(No Model.) 4 Sheets—Sheet 1.

R. D. GATES.

PULVERIZING MACHINE.

No. 260,092. Patented June 27, 1882.

Fig 1.

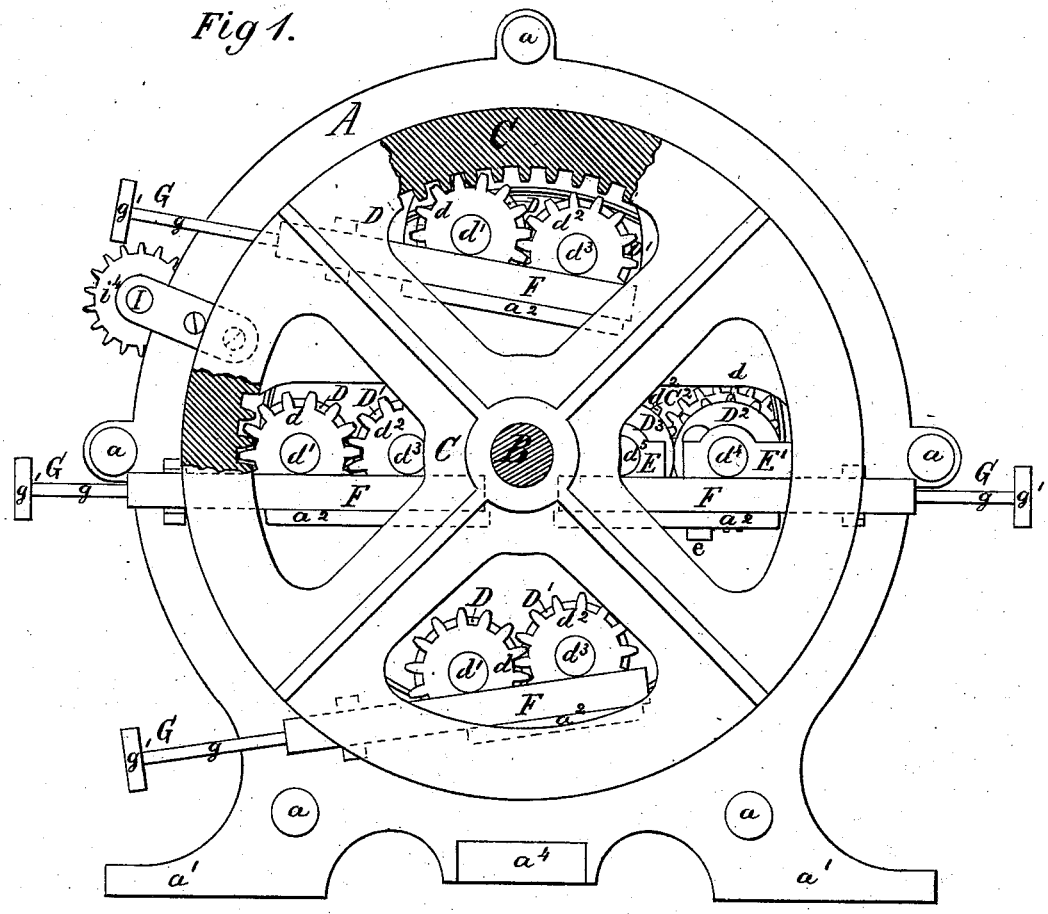
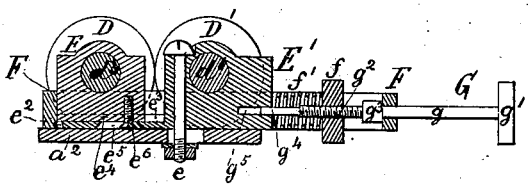


Fig 5.



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B. Carlyle Zenurek.

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by his Attorneys, Fenwick & Lawrence

(No Model.) 4 Sheets—Sheet 2.

R. D. GATES.

PULVERIZING MACHINE.

No. 260,092. Patented June 27, 1882.

Fig 2.

