No. 617,345. Patented Jan. 10, 1899.

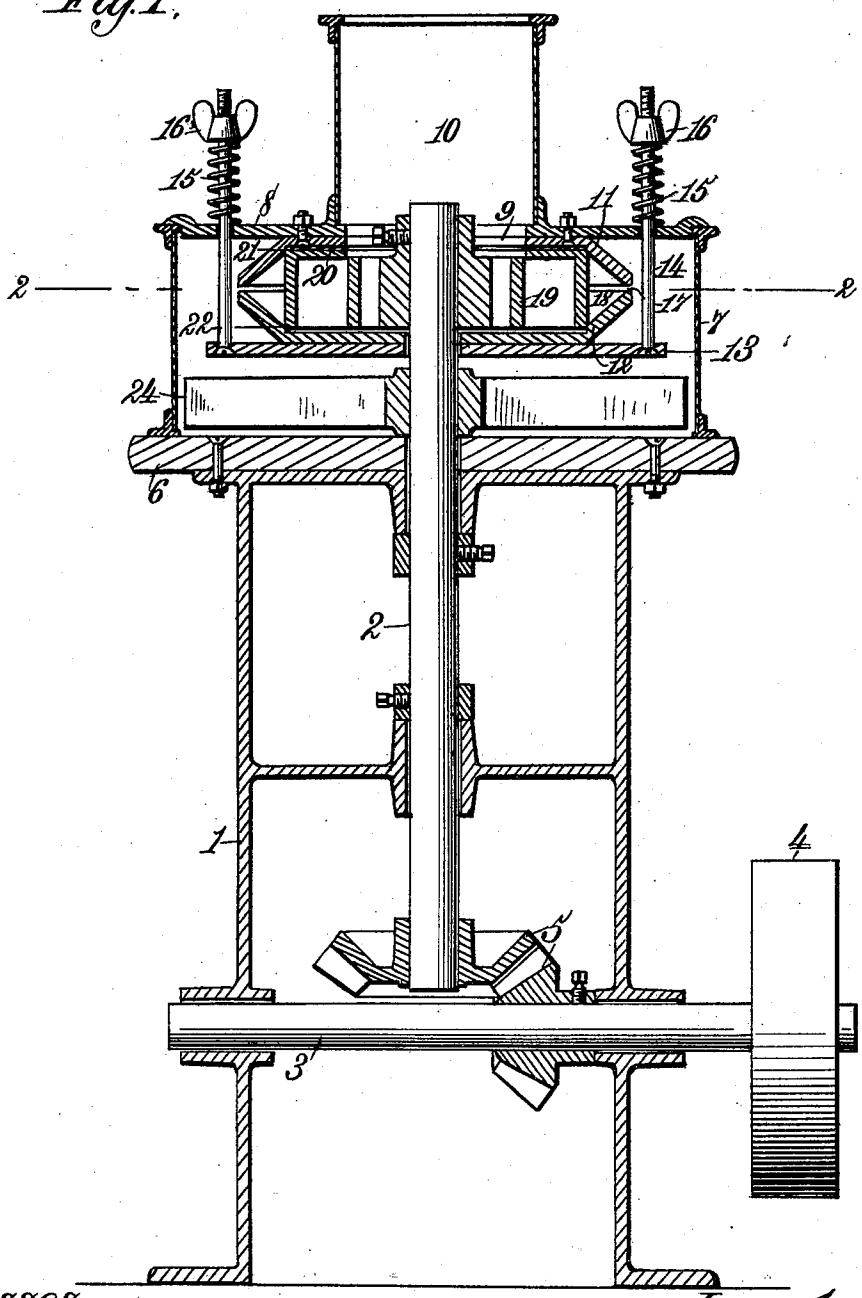
J. E. MITCHELL.

GRINDING MILL.

