(No Model.) 2 Sheets—Sheet 1.

J. F. WINCHELL.

CRUSHING AND GRINDING MILL.

No. 416,533. Patented Dec. 3, 1889.

Fig. 1

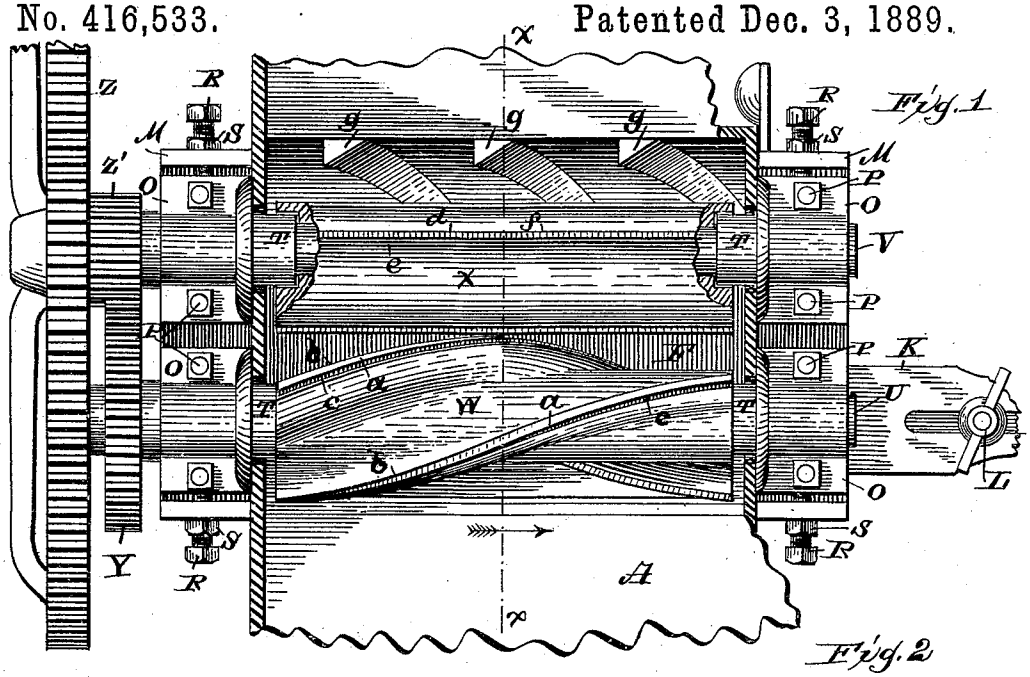


Fig. 2

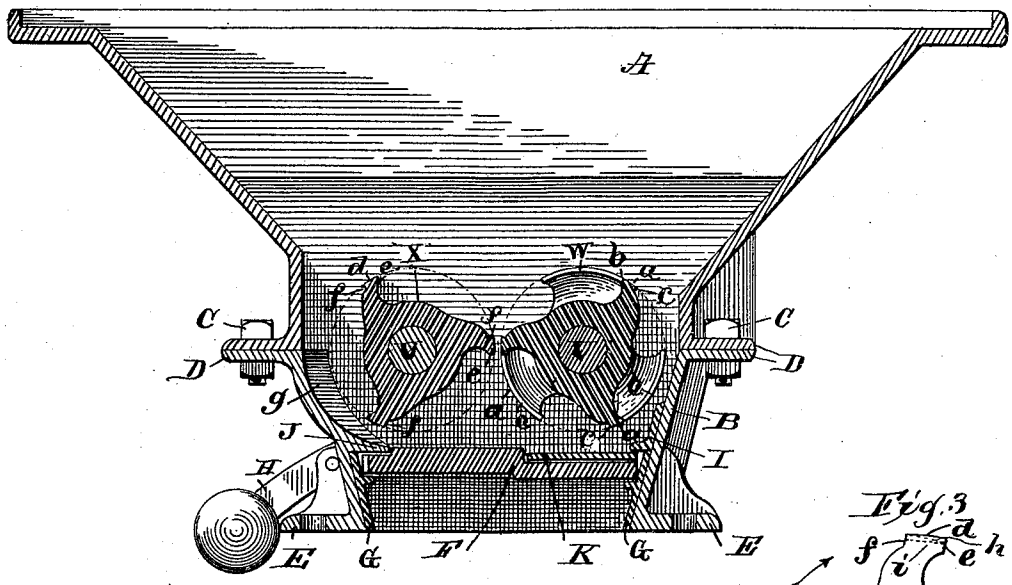


Fig. 3

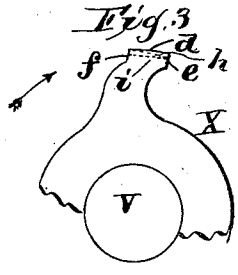
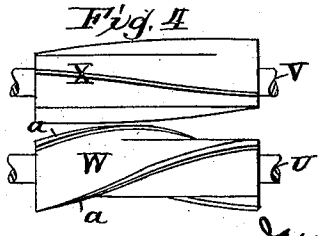


Fig. 4



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(No Model.) 2 Sheets—Sheet 2.

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CRUSHING AND GRINDING MILL.

