A. M. DELLINGER.

GRINDING AND CRUSHING MILL.

APPLICATION FILED JUNE 8, 1911.

1,074,844.

Patented Oct. 7, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

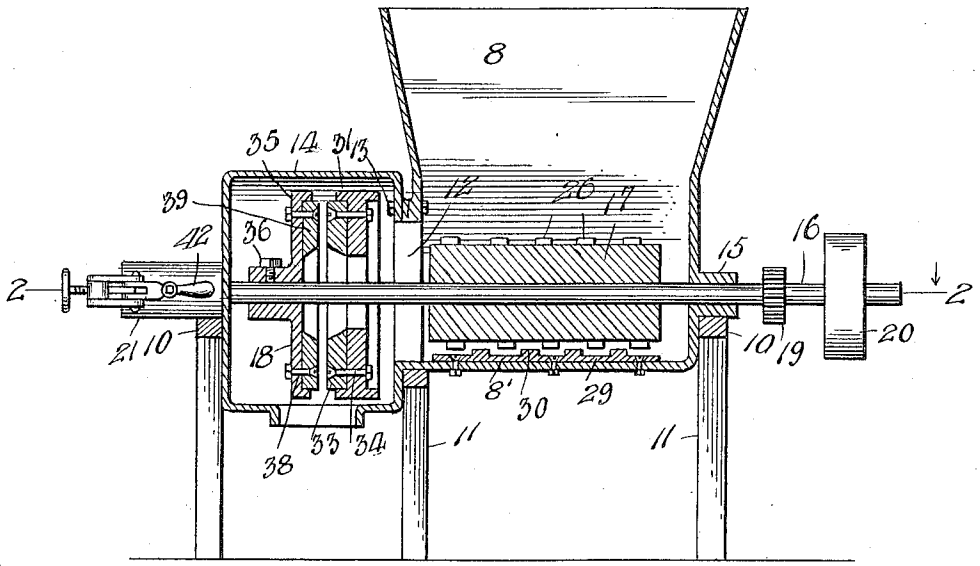
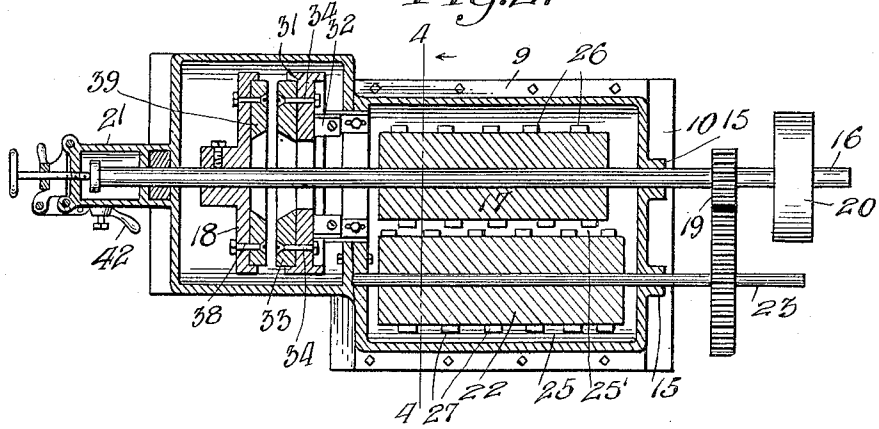


Fig. 2.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

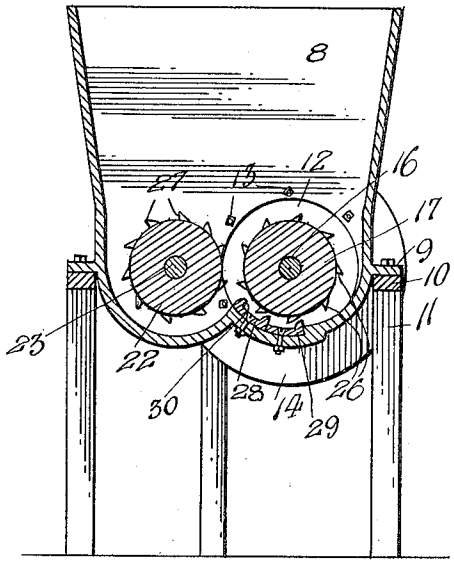


Fig. 4.

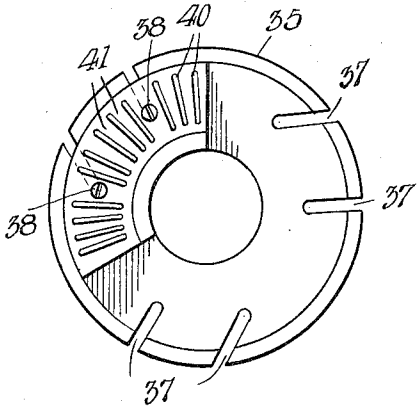


Fig. 5.

