(No Model.)

2 Sheets—Sheet 1.

J. HOLLINGSWORTH.

GRINDING MILL.

No. 305,751. Patented Sept. 30, 1884.

Fig. 1.

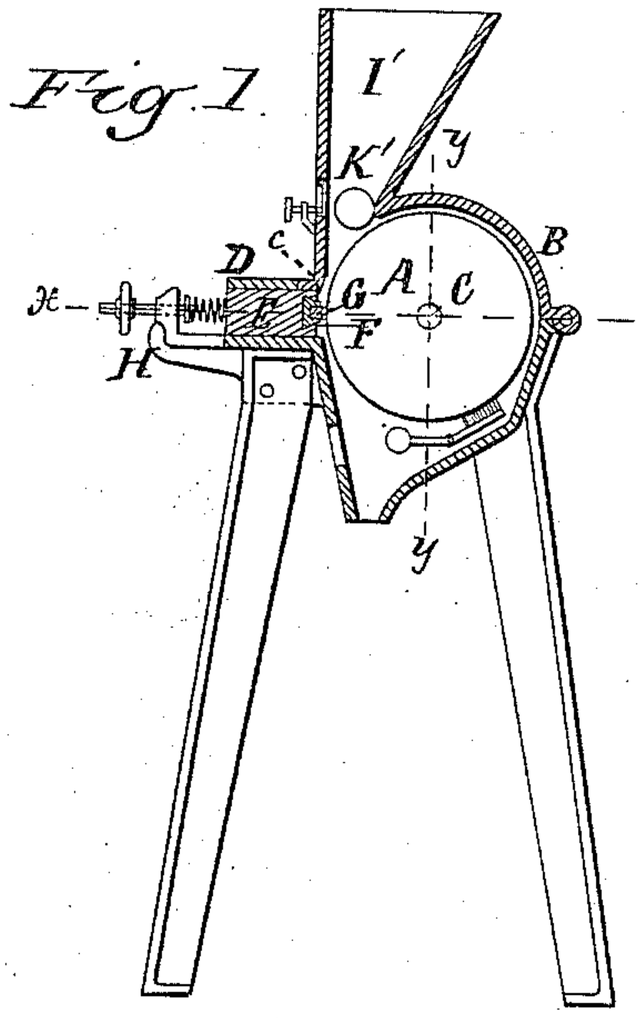


Fig. 2.

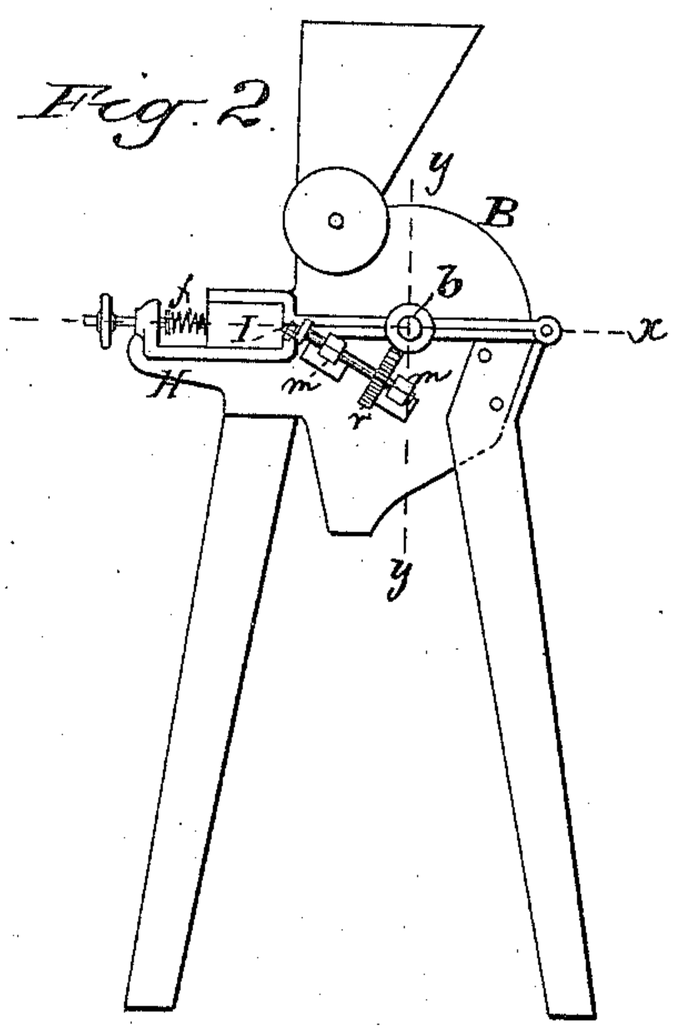


Fig. 3.