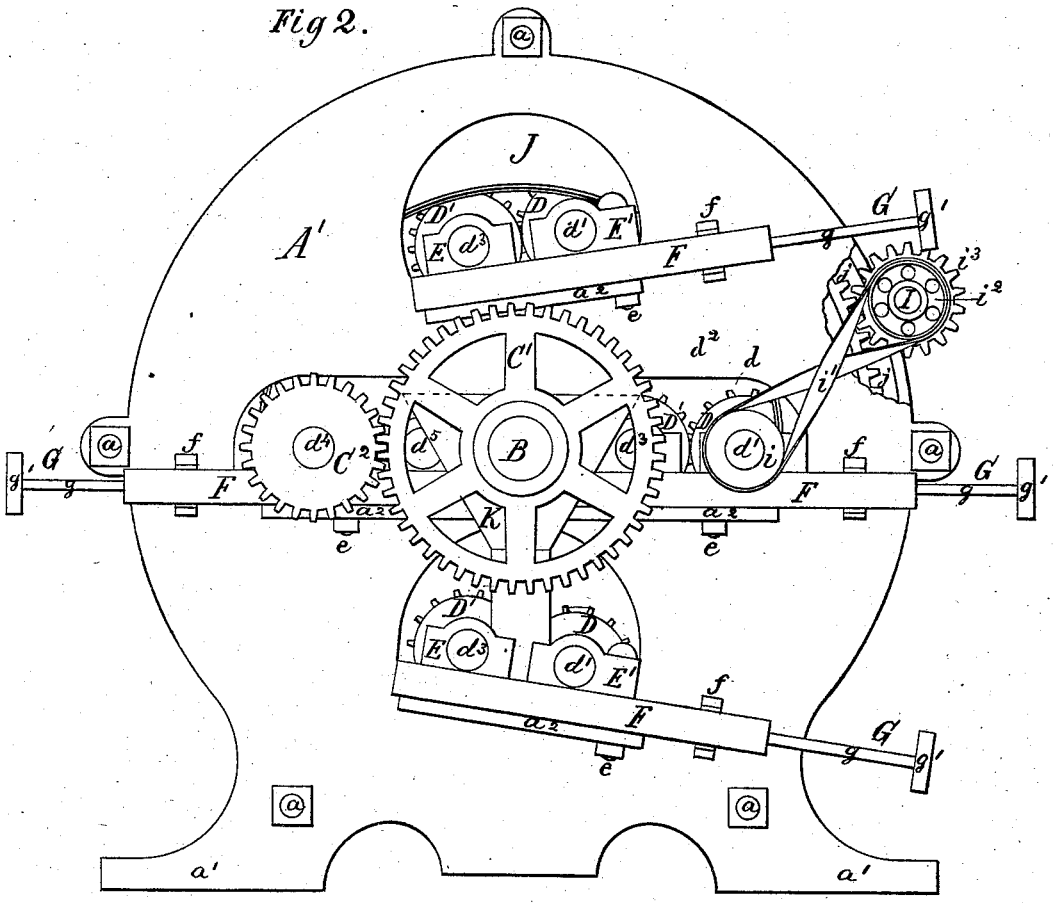
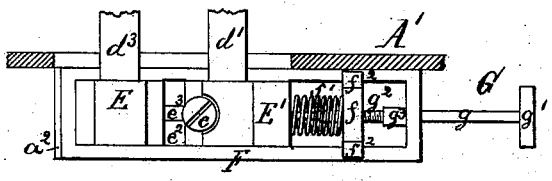


Fig 6.



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(No Model.) 4 Sheets—Sheet 3.

R. D. GATES.

PULVERIZING MACHINE.

No. 260,092. Patented June 27, 1882.

Fig 3.

