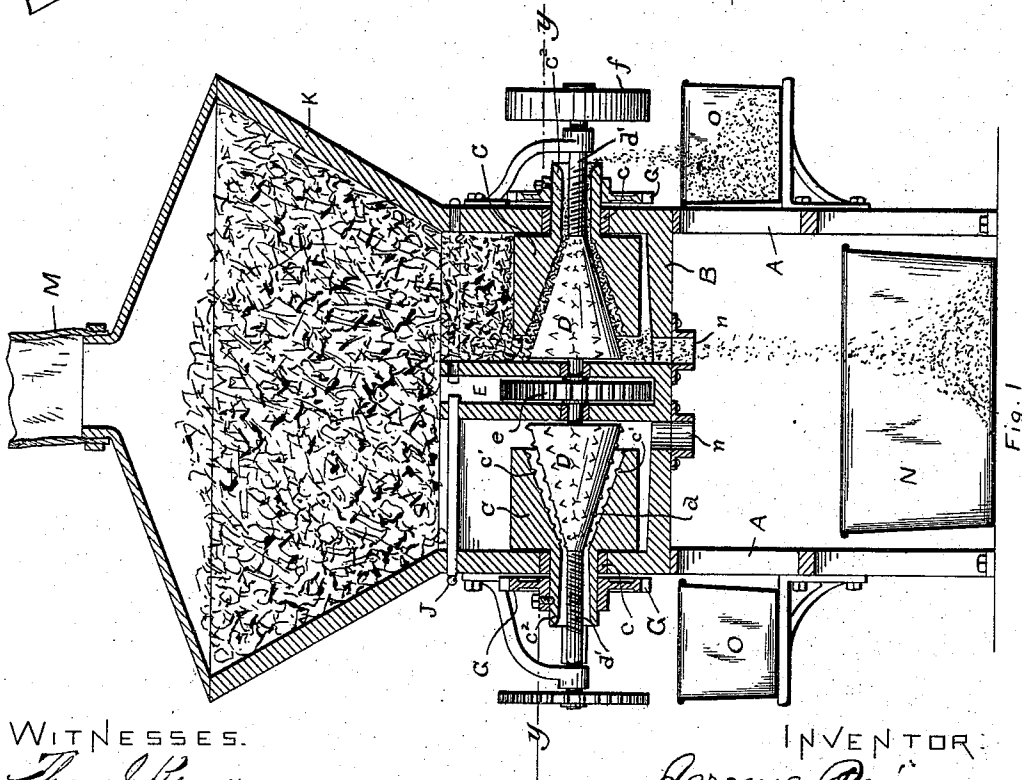
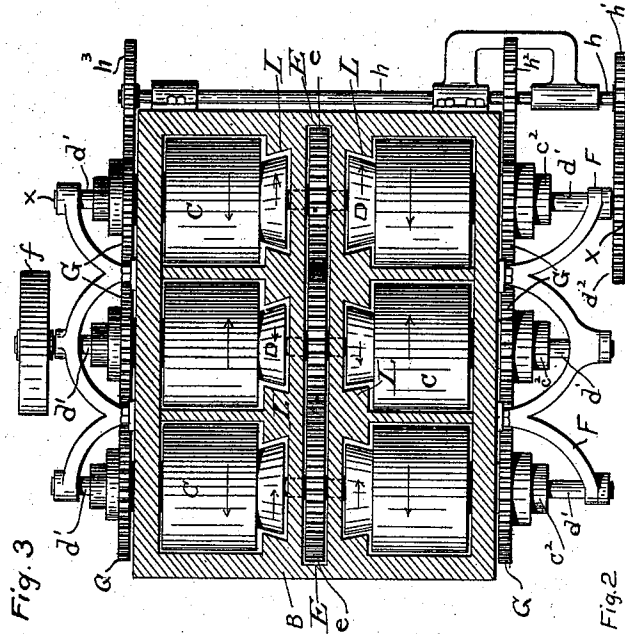
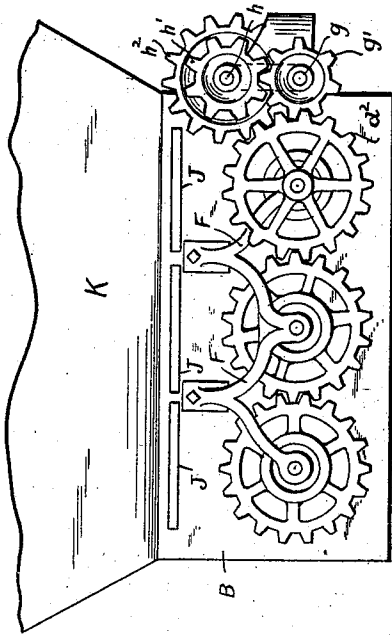