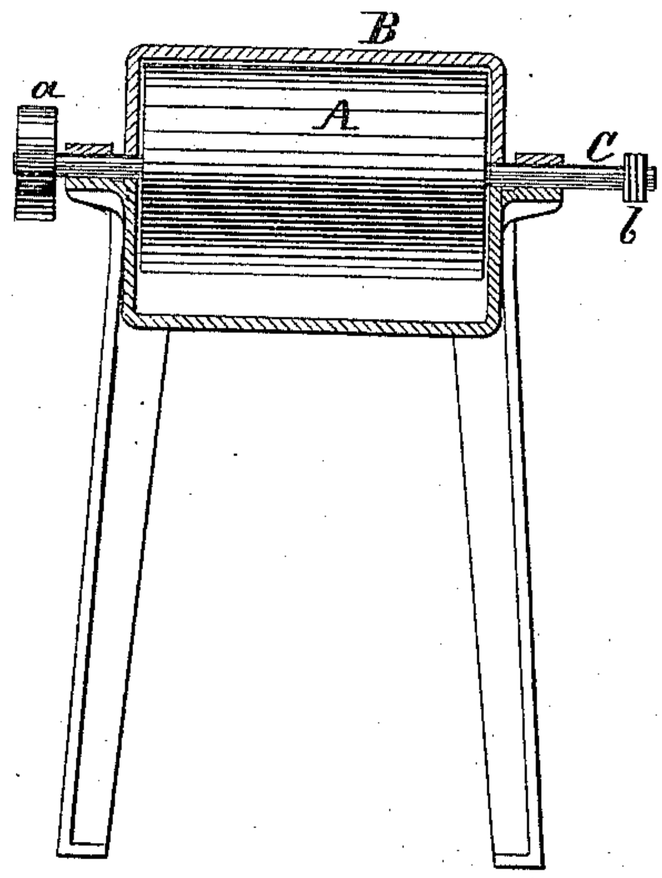


Fig. 4

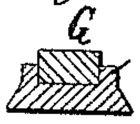
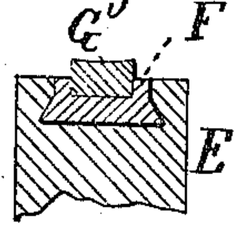


Fig. 5.

Fig. 6.



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(No Model.) 2 Sheets—Sheet 2.

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GRINDING MILL.

No. 305,751. Patented Sept. 30, 1884.

Fig. 7.

