(No Model.) 3 Sheets—Sheet 1.

J. Q. ADAMS.

GRINDING MILL.

No. 292,612. Patented Jan. 29, 1884.

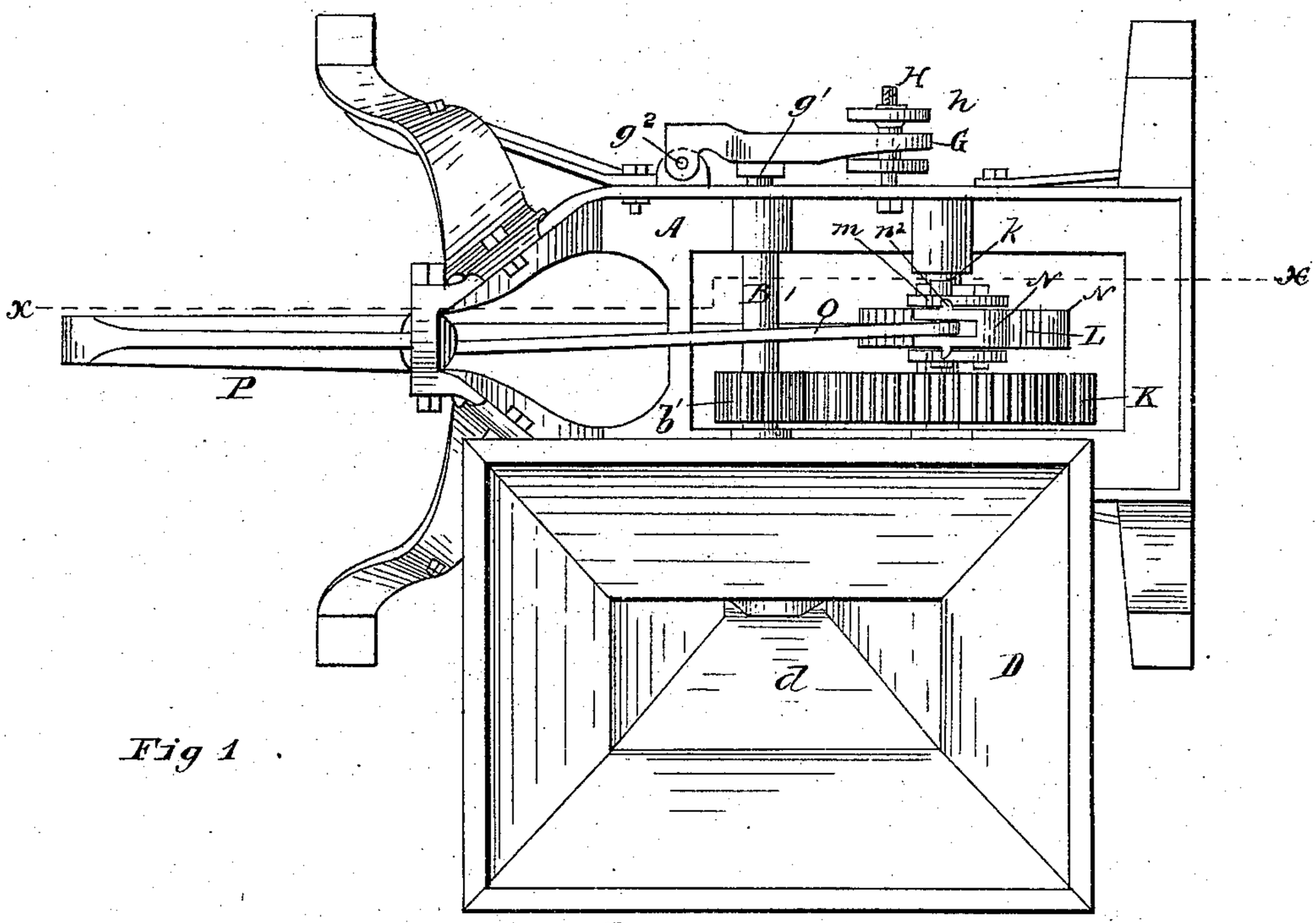

Fig 1.