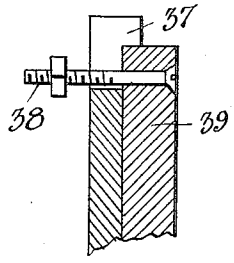
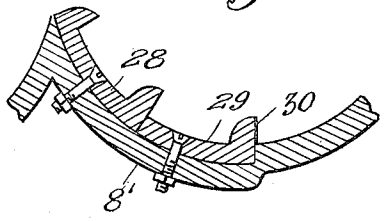


Fig. 6.



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UNITED STATES PATENT OFFICE.

ABRAHAM M. DELLINGER, OF LANCASTER, PENNSYLVANIA.

GRINDING AND CRUSHING MILL.

1,074,844. Specification of Letters Patent. Patented Oct. 7, 1913.

Application filed June 8, 1911. Serial No. 632,073.

To all whom it may concern:

Be it known that I, ABRAHAM M. DELLINGER, a citizen of the United States of America, and resident of Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Grinding and Crushing Mills, of which the following is a specification.

The main objects of this invention are first to prevent the material to be crushed and ground from forming a bridge above the grinding devices, as will often happen when only a single crushing roll is used, necessarily requiring a narrow hopper very subject to such obstruction; secondly, to insure the crushing of the grain to the best advantage by employing side by side two crushing rolls rotating in opposite directions away from each other and toward the walls of the hopper at different rates of speed, said rolls and hopper providing a throat for the first crushing of the material between the slower roll and the hopper wall and a second throat for its subsequent treatment between the two rolls, the hopper having also a fixed concave, which in final treatment coöperates with the swifter roll, the more slowly revolving roll doing the harder part of the crushing work and the swifter roll and concave completing this work; thirdly, to make the operation of the machine more perfect as a whole by providing the driving shaft with a grinding disk and a crushing roll which coöperate respectively with a fixed grinding disk and a second crushing roll rotating at a less speed than the former roll, a hopper receiving said rolls in its lower part and being provided with a grinding concave which directly cooperates with the more swiftly revolving roll; and finally, in improving divers details of construction, adjustment and combination and thereby also improving the entire machine.

To these ends the said invention consists in the construction and combination of parts hereinafter more particularly set forth and claimed.

Figure 1 illustrates a vertical longitudinal section taken on a line with the main shaft; Fig. 2 illustrates a horizontal section on the line 2—2 of Fig. 1; Fig. 3 illustrates a transverse vertical section on the line 4—4 of Fig. 2; Fig. 4 illustrates an end elevation of one of the grinding disks showing one of the grinding sections in place thereon; Fig. 5 illustrates a detail sectional view on an enlarged scale; and Fig. 6 illustrates an enlarged sectional view of the bed plates and their adjuncts.

As shown by the illustration, the hopper 8 has converging sides, vertical ends and a bottom with converging portions that are eccentric to the center of the crushing rolls. The bottom of the hopper from its longitudinal center, which is the highest point of the bottom to a point to one side of the center of the main grinding roll, has a depression or recess 8′ for the reception of plates, which together constitute a crushing concave and coöperate with the roll on the main shaft in crushing. The hopper 8, when made of cast metal, has exterior flanges 9 for connecting the hopper to a supporting frame 10, that has legs 11. One of the end walls of the hopper 8 in line with the main roll, has an opening 12 of slightly larger area than the external diameter of said main roll and about this opening, the end wall has apertures for the passage of bolts 13 that connect thereto a casing 14 which is adapted to receive the grinding disks. The end of the hopper 8 farthest from the casing 14 has apertured bosses 15 and 15′ for the shafts of the crushing roll, and the main shaft 16, which carries the roll 17 and revolving disk 18, pinion 19 and drive pulley 20, extends within the housing 21 that projects from the casing 14, as shown by the drawings and as fully set forth in my patent numbered 855,099, dated May 28, 1907.

The crushing roll 22 is fixedly attached to a shaft 23 which, beyond the hopper, has a gear wheel that meshes with the pinion 19 on the drive shaft 16 and it will be noted that the crushing rolls are horizontal and parallel and revolve in opposite directions so that the material placed in the hopper will be carried by the projections on the surface of the rolls during their rotation toward the walls and bottom of the hopper.

As shown in Fig. 3, the side walls of the hopper converge downward nearly to the horizontal plane of the tops of the crushing rolls, then descend a short distance nearly vertically to the doubly curved bottom of

the hopper which forms two concave surfaces conforming to the curvature of the surfaces of the respective crushing rolls at an interval below them and rising to a point between them. This construction provides at each side of the hopper a downwardly tapering throat between the proximate crushing roll and wall, the same being continued or joined to a curved throat between said crushing roll and said bottom and joining the corresponding throat of the opposite side, which passes under the other roll. The downwardly tapering throat at the side of the more slowly moving roll will provide means whereby the material will be crushed between the rolls and the walls before engagement with the removable sections which constitute a part of the bottom of the hopper.