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Fig. 5

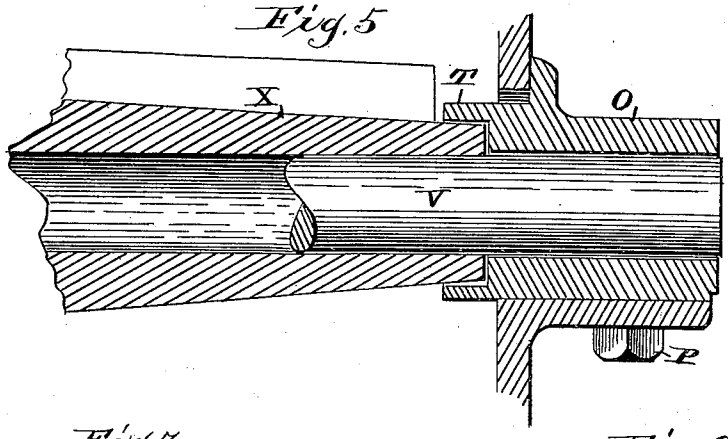


Fig. 7

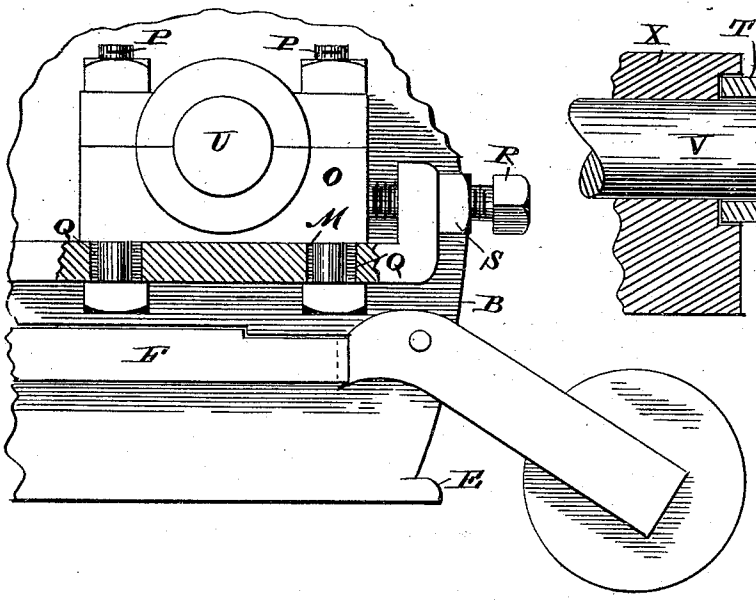


Fig. 6

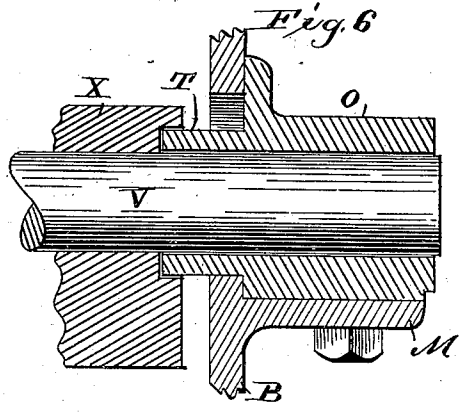
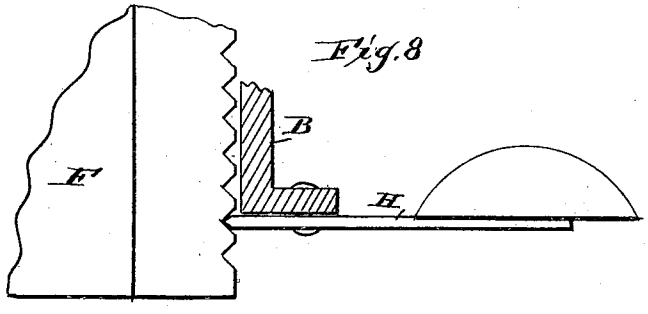


Fig. 8



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UNITED STATES PATENT OFFICE.

JAMES F. WINCHELL, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE FOOS MANUFACTURING COMPANY, OF SAME PLACE.

CRUSHING AND GRINDING MILL.

SPECIFICATION forming part of Letters Patent No. 416,533, dated December 3, 1889.

Application filed February 8, 1889. Serial No. 299,150. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. WINCHELL, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Crushing and Grinding Mills, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in crushing and grinding mills, and it is designed with reference to the initial reduction of ear-corn, either with or without the shuck on the ears, of bones, bark, and other refractory substances.

The improvements have reference to the employment, in a hopper or other portion of the mill-casing, of a crusher having spiral peripheral cutting or crushing edges and a co-operating crusher having substantially axial peripheral similar cutting-edges for the purpose of effecting a draw cut between the opposing edges of the two crushers to facilitate the reduction of the material and its disintegration in cases where it is of a fibrous nature; have reference to the form of the cutting parts of the crushers, which are so fashioned that each constitutes a cutting or crushing face with two distinct cutting or crushing edges or corners; have reference to interchangeably rotating either of the crushers at a greater speed than its associate, so as to effect the cutting action between the forward cutting-edge of the fast crusher and the rear cutting-edge of the slow crusher, so as to wear first one edge or corner and then the other