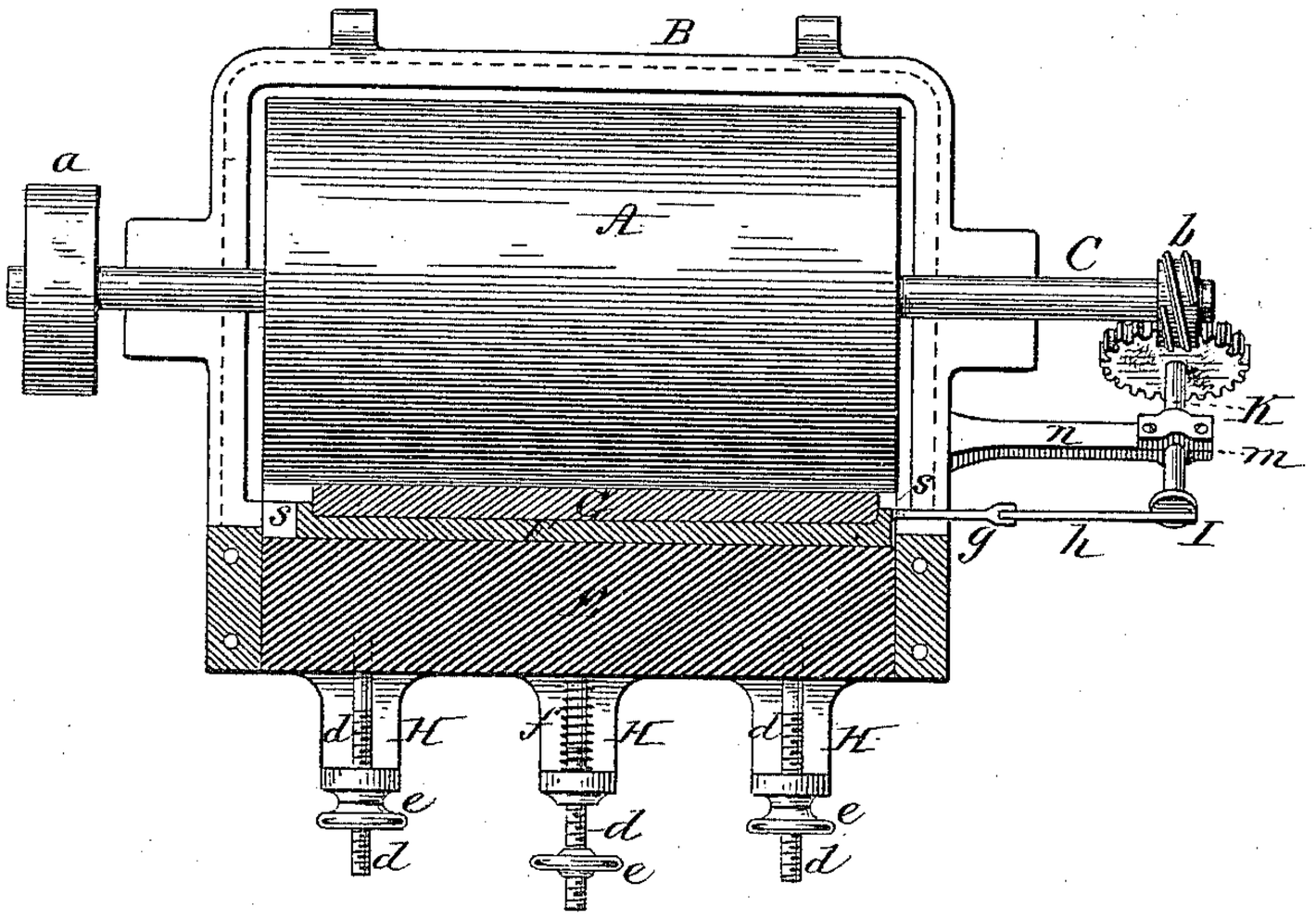
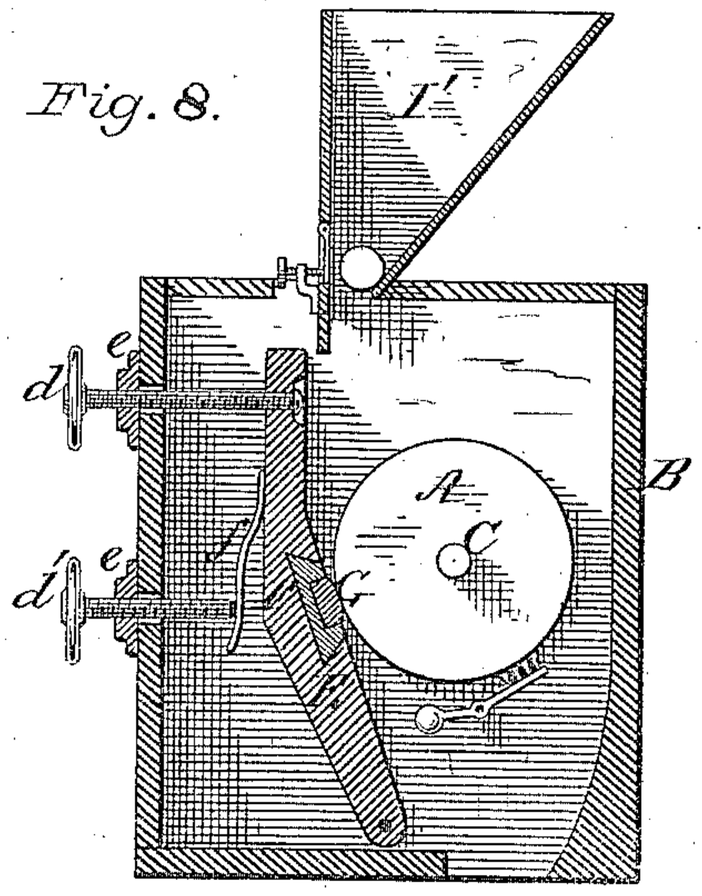


Fig. 8.



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UNITED STATES PATENT OFFICE.

JEHU HOLLINGSWORTH, OF NEW YORK, N. Y.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 305,751, dated September 30, 1884.

Application filed March 14, 1883. (No model.)

To all whom it may concern:

Be it known that I, JEHU HOLLINGSWORTH, of the city, county, and State of New York, have invented certain Improvements in Grinding-Mills, of which the following is a specification.