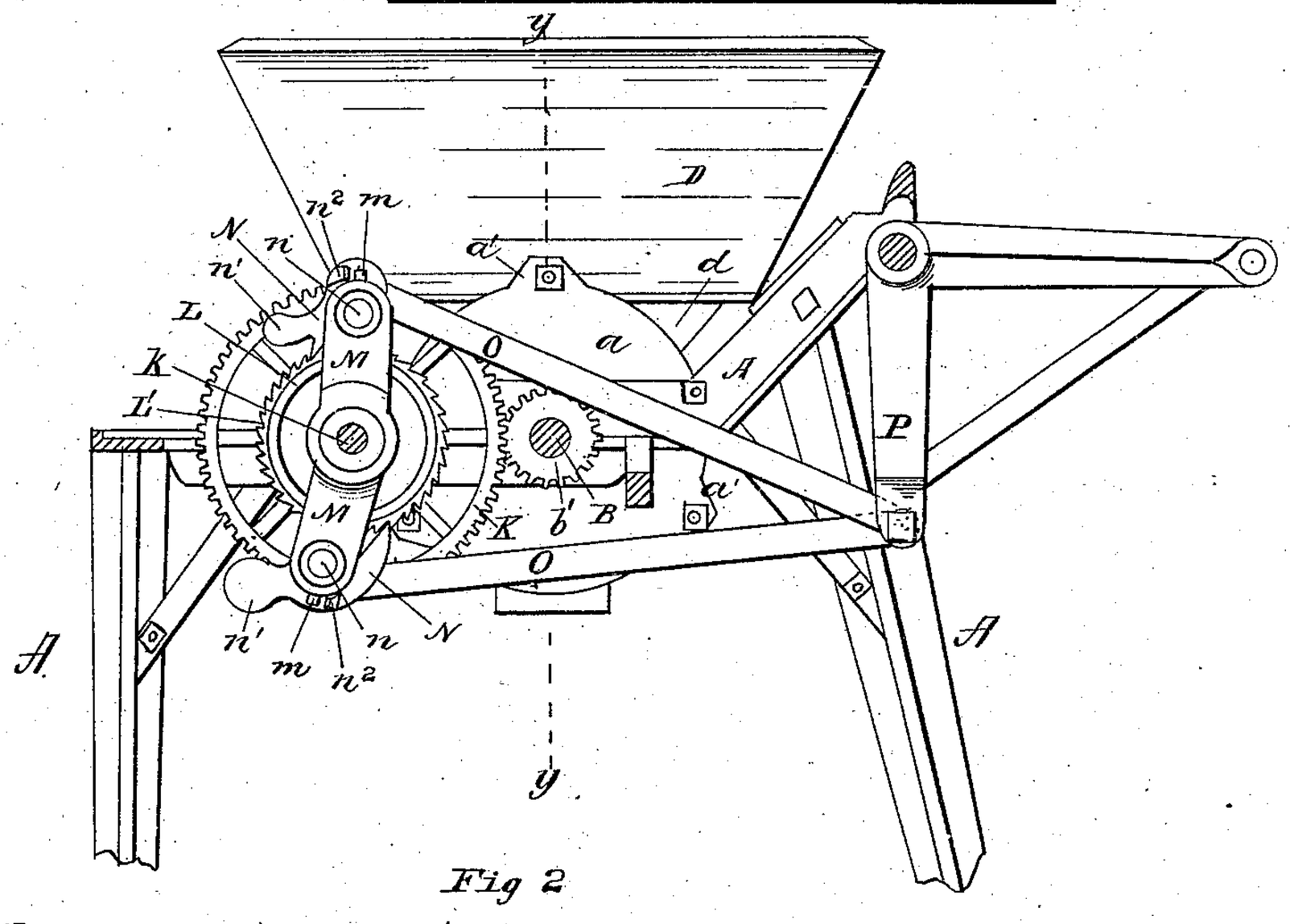

Fig 2

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(No Model.) 3 Sheets—Sheet 2.