In operation, take for instance corn on the cob, either dry or green, and when the same is fed into the hopper it will fall upon the rolls 17 and 22. The rotation of the rolls, as to direction, is such that their upper surfaces move away from each other and toward the walls of the hopper. This direction of rotation prevents the corn arching or bridging over the rolls which would stop the feed thereto. The corn which comes in contact with the slowly revolving roll 22 is drawn through the converging way 25 and is reduced or crushed before leaving the highest point of the bottom of the hopper. This crushed material is carried upward by the conjoint action of the two adjacent faces of the rolls and the major portion of crushed material is carried by the rapidly revolving or high speed roll 17 upward and over into the more restricted throat or way 25′. The straight radiating faces of the projections 26 on the rolls carry the partially crushed material to the inserted grinding plates for further crushing. The projections 26 and 27 upon the rolls 17 and 22 are arranged spirally upon the surfaces of the rolls and such arrangement effects travel of crushed material lengthwise of the roll and toward the opening 12 into the space between the two vertically disposed grinders. The horizontal and parallel crushing rolls, one rotating at high speed and the other at a low speed and turning so that the faces adjacent to the walls of the hopper may be moved downward and the roll adjacent to the wider throat moving at a lower rate of speed than its companion roll, provides an organization by which the crushing of the major portion of the corn or grain and cobs is effected by the slower moving roll and after the first crushing, the material is further reduced by the high speed roll and is conveyed thereby through the narrow throat or way to the bed pieces beneath the high speed roll.

As before stated, the hopper has a depression for the reception of plates or bed pieces 28 and 29, these bed pieces having thereon longitudinal ribs or projections 30, the straight faces thereof fronting the direction of rotation of the roll 17 and said bed pieces or plates together constituting a crushing concave coöperating directly with said roll 17 only. As shown in Fig. 6, these bed pieces are attached by bolts which pass through apertures therein and register with longitudinal apertures or slots through the bottom of the hopper to provide for longitudinal adjustment thereof. The bed pieces are readily removable and by the use of filling pieces may be secured as desired relative to the fast moving rolls and said bed pieces in practice forming a continuation of the narrow throat 25′. The bed pieces 28 and 29 are preferably constructed to extend through the opening 12, such extensions having longitudinal slots for the passage of bolts 28′ and 29′ used to connect the bed pieces to the hopper adjacent to the opening.

The crushing rolls 17 and 22 are of the same diameter and are rotated at different speeds and in opposite directions with the ways or throats of different sizes, one having the bed pieces constituting a novel and useful improvement which is well adapted for use independent of other further reduction instrumentalities. The main and secondary rolls traveling at different surface speeds, not only taking less power to actuate but cause a variable action on the stock in the hopper and prevent the stock arching above the roll. The stock as fed between the rolls and the walls of the hopper and then upward, provides an arrangement whereby the larger pieces are crushed by the secondary roll and such pieces are further crushed and reduced by the rapidly revolving primary roll. The distance between the horizontal rolls is such that the sectional bed pieces may be removed or placed in position in the depression or recess therefor without removing either of the rolls.

Within the casing 14, about the opening 12, there is secured a disk 31, the periphery of which is provided with a rib or flange on one side with lugs 32 for the passage of bolts that attach the disk to the inner wall of the casing where the same is maintained centrally about the shaft 16 and at right angles thereto. This disk 31 on the opposite side from the lugs 32 has grinding sections 33 held in place by bolts 34, the nuts on the bolts passing through parallel slots formed in the disk, two bolts being used to connect each of the sections to the disk. The sections are segmental and a sufficient number are used to form a circle; the dress or grinding faces of the segments may be the same so that a description of one of the grinding disks will serve as a description of both. The revolving grinding disk 35 is

made fast to the main shaft by a set screw 36 and this disk has a flange which is traversed at intervals by parallel slots 37 for the passage of bolts 38 by means of which the segments 39 are secured in place. Fig. 4 of the drawings shows the dress of the segments, they having peripheral furrows 40 and radiating ribs 41 between which are located shorter ribs, or instead of ribs as indicated, there may be depressions or radiating furrows and these segments have their inner edges inclined to provide a space in which the crushed material is delivered and with this type of grinder, there is a central feed and a peripheral discharge.

The means or instrumentalities for adjusting the shaft, as shown in my prior patent numbered 855,499, is applied upon one side of the projection from the casing 14 instead of upon the upper side as shown in the patent, a horizontal pull upon the lever 42 being considered more desirable in practice than an upward pull.