edge or corner of the cutting-surfaces of the said crushers, whereby the duration or life of such crushers is greatly prolonged, and whereby the wearing of one of such edges tends to make the other sharper, thus keeping up a self-sharpening action, the crushers being adjustable toward each other to compensate for the general reduction in their diameters occasioned by such wear; have reference to combining spirally-arranged beads or ribs with the crusher whose peripheral edges are substantially axial, so that such crusher will feed the material as well as if its peripheral edges were in a spiral direction; have reference to providing means for preventing the shuck and other fibrous material from winding around the crushers and being packed between either of them and the wall of the hopper, which will result in choking the mill and lessening its output, and have reference to certain details of construction and arrangement hereinafter more fully pointed out.

In the accompanying drawings, forming a part of this specification, and on which like reference-letters indicate corresponding parts, Figure 1 represents a plan view of a portion of a hopper with my improved crushers and the several adjunct features applied thereto; Fig. 2, a vertical sectional view of Fig. 1 on the line x x thereof; Fig. 3, a detail view of one of the crushers, showing more clearly the construction of the cutting features; Fig. 4, a view of the two crushers, showing one of them with its cutting-surface slightly spiral; Figs. 5 and 6, sectional views of portions of the crushers, their shafts, the journal-boxes, and adjacent part of the hopper, showing the means of preventing the winding of the shucks, &c.; Fig. 7, an enlarged fragmentary end view of a portion of the hopper, a crusher-shaft, its box, and the means of adjusting the same; and Fig. 8, a plan view and partial sectional view of portions of the cut-off, the gravitating detent, and the hopper.