(No Model.)

J. PRINCE.
GRINDING OR CRUSHING MACHINE.

No. 533,018.

Patented Jan. 22, 1895.



WITNESSES.

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JEROME PRINCE, OF MILFORD, MASSACHUSETTS, ASSIGNOR OF ONE-HALF
TO EDWIN MORGAN, OF SAME PLACE.

GRINDING OR CRUSHING MACHINE.

SPECIFICATION forming part of Letters Patent No. 533,018, dated January 22, 1895.

Application filed November 2, 1893. Serial No. 489,782. (No model.)

To all whom it may concern:

Be it known that I, JEROME PRINCE, of Milford, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Grinding or Crushing Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention embodies various improvements in grinding and crushing machines, especially valuable in grinding bones, shells, and the like for fertilizers, or in crushing beets for sugar making.

A prominent feature of my invention is the horizontally arranged, tapering, male and female grinders between which the material to be crushed passes, discharging at either end. The outer or hollow female grinder has a tapering concavity and an enlarged hollow journal opening from the small end of such concavity. Through this hollow journal, bearing the driving gear, the prolonged stem of the inner or male grinder passes, such stem having a spiral flange or groove, like a coarse screw thread, to convey outwardly such of the ground material as has not escaped at the larger end of the conical roller. This male, inner roller has one bearing in the interior partition of the frame and the other, at the extremity of its prolonged stem, in a peculiar bracket fixed on the outer wall of the case. There are preferably two or more pairs of these grinders arranged end to end in the case, and fixed on the same continuous shaft, so that the end-wise thrust of one male grinder neutralizes that of the other. The gearing is so arranged that each inner grinder turns in the opposite direction from its female mate. A hopper common to all the grinders is provided, with a spout leading to it, and a slide controlling the feed of material to each pair. The hopper may be partitioned centrally, to provide for grinding different material on opposite sides.

In the drawings Figure 1 represents a vertical section of my improved machine on line $x-x$ of Fig. 2. Fig. 2 represents a horizontal section of the case and intermediate partitions on line $y-y$ of Fig. 1. Fig. 3 represents a front elevation of the gearing.

A is the frame of the machine upon which is mounted the case B. Disposed in the case B are one or more pairs of grinders, six pairs being shown in Fig. 2. The outer grinder C is mounted in bearings at c and has a conical opening through its length, the surface of said opening being broken by projections or corrugations C' . An enlarged tubular journal C^2 forms part of each grinder C as in Fig. 1.

Grinder C partially incloses a conical inside grinder D whose outer surface is preferably at an angle slightly more acute than the tapering inner walls of said grinder C. The surface of the male grinder D also has corrugations or projections d . Each shaft d' upon which the grinders D are mounted passes entirely through and projects from each side of the case B, such shafts carrying on them, within the central partition E, gears e which are shown in mesh with each other. The outer ends of the shafts d' are supported in bearings in the brackets F, one of the shafts d' having mounted on it, the driving pulley f . One of the end shafts d' has mounted on it a gear d^2 .