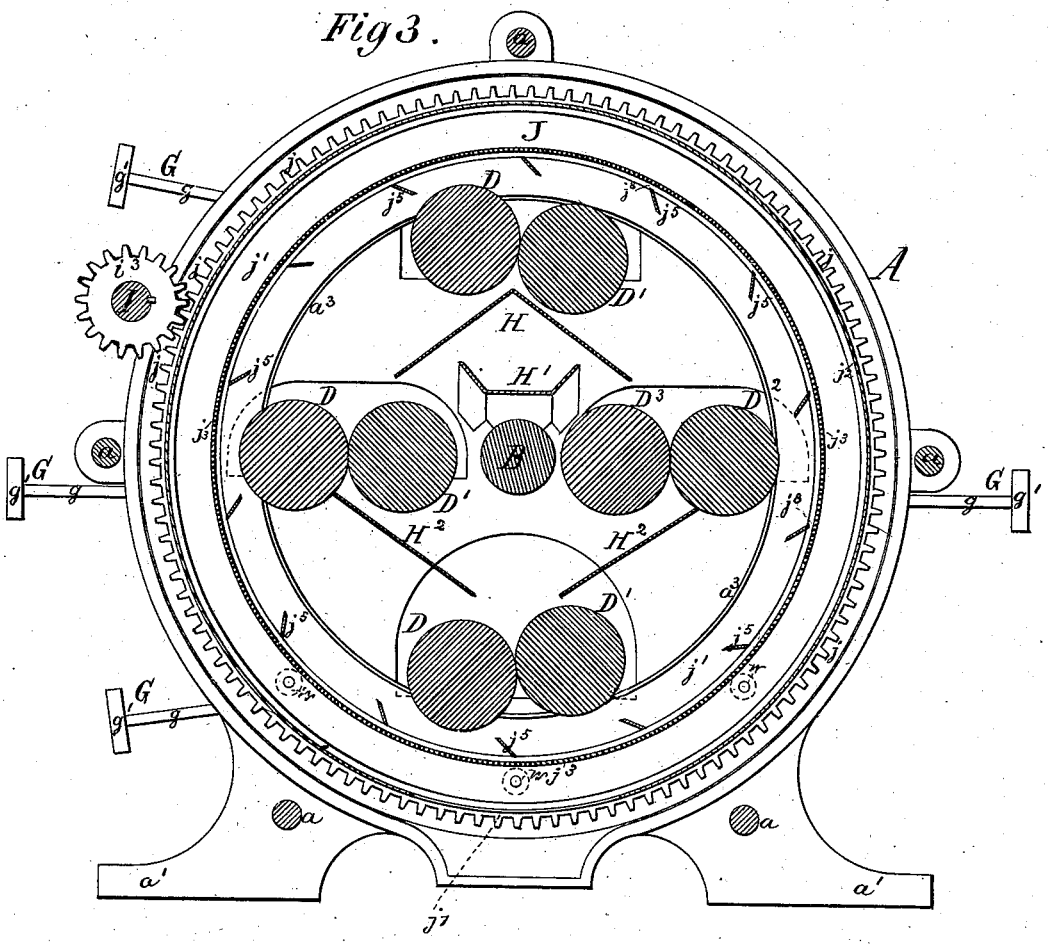
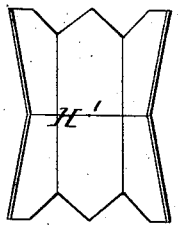


Fig 7.



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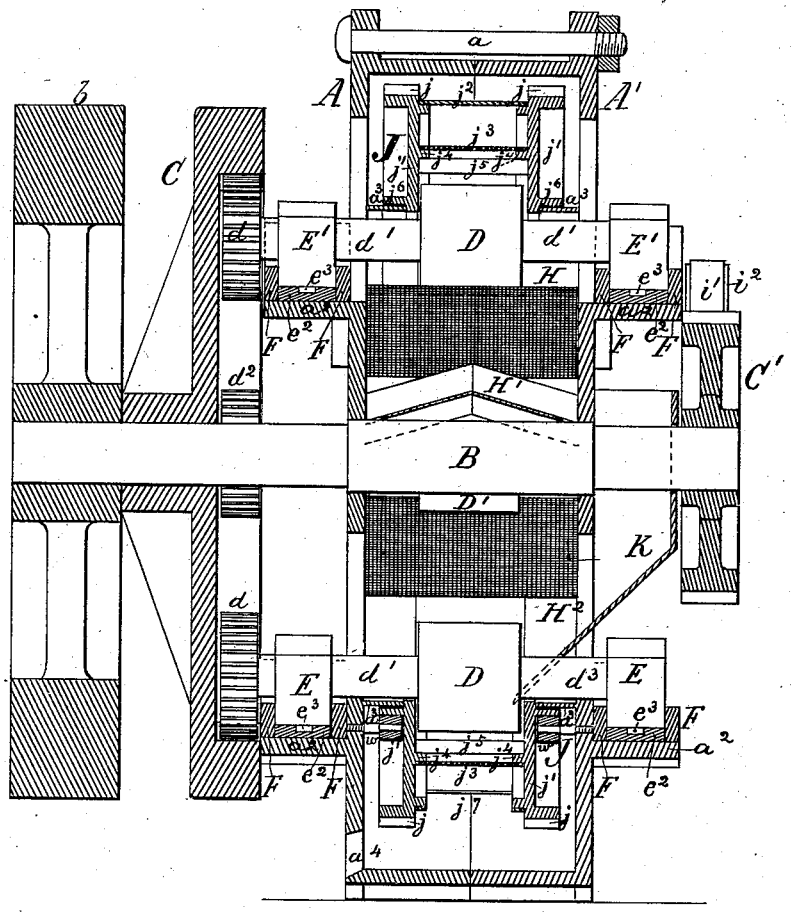
(No Model.) 4 Sheets—Sheet 4.