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Fig 3

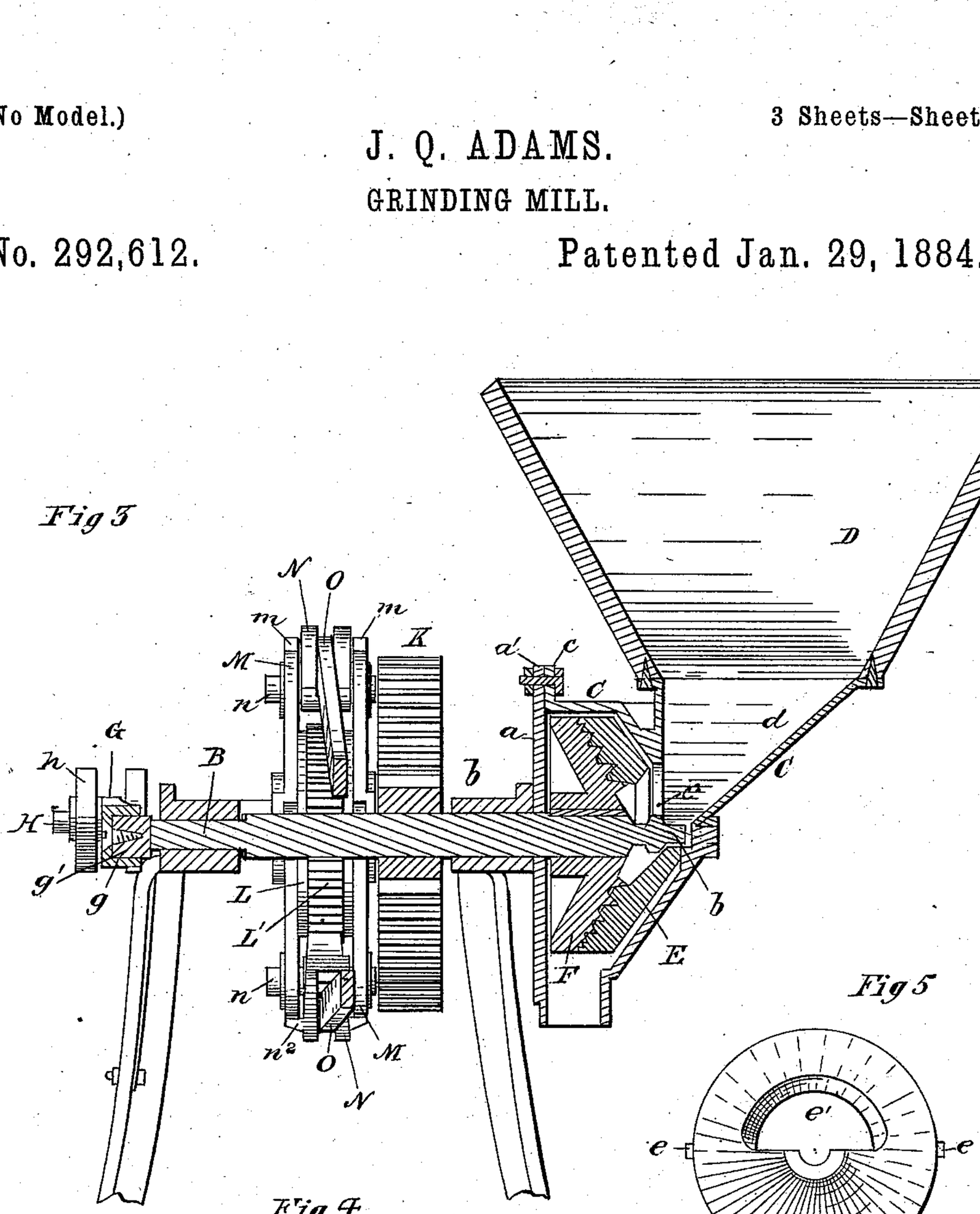


