remove the end boards, *e'*, from the hopper and place horizontally in the bottom thereof a feed-screw, *u'*, clearly shown in Fig. 6. This screw or worm is sustained at one end in a plate, *v'*, bolted to the hopper, and at the opposite end in a plate, *w'*, also secured to the hopper. The plate *w'* is removable, in order to permit the withdrawal of the worm at will and the substitution of the slide in its place. The form of this plate and the manner in which it is secured to the hopper by screws *y'* bearing against its edges are plainly represented in Fig. 8, the screws being seated in the plate which gives support to the vertical shaft before mentioned. The bridge-tree E is sustained at one end by means of a rod, *f''*, the upper end of which is passed through the top plate, *c*, and through the rubber spring *g''* thereon, and provided with a washer and nut, *h''*, at the upper end, this arrangement serving as an elastic or yielding suspension for the bridge-tree. At its opposite end the tree is suspended and adjusted by a rod, *e''*, the upper end of which is threaded and passed through the top plate of the frame and provided with a hand-nut, *i''*, by turning which the end of the rod may be raised and lowered. The rod *e''* is also provided immediately below the top plate of the frame with check-nuts *j''*, which, being properly adjusted, bear beneath the plate and limit the upward motion of the rod, thus preventing the bridge-tree from rising so far as to force the grinding-disks into contact with each other. The application of the nuts *j''* is advantageous not only in preventing the destruction of the mill by keeping the disks out of contact, but also in that they enable the operator, after having separated the disks for any reason, (such, for example, as the removal of foreign matters,) to instantly bring them back precisely to their original adjustment. Were it not for the presence of the nuts, it would be necessary for the operator to turn the screws *i* and elevate the lower disk with extreme caution requiring the expenditure of unnecessary time and the employment of skilled labor.

Having thus described our invention, what we claim is—

1. In a machine for reducing cane and similar materials, the grinding-disks, in combination with the rotary cutter-head provided with external knives, the head or turret having the throat or inlet, and the stationary upright blade located at the side of the throat and arranged to act in immediate proximity to the rotary blades, as described, whereby the stalks are first divided by a shearing action into lengths and subsequently subjected to a grinding action.

2. The head or turret *h*, provided with internal ribs and with a feed throat or opening, in combination with the upright knife secured to its side and the cutter-head provided with

blades N, arranged to move in close proximity to the fixed blade, but at a distance from the ribs, whereby the ribs are adapted to check the inward motion of the cane or other material during its severance by the knife.

3. In combination with the rotary head having the upright knives thereon, the encircling turret provided with internal ribs, a knife fixed at one side of the inlet-opening, and the feed spout or throat arranged to deliver the material at one side of the rotary head, whereby the stalks are caused to be drawn automatically inward and their advance retarded, so that they may be severed by the knives.

4. In a convertible hopper for a grinding-mill, the body provided with movable end boards, $e'$, substantially as described, whereby it may be adapted at will for use with a reciprocating slide or with a feed-worm.

5. In combination with the shaft bearing the socket, the base-plate $a$, adjustable plate S, and the bolts $t$ and $u$.

6. The hopper provided with the removable end boards, $e'$, and with the pinion $l'$, having a crank-pin thereon, whereby it is adapted for operation in connection with a worm or with a reciprocating slide, as occasion may require.

7. The hopper $d'$, provided at one end with the outlet-opening and the depending plate $v'$, in combination with the feed-worm $u'$, the worm-supporting plate $w'$, and the screws for securing said plate in position.

8. In combination with the lower grinding-disk, its spindle, and the bridge-tree, the suspension-rod $f''$, and the spring to sustain the same, the suspension-rod $e''$, and its nuts $i''$ and $j''$.

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ALBERT RAYMOND.

Witnesses:
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