R. D. GATES.

PULVERIZING MACHINE.

No. 260,092. Patented June 27, 1882.

Fig 4.



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Inventor:

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by his attys
Penwick & Lawrence

UNITED STATES PATENT OFFICE.

RYERSON D. GATES, OF CHICAGO, ILLINOIS.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 260,092, dated June 27, 1882.

Application filed March 1, 1882. (No model.)

To all whom it may concern:

Be it known that I, RYERSON D. GATES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Pulverizing-Machine, of which the following is a specification.

My invention relates to improvements in pulverizing-machines in which pairs of rollers are used instead of stamps or burrs; and the nature of my invention will be clearly understood from the following specification and claims and annexed drawings.

In the accompanying drawings, Figure 1 is an elevation of my improved machine, showing the main gearing for the operation of the pulverizer, parts of the main gear-wheel being broken away in order to illustrate the meshing of the roller-gear wheels and the main-gear wheel. Fig. 2 is an elevation of the opposite side of the machine, a part of the outer case being broken out to show the toothed gearing for operating the revolving screen. Fig. 3 is a vertical central section of the machine, taken at right angles to the main shaft. Fig. 4 is a vertical central section of my machine, taken in a line parallel with the main shaft and showing the said shaft in elevation. Fig. 5 is a vertical central longitudinal section, in detail, of one pair of the bearings of the rollers. Fig. 6 is a top view of the same, and Fig. 7 is a detail top view of a doubly-inclined distributing-chute used below the screen of the highest pair of rollers.

Similar letters refer to similar parts throughout the several views.

In the drawings, A A′ are two similar halves of a shell-frame united by bolts *a*. The form of the shell-frame is mainly that of a drum, legs *a′* being added in order to steady the frame in an upright position and fasten it to a suitable foundation. In the center of said frame a main shaft, B, is hung, which is at one end provided with an internally-toothed gear-wheel, C. This gear-wheel C drives a number of gear-wheels, *d*, upon the shafts *d′* of rollers D. The gear-wheels *d* mesh into gear-wheels d^2 on shafts d^3 of rollers D′, which are thus mated with the rollers D. The two rollers D D′ are hung in bearings E′ E, the former, E′, being fastened by a bolt, *e*, Fig. 5, to a suitable flange, a^2, of the shell-frame A A′. The bearing E′ has a horizontal flange, e^2, with a longitudinal guide-groove, e^3, and the bearing E rests upon the flange e^2 of the bearing E′ and has a longitudinal rib, e^4, formed on its bottom, which rib fits into the groove e^3.

At the bottom of the groove e^3 a conical slot, e^5, is provided in the flange e^2, through which a screw, e^6, passes into the bearing E. By these means the two bearings E E′ are prevented from deviating in a vertical direction, while the bearing E may move horizontally to or from the bearing E′, thus allowing the rollers D D′ to be parted more or less from each other. The said rollers are held close to each other by means of an oblong spring-frame, F, the rear end of which bears against the outer end of the bearing E. The front end of the frame F stands off a sufficient distance from the bearing E′ to allow a sliding nut, *f*, and tension-spring *f′* to be applied and adjusted therein between bearing E′ and the forward end of the frame F.

The adjustment of the nut and spring is effected by means of a hand-screw contrivance, G, consisting of a shank, *g*, having a hand-wheel, *g′*, at one end, a screw-threaded portion, g^2, and a guiding-extension, g^4, beyond said screw-threaded portion, g^2, at the other end. The guiding-extension g^4 enters a socket, g^5, in the stationary bearing, while the screw-threaded portion g^2 passes through and engages with the sliding nut *f*, which is held within the frame F and kept from turning by means of flanges f^2. A collar, g^3, on the shank *g* prevents the hand-screw from being pushed out of the frame by the tension-spring *f′*, which is placed between the sliding nut *f* and the bearing E′, while the socket g^5 allows the device G to move with the frame F and bearing E when the pressure of the rollers requires to be regulated. The pressure of the spring upon the sliding nut *f* causes the frame F to bear against the sliding bearing E, and thus forces the rollers D D′ against each other. By screwing the sliding nut *f* toward the rigid bearing E′ the rollers D D′ will be caused to bear with more force against each other, and with less force accordingly as the nut *f* is moved in a reverse direction.