The letter A designates the hopper or upper portion of the casing of a grinding-mill of any approved type, but preferably of the type shown and described in Letters Patent issued March 15, 1887, No. 359,588, to my assignees of this case, The Foos Manufacturing Company, of Springfield, Ohio. This hopper has secured to it a portion B by means of nuts and bolts C and flanges D, while this portion is in turn adapted to be connected with the casing proper of the mill by devices which engage the openings in the flanges E. In the portion B of the hopper I form ways for the support of a cut-off F, the ways being preferably composed of flange-strips G, secured at the sides of the hopper-throat. This cut-off is serrated at one end, as seen in Fig. 8, and is engaged by the short end of a pivoted gravitating detent H, whereby it is locked at different positions. The right strip G has a flange above the cut-off, as shown at

I in Fig. 2, while the hopper at the opposite side is fashioned with a similar flange J. These latter flanges prevent the cut-off from upward displacement. The cut-off in cross-section is preferably of the shape shown in Fig. 2, the rabbet on the upper side affording a seat for a supplemental cut-off K, which is adjusted back and forth on the main cut-off and secured by a thumb-nut L, as seen in Fig. 1.

The details of the supplemental cut-off are not material to the present improvements, and are not therefore more fully illustrated.

At either end the hopper is constructed with a shelf or ledge M, either of one piece with it or of a separate piece secured to it in any desired manner. Upon these ledges M are placed and bolted the boxes O of the crusher-shafts, the bolts P of which pass through the slots Q in the shelves M, so as to admit of adjusting the blocks toward each other as the crushers lessen in diameter in consequence of wear.

The ends of each shelf M carry an adjusting-screw R, provided with a jam-nut S, and are used to adjust the boxes toward each other a very slight distance at a time. From Figs. 5 and 6 it will be seen that the boxes O are constructed with a forwardly-projecting annular flange T, which flange and the adjacent end of the crusher overlap each other, the flange or crusher being the male member, according to the diameter of the crusher, as also suggested in Figs. 5 and 6. In either case the flange affords a fixed or non-moving surface between the walls of the hopper and the end of the crusher, and it is around this surface that the shuck or fibrous material will lodge and accumulate to a small extent, but only to a small extent, as I have found by experiment and in practice; nor will it bind against the crusher and continue to increase in quantity and pressure until it affects and finally stops the mill when this fixed surface is afforded for it to collect on. If such surface is not provided and strips of material get between the ends of the crushers and the wall of the hopper, they will wind and increase and harden until it will require to be cut with a chisel to remove it, as I have also ascertained in practice. With this surface, however, the difficulty is overcome.

The letters U and V designate the crusher-shafts, upon which are secured, in any convenient manner, the crushers proper W and X, constructed of cast iron or steel, or both, or other suitable material. In speaking of the crushers in this specification it will be understood that I refer to these devices as a whole.

On the respective shafts of the crushers are mounted a pinion Y and a driving-wheel Z, having a pinion Z′ connected thereto or formed therewith. The pinions Y and Z′ are of different diameter, as indicated in the drawings, and are interchangeable, as also the gear-wheel Z, from one shaft to the other, so as to rotate either crusher faster than the other. As shown, the crusher X will travel faster than the crusher W. The wheel Z receives motion from some convenient part, preferably the main shaft of the mill when the hopper is mounted upon it.

The crusher W is constructed with a number of spiral cutting or crushing surfaces *a*, having cutting or crushing edges *b* and *c*, which I term, respectively, the "forward" and "rear" cutting or crushing edges. The crusher X is constructed with the same cutting or crushing surfaces *d*, having cutting-edges *e* and *f*, respectively, which I also term "forward" and "rear" cutting or crushing edges. The surface *d* and the edges *e* and *f*, however, are either axial in their direction, or substantially so—that is to say, are practically axial as compared to the pronounced spiral direction of their coacting surfaces *a* and edges *b* and *c*. The object of this arrangement as regards the direction of these surfaces and edges of the respective crushers is to afford a draw cut between them, so as to co-operate in the crushing, reduction, and disintegration of the material, which draw cut is particularly valuable in disintegrating shucks and other fibrous material.

In order to enable the crusher X to feed the material toward the left-hand end of the hopper, as seen in Fig. 1, in which direction the crusher W feeds the material, so that it will drop over the inner end of the cut-off when the latter is partly drawn out, I provide the hopper, near the said crusher X, with spiral ribs or beads *g*, which tend to move the material in said direction as it is forced against them.