(Application filed Mar. 26, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

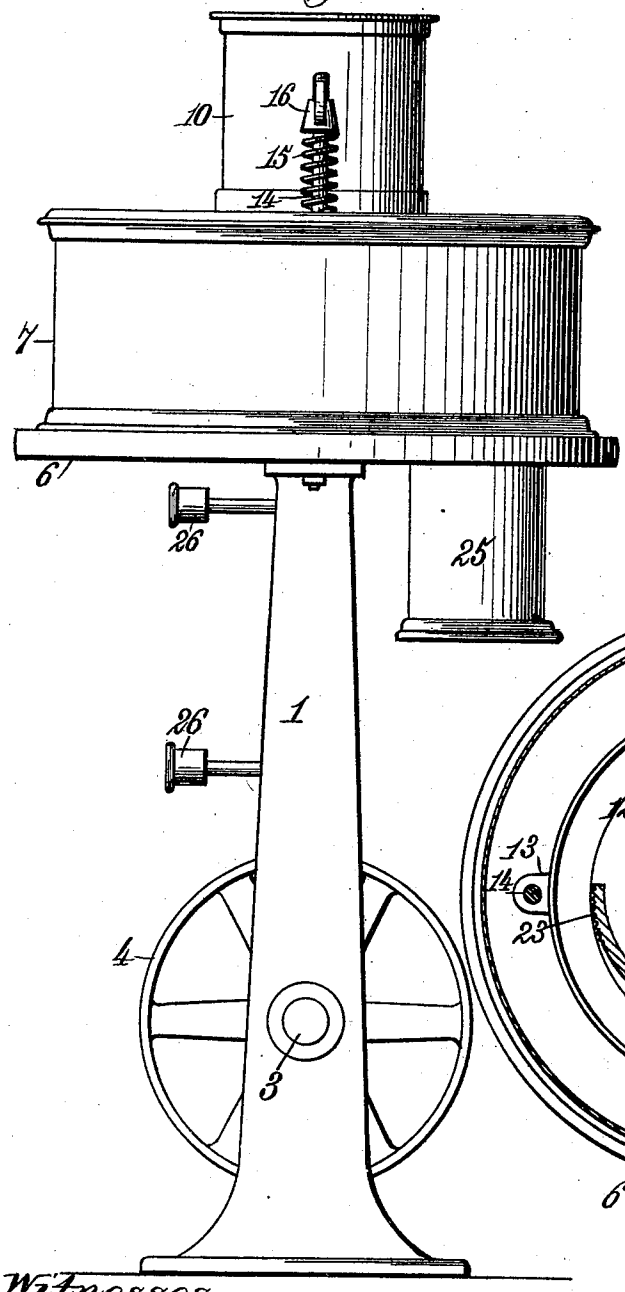
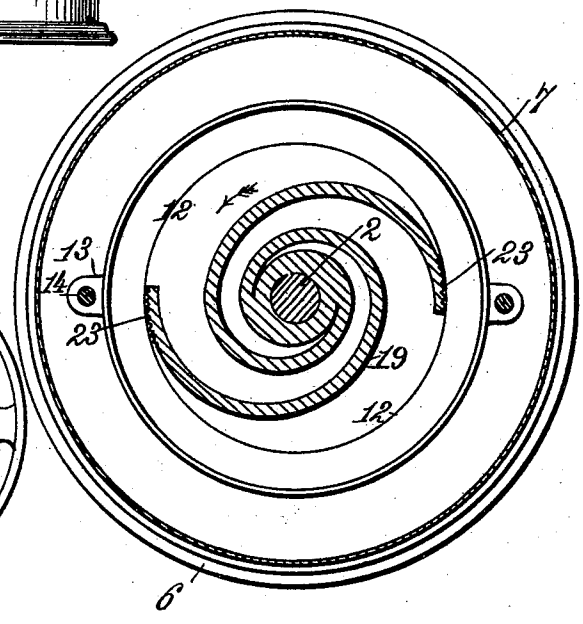


Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN E. MITCHELL, OF JACKSON, MICHIGAN.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 617,345, dated January 10, 1899.

Application filed March 26, 1898. Serial No. 675,301. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. MITCHELL, a citizen of the United States, residing at Jackson, in the county of Jackson and State of Michigan, have invented new and useful Improvements in Grinding-Mills, of which the following is a specification.

My invention relates to grinding-mills that are more particularly designed for the reduction of middlings and other products of wheat flouring-mills that have been previously sized or flattened, as by the action of a roller-mill.

It is a principal object of this invention to provide simple and thoroughly effective mechanism for disintegrating and pulverizing the material to be treated and at the same time avoid the cutting action that attends the employment of millstones, grinding-burs, or rotary disks or rings and the flattening action of the roller process of grinding.

To this end it is the purpose of my invention to effect the reduction of middlings and similar material by the abrasive action of rotary, spiral, or convolute blades operating upon an accumulated body of such material confined under an automatically-regulated pressure in an annular chamber of wedge-shaped cross-section between the converging peripheral portions of two reversely-dished and stationary pressure-plates. The material acted upon is disintegrated between the abrasively-acting surfaces of the extreme ends of said rotary convolute blades on one hand and the converging walls of the confining pressure-plates on the other hand, and the reduced material is continuously forced outward through an annular adjustable opening formed by and between the opposing circumferential edges of the stationary pressure-plates.