This invention may be employed for comminuting grain or other substances, but is more particularly employed for the reduction of middlings. Its object is to provide a simple and efficient means for reducing the grains, middlings, or other substances to the requisite degree of fineness, and at the same time for automatically maintaining the integrity of the grinding-surfaces. The invention comprises certain novel means whereby these objects are effectually secured.

Figure 1 is a vertical transverse sectional view, and Fig. 2 a side view, of an apparatus embracing my said invention; and Fig. 3 is a vertical sectional view taken in the line *y y* of Figs. 1 and 2. Figs. 4, 5, and 6 are detail views on a larger scale, showing one of the parts included in said apparatus. Fig. 7 is a horizontal section on the line *x x* of Fig. 1, showing on an enlarged scale the means for reciprocating the carrier-block of the concave; and Fig. 8, a vertical section showing a modified means of supporting and adjusting the concave in relation to the roller.

A is a grinding-roller placed within a suitable shell, B, and with the ends of its shaft C projecting through the ends of the said shell. Upon one of the said ends of the shaft C may be placed a driving-pulley, *a*, through which a rotary motion may be communicated to the roller A. Upon the opposite extremity of the said shaft C is a worm, *b*, the purpose of which will hereinafter appear. At one side of the shell B, coincident and longitudinal with the roller A, is an opening, *c*, from which extends laterally and in a plane substantially radial to the shaft C a chest or chamber, D, in which is placed an oblong block, E, which conforms to the chest or chamber D in such wise that the said block E may be moved inward and outward with reference to the adjacent surface of the roller A. Formed longitudinally in the inner side of the said block E—that is to say, in the side adjacent to the roller A—is a groove or longitudinal recess, (more fully indicated in Fig. 7,) and which constitutes a guide for a carrier-block, F, capable of a reciprocating movement within the said groove or socket. Formed longitudinally in the inner side of the carrier-block F is a socket, which receives the concave or non-rotating grinding device G, as shown in Figs. 5 to 7, inclusive. This concave G is made of suitable millstone material, and is fixed in the inner side of the carrier-block F, so as to move therewith. Fixed to the frame of the machine and extended back from the chest D are brackets H. Screw-bolts *d*, affixed on the outer side of the block E, extend outward through suitable holes in these brackets H, and have provided upon their threaded outer extremities nuts *e*, which latter bear against the outer ends of the brackets, so that by adjusting the nuts upon the screw-bolts the extent to which the block E is permitted to move forward toward the roller E is readily adjusted, the said nuts and screw-bolts enabling the block E to be adjusted so that the inner or grinding surface of the concave G may be brought parallel with the surface of the roller A. One or more spiral springs, *f*, may be placed upon a corresponding number of the screw-bolts *d*, between the inner surface of the brackets H and the outer surface of the block E in such manner as to brace the said block E inward toward or against the roller A to the limit permitted by the adjustment of the nuts *e* on the threaded outer ends of the screw-bolts *d*, as hereinbefore explained. The carrier-block F is connected by a rod, *g*, and pitman *h* with a crank, I, on the extremity of a short shaft, K, which is supported in a suitable bearing or bearings, *m*, duly provided to the supporting-frame of the apparatus—as, for example, by means of a bracket, *n*, as shown more fully in Fig. 7. Upon the opposite end of this shaft K is a worm-wheel, *r*, which gears into the worm *b* on the shaft C of the roller A, so that the rotation of the said shaft from the pulley *a*, or otherwise, communicates a rotatory motion to the crank I, which, through the pitman *h*, gives a rectilinear or reciprocating motion to the carrier-block F, which carries the concave G in due relation with the roller A, as hereinbe-