Fig 5

Fig 4

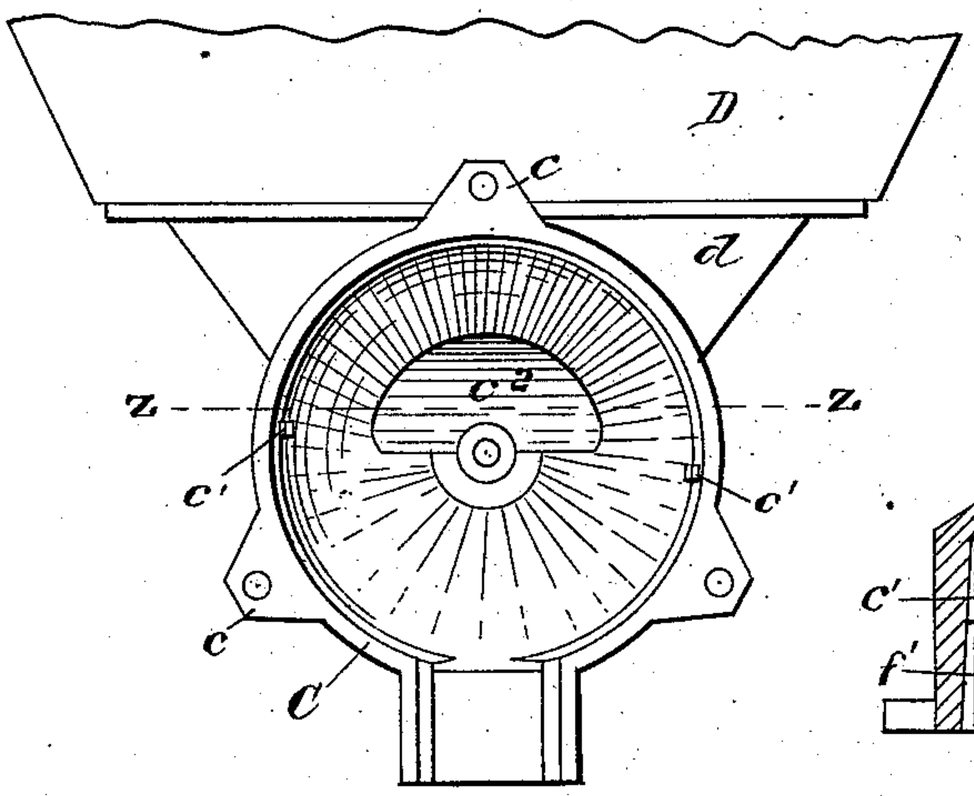
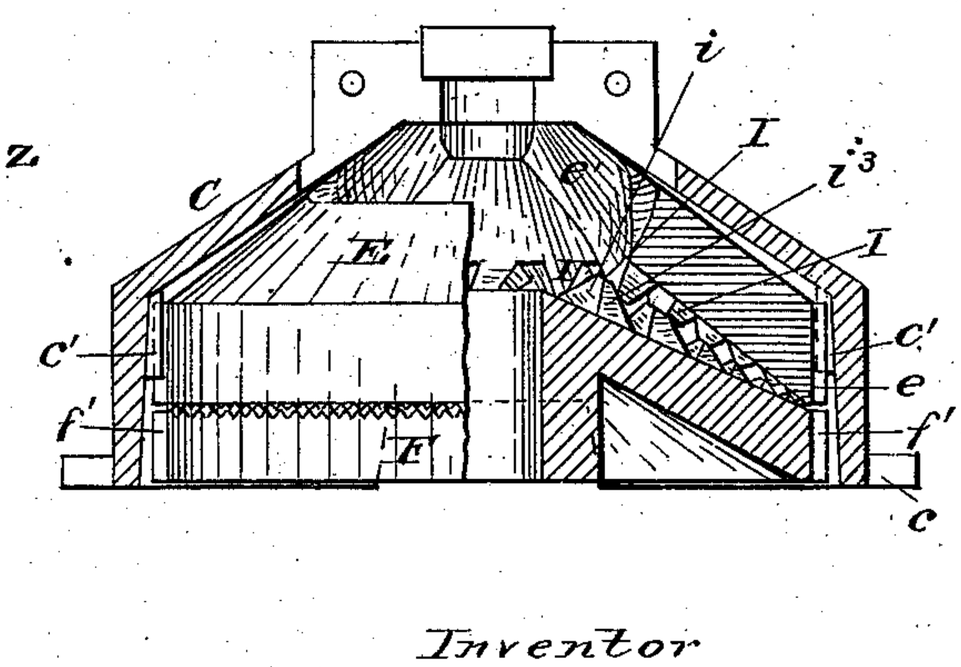