Other purposes and objects of the invention will appear from the features of construction and novel combinations of parts in a grinding-mill, as hereinafter more particularly set forth.

In the annexed drawings, illustrating the invention, Figure 1 is a vertical section of my improved grinding-mill. Fig. 2 is a horizontal section on the line 2 2 of Fig. 1. Fig. 3 is an elevation of the grinding-mill at a right angle to Fig. 1.

Referring to the drawings, the numeral 1 designates a substantial main frame provided with suitable bearings for a vertical shaft 2 and a lower horizontally-arranged shaft 3 to which a driving-pulley 4 is secured, the said shafts 2 and 3 being connected by bevel-gearing 5, as shown.

To the top of the main frame 1 there is securely bolted the bottom 6 of a stationary cylindrical casing 7 by which the upper portion of the vertical shaft 2 is surrounded. The cylindrical casing 7 has an upper head or cover 8, in the center of which is a circular feed-inlet 9, around which a cylindrical feed-hopper 10 is mounted.

An annular and dished upper pressure-plate 11 is bolted in an inverted position to the under side of the cover 8, around the feed-inlet, and a dished lower pressure-plate 12 is adjustably supported beneath. This lower pressure-plate 12 is supported underneath by a horizontally-arranged plate or bar 13, that is suspended by means of rods 14, which are extended through the cover 8 and surrounded by spiral springs 15, resting on said cover. The upper ends of these rods 14 are screw-threaded for attachment of thumb-nuts 16, bearing on the springs 15, which thereby provide a yielding and adjustable support for the lower pressure-plate. Obviously any other suitable means may be provided for adjusting the lower pressure-plate if desired.

It will be observed by reference to Fig. 1 that the pressure plates or disks 11 and 12 are reversely dished and that their beveled or dished peripheral portions are spaced apart, so as to afford an annular opening 17, leading out from an annular chamber 18 of wedge-shaped cross-section, the upper and lower walls of which are formed by the converging portions of said pressure-plates. Obviously the width of the annular opening 17 can be increased or diminished, as may be desired, by simply adjusting the thumb-nuts 16 on the screw-rods 14, that suspend the lower dished pressure-plate. Both pressure-plates 11 and 12 are stationary except for the vertical adjustment given to the lower plate.

The upper portion of the vertical shaft 2 carries spiral blades 19, Figs. 1 and 2, that are arranged to rotate in a horizontal plane between the stationary dished pressure-plates

11 and 12 in the direction of the arrow shown in Fig. 2, so as to have a conveying action from the center to the circumference. On the top of the scroll formed by the spiral or convolute blades 19 at their outer ends there is secured an annular flange 20, the inner periphery of which coincides with the central feed-inlet 9 through the cover 8 and upper dished pressure-plate. This annular flange 20 turns with the spiral blades 19 in a circular guideway 21, formed in the inverted upper dished pressure-plate 11, and a similar guideway 22 may be formed in the lower dished plate 12 for the lower edges of the spiral blades.

The annular flange 20 provides a brace for the spiral blades 19 and also serves as a guard, so that as the material to be disintegrated and pulverized is fed into the machine through the hopper 10 it will first drop to the central portion of the scroll and then be at once conveyed outward by the spiral blades and forced into the annular wedge-shaped chamber or space 18 and thence through the annular opening 17 in its periphery. There is no such flange at the bottom of the scroll, because in that situation it would afford an objectionable lodgment for the material, and would thereby interfere with the required action of the spiral blades. The degree of pressure necessary for forcing the body of material out through the annular opening 17 depends on the raising and lowering of the lower pressure-plate 12 by means of the adjusting thumb-nuts 16 on the suspension-rods. It is obvious that the more narrow the annular opening 17 the greater will be the pressure necessary for forcing a given quantity of material through said opening, and consequently the finer will the material be pulverized. The pulverizing or disintegration of the material is effected by abrasive action of the ends of the rotary convolute blades 19 against the accumulated layer of material confined under pressure between the converging walls of the dished plates 11 12, the degree of this pressure being determined by the adjustment of the lower pressure-plate. The lower pressure plate or disk 12 is held in yielding suspension by the springs 15, the action of which allows said lower plate to yield somewhat, so as to adjust itself automatically to any slight irregularities in the bulk or quantity of material being fed into and through the machine. A regulated adjustment can be given by means of the thumb-nuts 16, as before described. To increase the disintegrating and pulverizing action of the convolute or spiral blades 19, their outer end portions may be provided with corrugations 23, Fig. 2, if desired, or the ends of the blades may be left smooth.