By using two crushing rolls side by side instead of one roll only in coöperation with the hopper I avoid the narrowing of the hopper and the formation of a bridge in the material above the crushing devices. By using only two rolls instead of a greater number, while attaining excellent crushing action, I dispense with unnecessary and costly gearing as well as with the extra roll or rolls, avoid the greater operating cost and make the mechanism more simple and compact. By providing the relative degrees of rotation of the two rolls away from each other and adapting them, the hopper and concave to each other as stated we provide for an initial crushing action in the throat between the slower roll and the side of the hopper, a second crushing action on the lifted and partly crushed material in a narrower throat between the rolls and a final crushing action on this already twice crushed material, said final action occurring in the lateral extension of the latter throat and being between the more swiftly revolving roll and the concave. By using the same driving shaft to carry one of the crushing rolls and one of the grinding disks in combination with the fixed disk, the more slowly revolving roll and the hopper and adapting the rolls and hopper to provide the two throats and lateral throat extension and the successive crushing actions as specified, followed by the grinding action I provide for gradual and complete reduction of the material to a state of comparatively fine comminution, using very simple and strong and effective means to attain this end.

Having thus fully set forth my invention, I do not wish to be limited to the particular details of construction except where they are specifically claimed as in this type of machinery there may be a wide variance as to design, without departing from the essential features of my invention.

I claim:—

1. In combination with a hopper, a shaft carrying a crushing roll arranged in the bottom of said hopper, a second shaft carrying a crushing roll arranged beside the first in the bottom of said hopper and gearing between the said shafts arranged for driving the second shaft and roll from the first at a lower rate of speed, the said rolls turning away from each other at the top of the rolls and toward the walls of said hopper said rolls and the walls and bottom of the hopper being arranged to provide a downwardly tapering throat between the more slowly moving roll and the adjacent wall, through which throat the material to be crushed is first caused to descend, also a curved throat extending under said roll, between it and the bottom of the hopper and directing the material afterward up between the two rolls substantially as set forth.

2. In combination with a hopper, a main shaft carrying a crushing roll and a rotary grinding disk, said roll and disk acting successively on the material supplied by said hopper, a fixed grinding disk coöperating with the rotary disk aforesaid, a second shaft carrying a second crushing roll coöperating with the first mentioned roll and arranged beside it in the bottom of the hopper and gearing between these two shafts whereby the second shaft is driven from the first at a lower rate of speed and the said rolls turn away from each other at the top of the rolls and toward the walls of the hopper the said pair of rolls preventing the formation of a bridge by requiring the hopper to be broader immediately above them than would be feasible if only one roll were used.

3. In combination with a hopper, crushing mechanism arranged in the bottom thereof and consisting wholly of two rotary rolls arranged side by side and turning away from each other at the top of the rolls toward the walls of the hopper, a fixed crushing concave and gearing whereby one of the said rolls is rotated at a less rate of speed than the other, the said concave being arranged only under the more rapidly rotating roll and the more slowly moving roll providing a downward throat between it and the proximate wall of the casing and directing it under the said roll and the bottom of the hopper up between the two rolls whence it passes for final grinding out between the more swiftly moving roll and the bottom of the hopper, the latter being provided with a grinding concave under this more swiftly turning roll.

4. A pair of crushing rolls, in combination with a hopper in which they are lo-

cated, means for driving their upper surfaces away from each other and giving said rolls different rates of speed, the bottom of said hopper providing two curved faces under the said rolls respectively and rising in the middle toward the space between the more slowly moving roll and said casing and another throat between the said rolls and operating to crush the material first as it passes down through the first mentioned throat, then a second time as it is lifted up into the second throat and finally a third time as it passes under the more swiftly moving roll.

5. A pair of crushing rolls, in combination with a casing in which they are located and means for driving them at different rates of speed, their upper parts turning away from each other, the said rolls and hopper being constructed and arranged to provide a throat between the more slowly moving roll and said hopper and another throat between the two rolls and operating to crush the material first as it passes down through the first mentioned throat, then a second time as it is lifted up into the throat between the two rolls and finally a third time as it passes out under the more swiftly moving roll.

6. A pair of crushing rolls in combination with a casing in which they are located, means for driving them away from each other at the top of the rolls at different rates of speed and a fixed concave arranged in proximity to the more swiftly moving roll, the said parts being arranged to provide a throat between the more slowly moving roll and said casing and another throat between the said rolls and operating to crush the material first as it passes down through the first throat, then a second time as it is lifted up into the second throat and finally a third time as it passes between the concave and the proximate roll.

In testimony whereof, I have hereunto affixed my signature in the presence of two witnesses.

ABRAHAM M. DELLINGER.

Witnesses:
B. FRANK KREADY,
WM. M. HOLLOWBUSH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."