Fig 6



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GRINDING MILL.

No. 292,612. Patented Jan. 29, 1884.

Fig 7

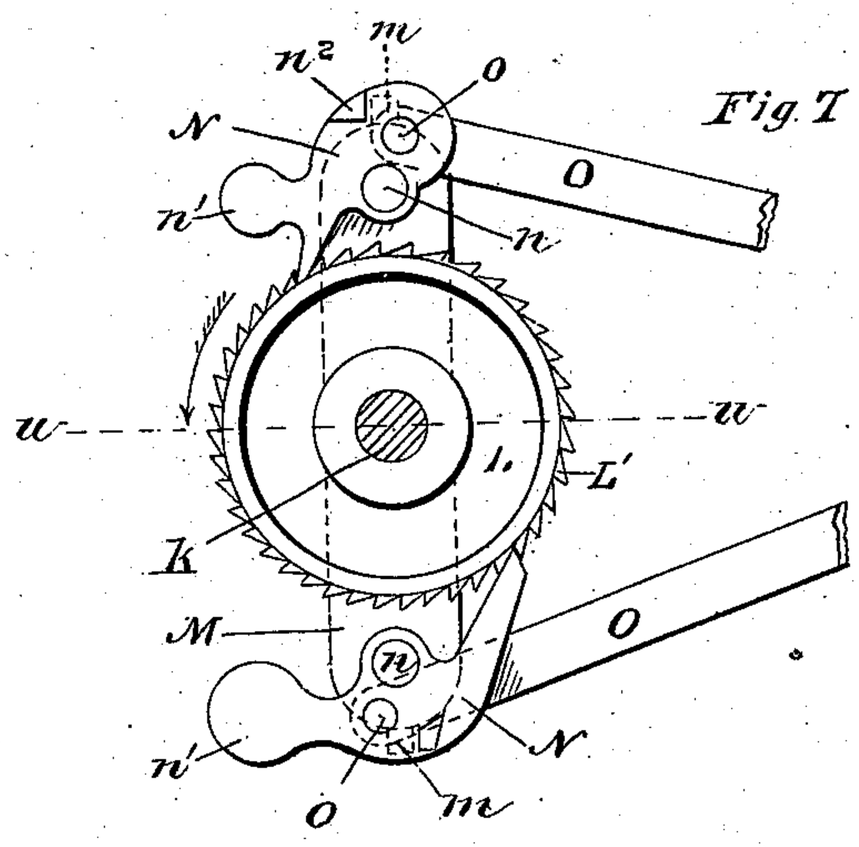


Fig 8

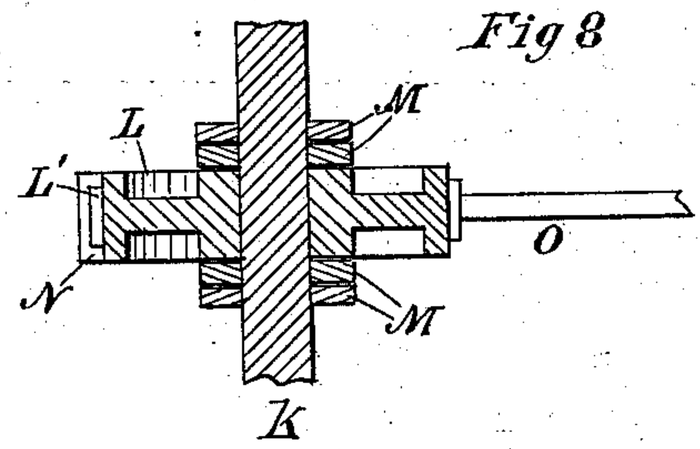


Fig 9

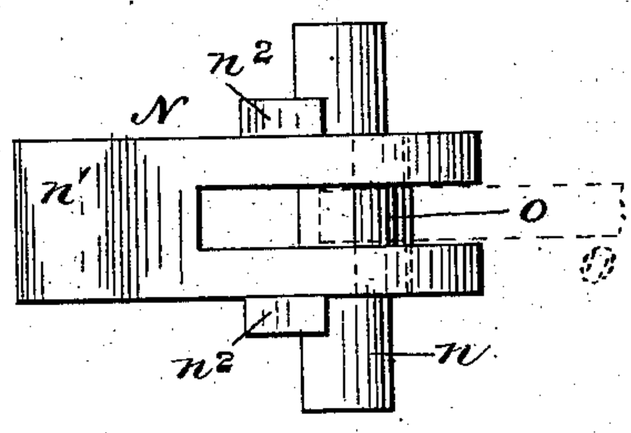


Fig 10

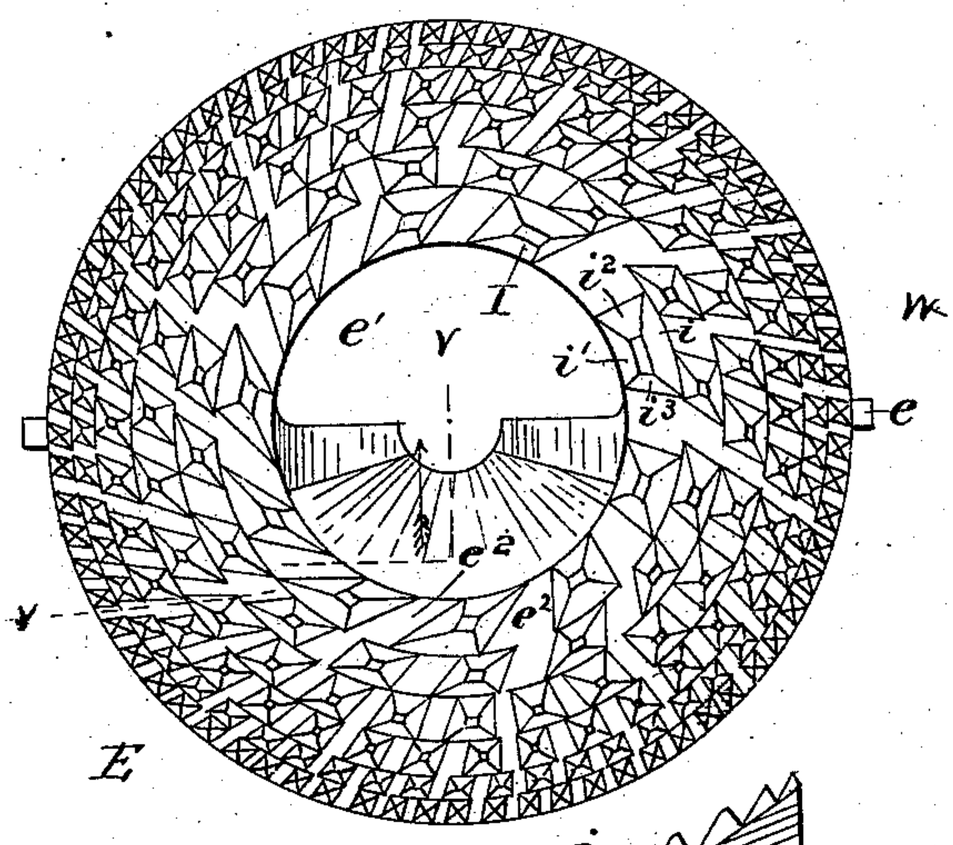


Fig 11

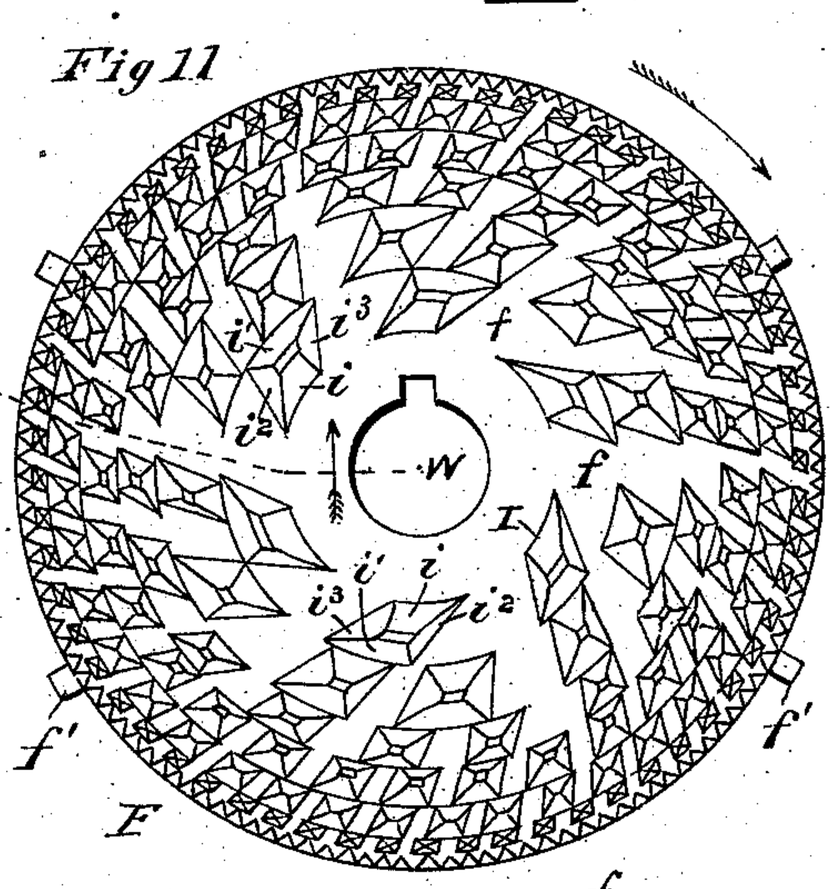


Fig 12

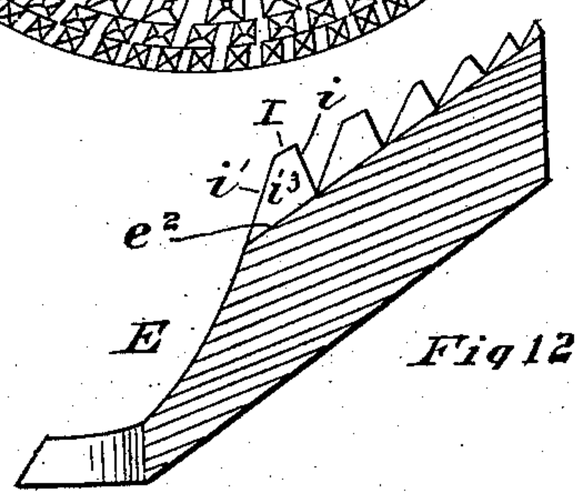
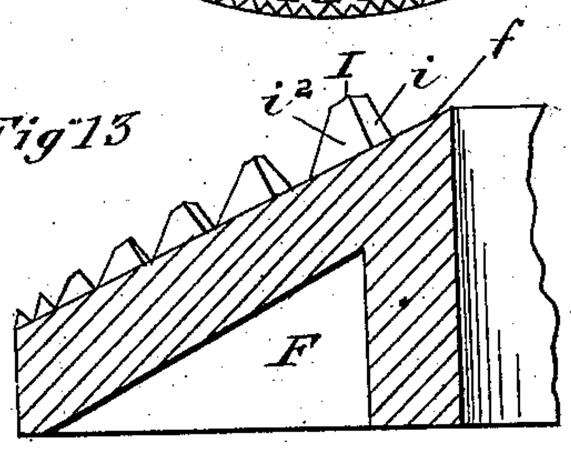


Fig 13



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UNITED STATES PATENT OFFICE.

JOHN Q. ADAMS, OF MARSEILLES, ILLINOIS.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 292,612, dated January 29, 1884.

Application filed February 8, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN Q. ADAMS, a citizen of the United States, residing at Marseilles, in the county of La Salle and State of Illinois, have invented certain new and useful Improvements in Grinding-Mills, fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan view of a mill containing my improvements. Fig. 2 is a vertical section of the same, taken on the line *x x*, Fig. 1; Fig. 3, a similar section taken on the line *y y*, Fig. 2; Fig. 4, an inside elevation of the casing for the burrs and lower portion of the hopper, the inner plate of the casing being removed; Fig. 5, an outside elevation of the stationary or concave burr; Fig. 6, a transverse section of the burrs and their casing, taken on the line *z z*, Fig. 4, and on an enlarged scale; Fig. 7, a detail elevation of a ratchet-and-pawl mechanism for imparting continuous rotation to the grinding-shaft from a windmill; Fig. 8, a detail section taken on the line *u u*, Fig. 7; Fig. 9, a detail plan of one of the driving-pawls and connections on an enlarged scale; Fig. 10, an elevation on an enlarged scale of the concave burr, showing the dress of the grinding-surface; Fig. 11, a similar elevation of the convex burr; Fig. 12, a detail section taken on the line *v v*, Fig. 10; and Fig. 13, a similar section taken on the line *w w*, Fig. 11.

My invention relates to improvements in that class of mills in which the grinding is done by small burrs of iron, these mills being especially adapted to the grinding of feed.