The reversely-dished pressure plates or disks 11 and 12 are stationary except for the vertically-yielding adjustment of the lower plate, it being the purpose of these plates to confine the material under a regulated pressure while disintegration or pulverizing is effected through the friction induced by the bulk of material acted on by the rotary spiral blades.

The pulverized material passing through the narrow annular opening 17 falls onto the bottom 6 of the cylindrical casing 7 and is then carried by rotary arms or sweeps 24 to a discharge-spout 25, Fig. 3, through which it makes its exit from the machine. The rotary arms 24 are carried by the vertical shaft 2 and operate within the lower part of the casing 7, from the bottom of which the discharge-spout 25 depends.

In Fig. 3 the number 26 designates lubricating devices for the bearings of the vertical shaft 2, by which the abrasive scroll-blades 19 and sweep-arms 24 are carried.

With this machine the material acted on is disintegrated or reduced by abrasive action of the convolute or spiral blades 19 against the layer of material confined between the converging walls of the stationary and reversely-dished pressure-plates 11 12, and the annular circumferential opening 17 is simply to afford automatic discharge of the reduced material as controlled by the yielding adjustment of the lower pressure-plate. The more pressure necessary to open or widen this annular passage 17 the more severe will be the abrasive or disintegrating action of the scroll-blades 19 on the material passing between the ends of said blades and the converging peripheral portions of the dished pressure-plates.

The machine is thoroughly operative, practical, and successful for the reduction of fine middlings, stock, or material that has been sized down or flattened by previous reductions of a roller-mill.

What I claim as my invention is—

1. In a grinding-mill, the combination with stationary dished pressure-plates, one inverted over the other with an annular automatically-adjustable opening between the adjacent edges of said plates and a central feed-inlet through the upper plate, of rotary spiral blades mounted between said dished plates to exert a disintegrating action on the layer of material confined between the converging walls of said plates and the rotary spiral blades and force the disintegrated material outward through said annular opening, substantially as described.

2. In a grinding-mill, the combination of a stationary casing having in its top a central feed-inlet, stationary dished pressure-plates, one inverted over the other with an annular automatically-adjustable opening between the adjacent edges of said plates, the upper plate being provided with an annular opening in communication with the central feed-inlet, and rotary spiral blades mounted between said dished plates to exert a disintegrating action on the layer of material confined between the converging walls of said plates and the rotary spiral blades and force

the disintegrated material outward through the annular opening between said plates, substantially as described.

3. In a grinding-mill, the combination of a stationary vertical cylindrical casing provided at the top with a central feed-inlet, a stationary annular upper dished pressure-plate secured in said casing in an inverted position around the under side of the feed-inlet, a stationary lower dished pressure-plate supported in said casing below the annular upper dished plate with an annular opening between the adjacent edges of said plates, and rotary spiral blades mounted between said dished plates to exert a disintegrating action on the layer of material confined between the converging walls of said plates and the rotary spiral blades and force the disintegrated material outward through the annular opening between said plates, substantially as described.

4. In a grinding-mill, the combination of a stationary vertical cylindrical casing having in its top a central feed-inlet and provided with a discharge-spout at the bottom, a stationary annular upper dished pressure-plate secured in said casing in an inverted position around the under side of the feed-inlet, a stationary lower dished pressure-plate supported in said casing below the annular upper dished plate, the said plates having an annular opening between their opposite edges, means for adjusting the said lower plate vertically to vary the width of said annular opening, a vertical rotary shaft extended centrally through said stationary casing and inclosed stationary plates, rotary spiral blades mounted on said shaft between the said pressure-plates to exert a disintegrating action on the material confined between the converging walls of said plates and the rotary spiral blades and force the disintegrated material outward through the annular opening between said plates, and rotary arms carried on the vertical rotary shaft immediately below the lower pressure-plate to convey the reduced material to the discharge-spout, substantially as described.

5. In a grinding-mill, the combination of a vertical rotary shaft, a cylindrical casing supported around a portion of said shaft and having an upper head or cover provided with a central feed-inlet, a discharge-spout in the bottom of said casing, an annular upper dished pressure-plate secured in an inverted position in the upper part of said casing around its feed-inlet, a lower dished pressure-plate movable to and from the said upper plate to vary the width of an annular opening between the peripheral edges of said plates, rotary spiral blades mounted to operate in a horizontal plane between said reversely-dished pressure-plates, rods for suspending the lower pressure-plate, springs and adjusting-nuts on said rods, and rotary arms mounted below the pressure-plates to convey the disintegrated material to the discharge-spout, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN E. MITCHELL.

Witnesses:
C. R. KNICKERBOCKER,
JNO. G. MUNDY.