The adjustment of the pressure upon the roll-

ers can be effected by the screw device G outside the frame of the machine and out of the range of the gear-wheels with perfect safety, and damaged bearings can easily be removed and new ones substituted, as they need not be specially fitted to their supports on the frame F, as is the case with roller-bearings of ordinary construction. This manner of regulating the pressure of the rollers does not interfere with the adjustment of the wheels d d^2 to a proper working relation with the gear-wheel C, for it will be seen that the frame F, with the parts attached, can be moved backward or forward by simply loosening the bolts e and moving the bearings E′ upon the flanges a^2.

The pair of rollers D^2 D^3 is in every respect similar to the pair D D′ described, except that this pair is not driven by the internally-toothed gear-wheel C, as this would cause said pair to be revolved in the wrong direction. I have therefore provided the other end of the main shaft B with a gear-wheel, C′, which drives another gear-wheel, C^2, on the shaft d^4 of the roller D^2. The shafts d^4 and d^5 of the rollers D^2 D^3 are also provided with wheels d d^2, meshing into each other, and thus operating these rollers. This arrangement of wheels may, however, be substituted by any other suitable arrangement, and I therefore may not in practice confine myself to this special construction.

Below the uppermost pair of rollers D D′ a doubly-inclined screen, H, Fig. 3, is provided, which is suitably hung between the shell-frame of the machine and conducts the coarser particles dropped by said rollers equally divided to the next pairs D D′, D^2 D^3 below, while a doubly-inclined chute, H′, conducts the finer particles from the upper pair of rollers D D′ to points outside the ends of the lowest pair D D′ and inside annular flanges, a^3, and thence upon a revolving screen or sieve, through which they escape and pass off into a receiving or discharging chamber of frame A A′.

The middle pairs of rollers are each provided with an inclined screen, H^2, and these screens receive the ground products of the said rollers and conduct the coarser particles to the lower pair of rollers to be reground, while the finer particles descend through the screens H^2 upon the screen j^3, and thence into the receiving or discharging chamber below. The lowest pair of rollers is not provided with a guide-screen, as it also performs a fine-grinding or finishing operation.

One of the roller-shafts, d', has a pulley, i, which, by means of a belt, i', drives another pulley, i^2, on a shaft, I. This shaft I is suitably hung to the shell-frame of the machine, and is provided with a number of cog-wheels, i^3 i^4, which gear into toothed rings j, formed on the circumference of the revolving cylindrical frame J of the endless screen or sieve j^3, which encircles the pairs of rollers, and within which said rollers are operated, while the said screen, with its frame, revolves around them upon suitable friction-roller supports, w, at bottom of the shell-frame. The cylindrical frame J has open ends, and is by preference made of two annular ribbed or flanged plates, j', upon which the toothed rings are applied or formed, and to which a circumferential cylindrical portion, j^2, is suitably fastened, the same being applied between the plates and upon upper flanges thereof. The annular screen j^3, which is inside of and some distance from said cylindrical portion j^2, is fastened to an annular rib, j^4, of each of the plates j' by suitable means, and inside of the screen j^3 are provided oblique elevating-partitions j^5, the same being applied between the plates j' j' and set with their outer edges free from contact with the inner surface of the screen j^3, so as to form escape-passages j^8 between the rear edges of the elevating-partitions and the screening-surface. The elevating-partitions, by being set oblique within the screen-frame and in relief from the sieve or screen, serve for carrying up the substances fed into the screen from a hopper, K, to be ground or pulverized by the rollers; also, for recarrying up the substances to be reground after they have been one or more times subjected to the grinding-rollers, and while the partially-ground substances are being re-elevated the fine flour, meal, or other material has freedom to pass back behind the elevating-partitions through the escape-passages j^8 and out through the meshes of the screen or sieve into a general receptacle for the pulverized material, while the coarser partially-ground substances are discharged between the grinding-rollers, to be further ground or pulverized.