The invention relates to certain improvements in the grinding mechanism, and also to improvements in the driving mechanism by which the mill is adapted for use with windmills.

I will proceed to describe in detail the construction and operation of the various devices by means of which my improvements are practically carried out in a full-sized organized machine, and will then point out definitely in the claims the special improvements which I believe to be new and desire to secure by Letters Patent.

In the drawings, A represents a main or supporting frame, which may be of any suitable construction, varied as circumstances may require. In this frame is mounted a horizontal shaft, B, which may be called the "grinding-shaft," as it carries the movable or revolving burr. At one side of the frame is a circular case, C, within which the grinding-burrs are inclosed. The inner plate, *a*, of this casing is fastened securely to the main frame—in fact, may be called a part of the frame—and the grinding-shaft passes through it. The hollow or main portion of the casing is bolted to this fixed plate by means of lugs *a'* on the latter, and corresponding lugs, *c*, on the former. On the interior of the casing are two ribs, *c'*, arranged on opposite sides of the casing and on opposite sides of a plane passing diametrically through the latter, as shown in Fig. 4 of the drawings. The casing is also adapted for the attachment of a hopper, D, the throat *d* of which is a part of the casing and leads to a feed-opening, c^2, in the outer wall of the latter. The main portion of the casing and hopper is readily detached from the stationary plate by removing the bolts whenever it is desired to reach the burrs for any purpose whatever. The shaft B terminates just underneath the outer edges of the casing on the lower part of the feed-opening, and the portion rotating in the feed-opening is flattened to make a widened section, *b*, which stirs the grain, and thereby facilitates the feed. The bearings of the shaft are, however, on the main frame, and in them the shaft has a certain amount of longitudinal movement, so as to be adjusted for fine or coarse grinding.

The grinding device consists of two cast-iron burrs, E and F, the first of which has a concave grinding-surface, while the latter has a similar convex surface. The concave burr E is provided with ribs *e* on its outer rim, arranged on opposite sides of the burr, and adapted to engage with the ribs *c'* in the casing when the burr is in position, as shown in Fig. 6 of the drawings. This burr is a little smaller than the casing and is arranged loosely in the front part thereof, the outside of the casing being shaped to substantially fit the conical outer face of the burr, though the inclination of the casing is somewhat less than that of the burr, so that a slight flaring space will be left

between the burr and the casing, as shown in Fig. 6 of the drawings, which provides a bearing for the burr at or near its center only and within the case, the purpose of which will presently be mentioned. The burr is withheld from rotating by the ribs on it and the casing heretofore described, these ribs being arranged to act in a direction opposite to the revolution of the burr F, which is secured to the grinding-shaft; but the movement of the burr in the opposite direction is unrestricted. There is also a feed-opening, e', in the central portion of the burr E, communicating with the throat of the hopper, this opening being semicircular in form and above the central bearing-surface, e^2.

As already stated, the burr F is fastened to the shaft B. Its convex grinding-surface is of a form substantially to fit the concave surface of the burr E, but the angle of inclination of the convex surface is made slightly less than that of the corresponding concavity, so that in working position the outer edges of the grinding-surfaces will come together, while their inner surfaces will gradually separate slightly, as shown in Fig. 6 of the drawings, in which, however, this separation is exaggerated for the purpose of illustrating it clearly to the eye in the drawings.

As stated above, the grinding-shaft B has longitudinal movement in its bearings. Obviously this movement will adjust the convex burr in relation to the concave burr, and the movement will be from the center of the former, which is also the center of the latter. Now, if the burr E were in an absolutely fixed position it would require exceedingly nice fitting of the two burrs to secure evenness in their relation to each other and proper regularity of adjustment; but with the arrangement above described of the concave burr within the case, it is free to rock so as to readily accommodate itself to the variations of the burr F, thus securing uniformity of relation and adjustment throughout the grinding-surfaces.

Any suitable device may be used for adjusting the shaft back and forth. I have shown in the drawings a lever, G, pivoted at one end to the main frame by a wooden pin, g^2, operating as a "break-pin" in the usual way at one side of the shaft, and extending across the end of the latter is a pin, H, which is received in a hole or notch in the lever. This pin is threaded and is provided with a setting-screw, h, by means of which the end of the lever is moved in and out in relation to the frame. A socket or seat, g, is provided in the lever just opposite the end of the shaft, in which is placed a wooden block, g', which rests against the end of the grinding-shaft and forces the latter inward when the lever is moved inward by the set-screws, thereby adjusting the conical burr nearer to its concave mate for fine grinding. It is not necessary to have the adjusting device act positively on the shaft to move it backward. The feed will accomplish this whenever the end of the lever is loosened so as to permit the shaft to slide backward.