Grinders C have mounted on their tubular journals connecting gears G.

On one end of the case B is mounted a shaft g , bearing on it gear g' meshing with the gear d^2 . Bracket H supports above shaft g a second shaft h , which carries on one end the gear h' meshing with gear g' , and another gear h^2 which meshes with one of the outer guide gears G. Shaft h carries gear h^3 which connects with the rear train of gearing on the outer grinder C. Slides J regulate the amount of material fed to the grinders, each compartment having an independent slide.

K is the hopper and M the supply pipe from the large bin.

N is the receiver for the lower outlets, and O, O are the receivers for the side outlets.

If the gears G and e are of the diameters shown as compared with their respective grinders, and in mesh as represented, the middle set of grinders will turn in the opposite direction from those at either side. To cause all the male grinders to turn in one direction and all the female to turn the other

way, it is only necessary to reduce the diameter of their respective gears and introduce pinions between them.

The operation of the machine is as follows:

5 The material to be ground is contained in the hopper K and is supplied to the different compartments by withdrawing the slides J. Power applied to pulley *f*, is transmitted through the shaft *d'* to the series of inner
10 grinders D, by means of the gears *e*, which revolve them in the direction shown by the arrows. Power is transmitted to the outer or female grinders C, by means of the gear *d*² on the end of shaft *d'*, and through the gears *g'*,
15 *h'* and *h*² to the end gears G, on the front side, and by gear *h*³ on the rear. The extra gear *h* is used to reverse the motion of the outer grinder C from that of the inner grinders D, as shown by the arrows. The larger end of
20 each grinder D protrudes beyond the open end of the hollow grinder C, so that the bones or other materials to be ground rest upon its upper surface. At each side of these protruding ends, and in the horizontal plane of their axes is a solid ledge L, formed on or se-
25 cured to the partition E, as seen in Fig. 2. These ledges prevent the bones, &c., from passing down bodily at the ends of the rollers C and at each side of the protruding ends
30 D, and oblige the material to work into the annular space between these rollers, there to become disintegrated. These rollers revolve in opposite directions, the grinding surface of each moving upwardly toward the line
35 where the bones enter from above. A portion of the crushed material will naturally work toward the small end of the rollers D, to escape the pressure of the mass in the hopper, and other portions will escape at the large
40 end, as indicated in Fig. 1. The centrifugal tendency is resisted by this pressure and by the inclosing character of the rollers C.

The shafts *d'* are preferably threaded or spirally flanged from the apex of the cone to
45 the mouths of the tubes *c*², to aid in discharging the ground product. See Fig. 1.

Different grades of work are turned out by giving more or less space between the grinders.

I claim as my invention—

1. In a grinding or crushing machine, the tapered grinders C, D, working one within the other, with an annular space between them, the body of the inner grinder D extending at its larger end beyond the extremity
55 of the outer one and having an axial journal and bearing, and the outer grinder having at its opposite end a hollow journal surrounding the prolonged stem of the inner one, in combination with the wall or partition E and the
60 solid ledges L thereon, at each side of the protruding larger end of the grinder D, substantially as set forth.

2. In a grinding or crushing machine, a frame having a plurality of compartments,
65 horizontally disposed male and female toothed grinders working therein, gearing arranged to turn such grinders in opposite directions, a hopper common to all the compartments and a separate slide for each, in combination with discharge openings at both ends
70 of the grinders, substantially as set forth.

3. In a grinding or crushing machine, two inside conical grinders D D fixed on the same continuous shaft *d'*, with their bases toward
75 each other, so as to neutralize the endwise thrust in combination with two internally tapering female grinders C surrounding such inside grinders and formed with hollow axial extensions *c*² constituting their journals, and
80 with gearing applied to such projecting journals and to a connecting shaft, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of
85 two subscribing witnesses, on this 19th day of October, A. D. 1893.

JEROME PRINCE.

Witnesses:

A. H. SPENCER,
C. D. KEYES.