fore explained, so that simultaneous with the rotation of the roller A there is a reciprocating motion of the concave G, thereby subjecting the grain which passes between the said roller and the said concave to a combined action derived from the simultaneous rotatory motion of the roller A and the reciprocating motion in conjunction therewith of the concave G. The effect of the two grinding-surfaces having this relative motion with regard to each other and with regard to the grain, middlings, or other material subjected to their action is to comminute such material much more effectively and much more rapidly than if the grain were subjected only to the action of the rotatory roller in connection with a stationary concave. By these means, therefore, a much more efficient, economical, and uniform grinding operation is secured than is obtainable without such construction and operation of the grinding devices. Furthermore, the said construction and operation of the grinding devices enables them to so act upon each other when any material to be ground or acted upon is interposed between them that the grinding effect of the reciprocating motion is to maintain the surface of the rotating roller straight longitudinally. In like manner the rotating roller has the same effect upon the grinding-surface of the concave, so that the two are thereby automatically fitted one to the other in such relation as to exert a uniform grinding action throughout the entire length of both, their integrity or working capacity being thereby maintained without the expense or special operation incident to repair, waste, &c. This advantage is very great, inasmuch as millstone, of which it is preferred to form the reciprocating concave and the roller, are frequently found to have soft places in them, which wear away more rapidly than the harder portions of the material, and which have heretofore required special and expensive mechanical operations, in order to repair the inequalities resulting from the wearing away of the soft parts of the material. Furthermore, by the construction and operation of the aforesaid parts I obviate in the grinding of middlings what is termed "caking" or "flaking," and which has hitherto been a serious drawback in the grinding or reduction of middlings by means of rollers; whereas by my invention the grinding effect exerted upon the material is such as to render such caking impossible. The grinding-surface of the concave G may be flat, as represented in Fig. 5, convex from its upper to its lower edge, as shown in Fig. 6, or concave from its upper to its lower edge, as represented in Fig. 7. It is of course to be understood that the grain, middlings, or other material to be ground is poured into the hopper I′ and thence by means of the feed-roller K′ is transferred in graduated quantities to the roller A and concave G, to be operated upon by the joint action of the said roller and concave, as hereinbefore explained.

The block E, instead of being placed in a chamber, as described, and moving in a straight line, so to speak, to and from the roller A may be extended downward and pivoted at its lower edge to the frame, so as to be adjustable to and from the roller A, thereby producing the same result as concerns the adjustment of the concave as when placed in the chamber, as hereinbefore set forth, the one construction of the said block being the equivalent of the other. This modification is shown in Fig. 9, in which the block E is shown as being pivoted to the inclosing shell or case B, and, extending above the roller, is connected at its upper end with one or more stop-screws *d*, passing through a nut, *e*, while one or more separate screws, *d′*, bear upon a spring, *f*, secured to the block E, to give the required pressure to the concave.

Referring to the concave G, it is important that it should be seated in its carrier-groove so as not to have an independent reciprocating movement, and for this purpose it is fixed within the groove of the carrier-block F between shoulders *s s*, formed at each end of said groove, as shown in Figs. 3 and 8.

It will also be seen that the groove in the reciprocating block E is dovetailed, so as to hold the block F in place, while the groove in the carrier-block F allows of the free removal and replacement of the grinding-surface G without removing its carrier-block F from its supporting-block E.

It is also important that the concave should present to the roller a comparatively narrow grinding-surface, and the block G should for this purpose be quite narrow. Indeed, when the block G has a convex surface, as in Fig. 6, its acting surface will be confined to the middle of the block along its entire length. Broadly considered, the combination, in a grinding-mill, of a roller having a continuous rotary motion, a grinding-concave, means for adjusting it in relation to the roller, and means for giving a reciprocating motion to said concave simultaneous with the rotary motion of the roller is not claimed herein. In my improved mill the stops serve only to limit the movement of the concave toward the roller, and the grade of grinding action depends, principally, upon the pressure of the spring, and the proper adjustment and supporting of the narrow concave by the blocks E and F, as described.

What I claim as my invention is—

1. The combination, with the roller A, of a closed shell or case, B, therefor, having an opening, *c*, at one side, a laterally-extending chest, D, forming an oblong chamber coincident with said opening, the oblong block E, conforming to said side chamber, the carrier-block F, the concave G, and means, substantially such as described, whereby said block and its concave are adjusted within said chamber, for the purpose described.

2. The combination of the roller A, the oblong block E, the carrier-block F, and the concave G, with the inclosing-case B for the roller, and the inclosing-case D, forming a guide for

said block E, means for giving a reciprocating motion to said concave, means for limiting the movement of the concave toward the roller, and means for giving the required grinding-pressure to the concave, substantially as described.

3. The carrier-block F, having a longitudinal shouldered groove, combined with the block E, having a longitudinal dovetail groove, the concave G, the roller A, and means, substantially such as described, for confining, guiding, and supporting said block E and for reciprocating the carrier-block, all constructed substantially as herein set forth.

4. The combination, in a grinding-mill, of the grooved pressing-block E, the grooved carrier-block F, the concave G, the grinding-roller A, the feed-roller K, the inclosing-cases B D, means for adjusting the block E, means for giving it pressure, means for regulating said pressure, and means for reciprocating the carrier-block, substantially as described.

5. The combination of the roller A, concave G, carrier-block F, block E, and mechanical means for communicating a reciprocating motion to the concave, and mechanical means for adjusting the block E with reference to the roller A, brackets H, screw-bolts *d*, and nuts *e*, all substantially as and for the purpose herein set forth.

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