The dress of the grinding-burrs is somewhat peculiar, and I will now proceed to describe it. Each of the grinding-surfaces is provided with teeth I, which are placed in circles around the surface and arranged alternately, or in such manner that a circle of teeth on one will enter the space between two circles on the other. These teeth I are of a peculiar diamond or rhomboidal form in cross-section. The inner faces, i, of the teeth on the convex burr are on a circle, the center of which will be found within the concavity of the burr, and the outer faces, i', are on a different circle, the center of which will be found at a point considerably beyond, or outside of the convex surface of this burr, but in line with the center of its convexity. It will thus be seen that these faces stand at a very considerable angle to each other. The front face, i^2, is cut at an angle inclining backward from the inner edge of the tooth, and the rear face, i^3, on about the same angle, though the two faces are inclined toward each other. The inclination of the forward faces is simply for the purpose of admitting the feed freely to the grinding-surfaces, and the similar inclination of the rear faces is for the purpose of permitting the ground material to pass out freely into the channels toward the outer edges of the burrs. The teeth on the concave surface are of precisely the same shape, except that their angles are, of course, reversed—that is, the faces i are outside and the faces i' inside. Suitable channels, e^2 and f, are arranged radially in the surfaces to facilitate the passage of the material from the center to the circumference of the burrs. It will be seen that the grain will be taken between the surfaces i and i' of the teeth, and cut and crushed by this action. The teeth gradually decrease in size from center to circumference of the burrs, so that the fine grinding will be done at the edges where the burrs come close together. It will also be seen from Figs. 3 and 6 of the drawings that the cutting-edges of the teeth pass across each other's faces, and hence the teeth are made self-sharpening by simply adjusting the burrs close together, and running the mill a short time without feed. The revolving burr F has ribs f' on its rim, which carry round the material escaping outside of the burr in the case to the delivery-opening at the under side of the latter.

The mill thus constructed may be operated by any power suitable for the purpose, but as there is an especial demand for small mills of this description to work in connection with windmills, I have shown an improved mechanism for communicating a constant rotary motion to the grinding-shaft through the reciprocating motion of the ordinary windmill-pitman, though I do not wish to be understood as limiting my improvements to a mill of this description.

A pinion, b', is secured to the grinding-shaft,

with which a gear-wheel, K, is arranged to engage, the latter being mounted on a shaft, *k*, arranged in suitable bearings on the main frame parallel to the grinding-shaft. A ratchet-wheel, L, is secured to this same shaft outside of the gear-wheel, being provided with ordinary ratchet-teeth, L′. This ratchet-wheel is embraced by yokes M, each of which is mounted loosely on the gear-shaft. A pawl, N, is pivoted by a pin, *n*, in the outer end of each of the yokes, so constructed as to engage with the teeth of the ratchet-wheel. These pawls are weighted to cause them to engage quickly with the ratchet-wheel, the weights *n′* being arranged according to the position of the pawls above or below the shaft. Connecting-rods O are provided at one end, respectively, to the pawls N, the pivot-pins *o* being back and outside of the pivots in which the pawls work. The other ends of these rods are connected by the same pivot to one arm of a bell-crank lever, P, the outer arm of which is connected in any suitable way to the reciprocating-rod of a windmill. Obviously a continuous rotary movement will thus be communicated to the ratchet-wheel by the operation of this double pawl mechanism, which, in its general features is well-known for this purpose. The connection of the rods O directly to the pawls and at a point outside of their pivots, it will be seen, forces the pawls into engagement with the ratchet by the working thrust or pulls of the respective rods. The weights on the pawls aid their movement so as to cause quick engagement. Obviously the thrusts or pulls of the rods in the opposite direction will turn the pawls on their pivots so as to disengage them from the ratchet-wheel and carry them idly over the latter. The backward vibration of the pawls is limited by stops n^2 on the pawls, which come in contact with corresponding stops, *m*, on the respective yokes; a sufficient play being permitted between the stops to provide for the perfect disengagement of the pawls from the ratchet-wheel.

Any other suitable mechanism may be employed for the purpose of driving the grinding-mill by a windmill, though I have found that described above very satisfactory in its operation for this purpose.

I do not wish to be understood as limiting myself in details of construction in all particulars to the description given above, for obviously there are some of the main features of my invention which may be applied to mills differing in construction in other respects from that which I have described.

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

1. In a grinding-mill composed of a shell and loose concave burr, and a conical revolving burr fitted within the said shell, the ribs *c′ e*, arranged, respectively, upon the shell and concave burr, whereby the said concave burr is permitted to rock, but prevented from revolving.

2. The casing C, having its inner face concave, in combination with the concave burr E, the outer convex face of which is inclined at an angle less than that of the casing, and set loosely within the casing, substantially as and for the purpose set forth.

3. The casing C, having its inner face concave and provided with ribs *c′*, in combination with the concave burr E, having its outer convex surface inclined at an angle less than that of the casing, and provided with ribs *e*, whereby the burr is free to rock within the casing, but is held from rotating with the revolving burr, substantially as described.

4. Combined with the driving-shaft of a grinding-mill, the pinions *b′ k*, the ratchet-wheel on the shaft *k*, the yokes M, the rods O O, and bell-crank P, and the pawls N, pivoted in the yokes, and having weights N′, substantially as described.

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