I have already alluded to the difference in the speed of the two crushers and to the result this effects in relation to the coaction between the forward and rear cutting-edges, respectively, of the two crushers. I find in the practical operation of these improvements that the edges *e* of the crusher X will coact with the edges *c* of the crusher W, when geared as shown in Fig. 1. I also find that when the pinions Y and Z′ and the gear-wheel Z are transferred from one shaft to the other of the crushers the edge *b* of the crusher W will coact with the edges *f* of the crusher X. The result of these actions is first to wear the surfaces *a* and *d* in the direction of the dotted lines *h*, and then in that of the dotted lines *i* in Fig. 3. Thus when one edge becomes dull the wear can be shifted to the other edge and the edge first dulled resharpened during the operation of dulling the second edge. This greatly lengthens the durability or time of usefulness of the cutting-edges, while, as the diameter of the crushers thus lessens, they can be adjusted together to preserve their proper distance apart through the adjustable boxes already described.

In Fig. 4 I have illustrated the crusher X with its surfaces D and edges *e* and *f* run-

ning in a slightly spiral direction, in which case the ribs *g* will be disposed to suit the particular pitch of such surfaces and edges. I have illustrated this variance from the axial direction of said surfaces and edges in order that it may be understood that I do not confine myself to running such surfaces and edges in a precisely axial direction. There are other ways of adjusting the rollers toward each other, and I do not wish to limit myself to the means shown and described for this purpose. Nor yet do I wish to be understood as limiting myself to a differential speed between the crushers when one of them has pronounced spiral cutting or crushing edges and the other approximately axial cutting or crushing edges, though I prefer to run them at different speeds, and to first run one and then the other at the higher speed.

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

1. In a mill, the combination, with a hopper, of two crushers mounted therein, one of which is constructed with peripheral spiral cutting or crushing edges and the other with approximately axial peripheral cutting or crushing edges and oblique ribs or raised surfaces within the hopper, and near to the latter crusher, whereby a longitudinal feeding action is obtained by the conjoint operation of said latter crushers and the oblique ribs or surfaces, and mechanism to rotate said crushers.

2. In a mill, the combination, with a hopper, of two crushers mounted therein, one of which is constructed with peripheral spiral cutting or crushing edges and the other with approximately axial peripheral cutting or crushing edges, and a gear-wheel and pinion mounted on the shaft of one of the crushers and a larger pinion on the shaft of the other crusher, the said gear-wheel and pinions being interchangeable from shaft to shaft.

3. In a mill, the combination, with a hopper, of two crushers mounted therein, one of which is constructed with spiral peripheral cutting or crushing edges and the other with axial peripheral cutting or crushing edges, bearings in which said crushers are mounted, capable of adjustment one with respect to the other, and a gear-wheel and pinion mounted on one shaft and a larger pinion on the other shaft, said gear-wheel and pinions being interchangeable from shaft to shaft, and oblique ribs on the inner side of the hopper and near to the crusher with axial cutting-edges, whereby a longitudinal feeding action is obtained by the conjoint operation of said latter crusher and the oblique ribs or surfaces.

4. In a mill, the combination, with a hopper, of two crushers mounted therein, one of which has spiral peripheral surfaces, each surface having two cutting-edges, and the other of which has axial peripheral cutting-surfaces, each surface having two cutting-edges, and mechanism for rotating said crushers toward each other at differential speeds, whereby a draw cut is effected between the forward cutting-edge of one crusher and the rear cutting-edge of the other crusher for the disintegration of fibrous material.

5. In a mill, the combination, with a hopper, of two crushers mounted therein, with the bearings thereof adjustable with respect to each other, one of said crushers having spiral peripheral surfaces, each surface having two cutting-edges, and the other of said crushers having axial peripheral surfaces, each surface having two cutting-edges, and gearing interchangeable from one crusher-shaft to the other and imparting differential speed to said crushers, whereby a draw cut is effected between the forward cutting-edges of one crusher and the rear cutting-edges of the other crusher for the disintegration of fibrous material.

6. In a mill, the combination, with the hopper and a shaft-box secured thereto and provided with an inwardly-projecting annular flange, of a crusher whose shaft is mounted in said box and the end of which is annularly recessed and extends over said flange.

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

JAMES F. WINCHELL.

Witnesses:

CHASE STEWART,

WARREN HULL.