The plates j' are provided with outer annular ribs, j^6, fitted loosely around annular flanges a^3, formed on the inner sides of the shell-frame A A′ of the machine, and by means of the same the unground and ground products are prevented from falling into the space between the shell-frame and revolving screen or outside the screen. The screen or sieve j^3 being of very fine mesh and continuous or endless, only the fine or fully-pulverized particles of grindings can leave the screen-frame J by falling through the meshes of the screen j^3 upon the cylindrical portion j^2, and from this latter portion, through an opening, j^7, therein, to the bottom of the shell-frame, whence they are removed in a suitable manner through an opening, a^4, or otherwise.

The mixed coarser and finer particles of the grindings are carried up by the elevators j^5 of screen j^3, and from time to time portions of the same slip down between the said elevators and the screen j^3, and while the finer particles constantly fall through the screen j^3 the coarser particles are carried up on the partitions j^5 until they drop off and pass between the rollers to be subjected to a fine grinding between the lower pair of rollers.

A hopper, K, is suitably provided on one side of the frame, by which hopper the screen is continually supplied with fresh material for grinding, which material is carried up from the

bottom of the machine to a position above the top pair of rollers and dropped between said rollers.

All openings in the shell-frame are in practice carefully closed up by means of suitable sliding covers, so that the escape of pulverized and other material therefrom is rendered impossible. The shaft B is also provided with a pulley, *b*, which, by means of a belt, is driven from the line-shaft of the mill.

Instead of the wheels C′ C², above described, a small intermediate gear-wheel could be employed on a stud of the rigid bearing E′ of the roller D², so as to cause it to mesh into the internally-toothed gear-wheel C and the wheel *d* of the roller D², and thus all the wheels *d d*² could be arranged on the same side of the machine, allowing free access to the other side.

By my machine a fine grinding of a portion of the substances is effected by each pair of rollers, and this fine-ground portion is at once discharged upon the revolving sieve or screen *j*³, and thus the already fine enough substances are not subjected several times to a recrushing or regrinding operation, and the labor and wear and tear of the machine are lessened, while the amount of work performed in a given time with a given number of pairs of rollers is increased.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a grinding or pulverizing machine, the combination, with a surrounding inclosing-case provided with supply and discharge passages, of a revolving screen, *j*³, having its periphery formed of suitable screening material, and a pair of crushing-rollers arranged within the revolving screen and out of contact with the screening-surface, substantially as and for the purpose described.

2. In combination with a pair of crushing-rollers, D D′, the frame A A′, the bearing E′, and means for adjusting the same on said frame of the bearing E, means for adjustably securing the same upon the bearing E′, the frame F, inclosing the two bearings, the spring *f*′, nut *g*², and adjusting-screw G, substantially as and for the purpose described.

3. The revolving cylindrical screen *j*³, provided with elevating-partitions *j*⁵, and the escape-passages *j*⁸, in combination with a pair of crushing-rollers arranged within the screen *j*³, and acting to crush the substances independent of any crushing action by any portion of the cylindrical screen, substantially as described.

4. The combination of the revolving screen *j*³, two pairs of crushing-rollers, D D′, D D′, with a guide-sieve for conducting ground substances from the one pair of rollers to the other, substantially as described.

5. The combination of the revolving screen *j*³ and three pairs of crushing-rollers, D D′, D D′, D D′, with a guide-sieve which conducts substances from the first to the second pair of rollers and a guide-sieve which conducts substances from the second to the third pair of rollers, the finished substances being screened by the joint action of the sieves and revolving screen *j*³, substantially as described.

6. The combination of the revolving screen *j*³, crushing-rollers D D′, and guide-sieves H H², substantially as and for the purpose described.

7. The combination of the distributing-chute H′ with the upper sieve, H, and the upper pair of rollers D D′, substantially as and for the purpose described.

8. A revolving screen, *j*³, having flanges *j*⁶, and friction-rollers *w*, in combination with an outer inclosing-case, A A′, provided with guard-flanges *a*³, a supply-passage or hopper, K, and a discharge-passage, *a*⁴, substantially as described.

9. The combination of the revolving screen *j*³, four pairs of crushing-rollers, D D′ D² D³, guide-sieves H H², a central shaft, and gearing for revolving the rollers of the respective pairs in the proper directions, substantially as described.

10. The combination of an outer case, four pairs of crushing-rollers, D D′ D² D³, the driving-gear C, and adjustable bearings outside the case with a revolving elevating-screen *j*³ within the case and surrounding the crushing-rollers and suitable gearing for imparting motion to the respective pairs of rollers and to the screen, substantially as described.

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