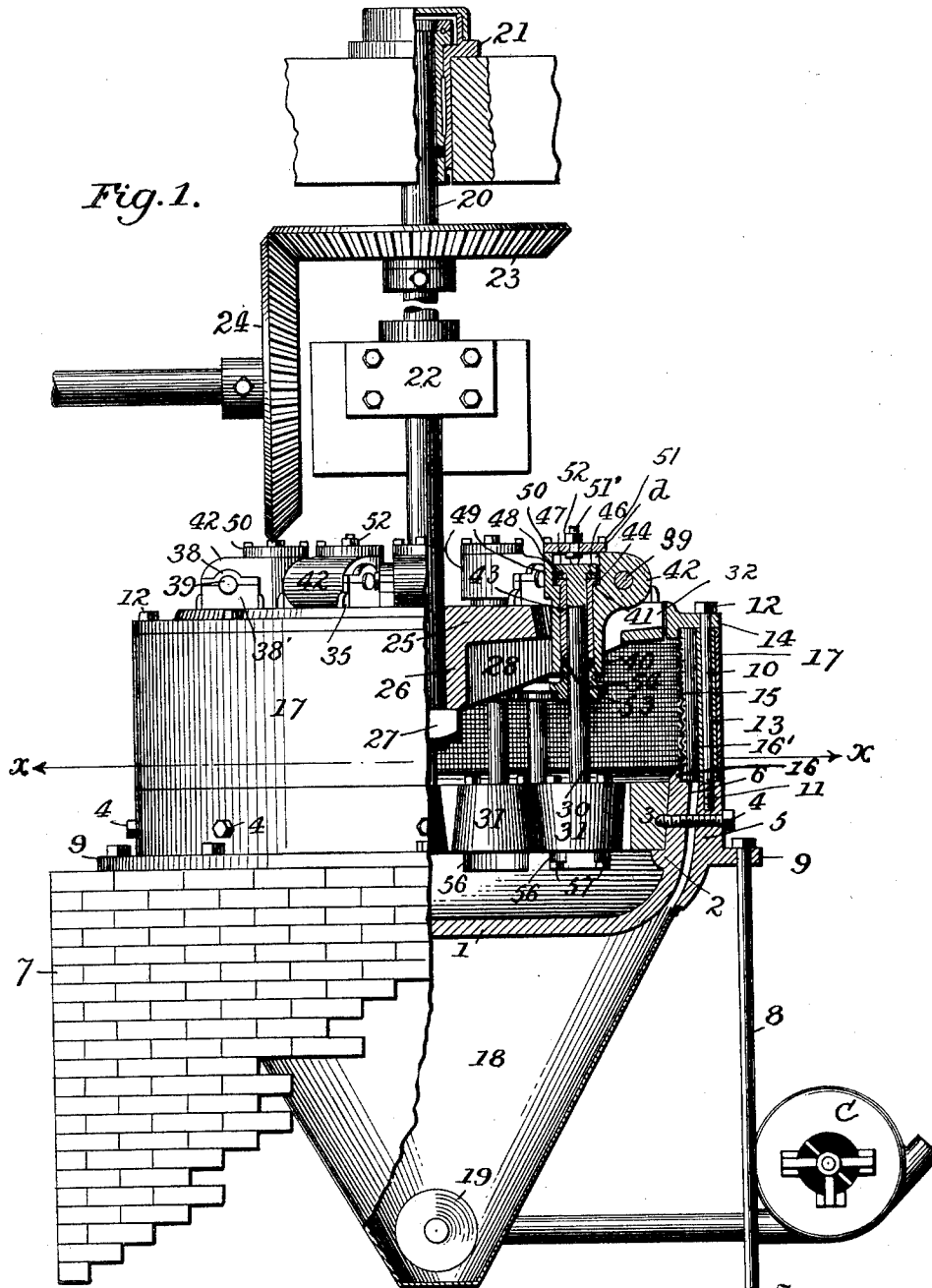


2 Sheets—Sheet 1.

No. 586,835.

Patented July 20, 1897.



J. J. Hinkel
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Inventor
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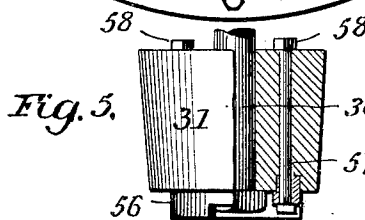
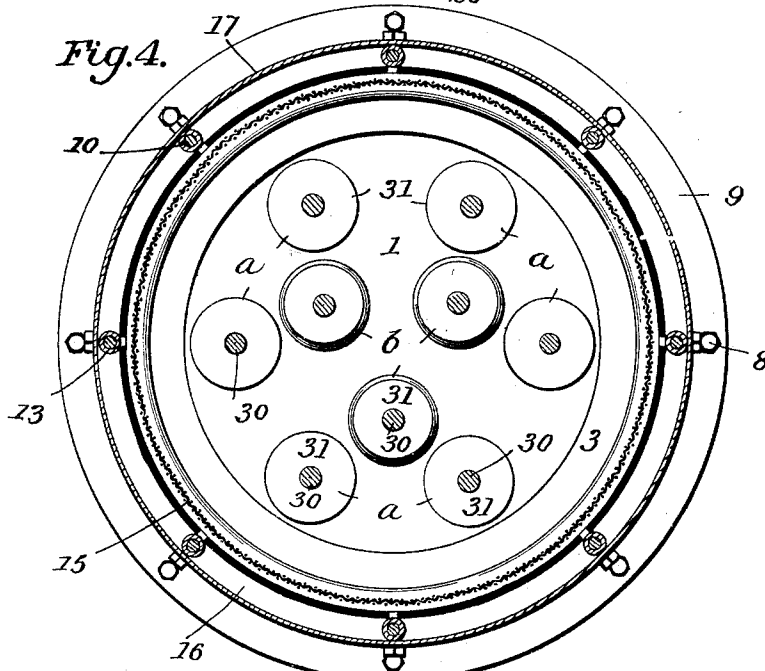
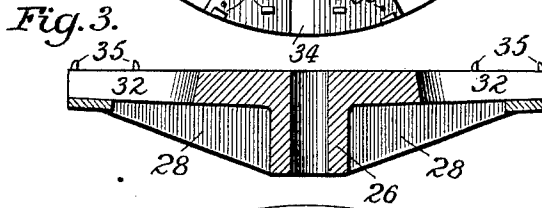
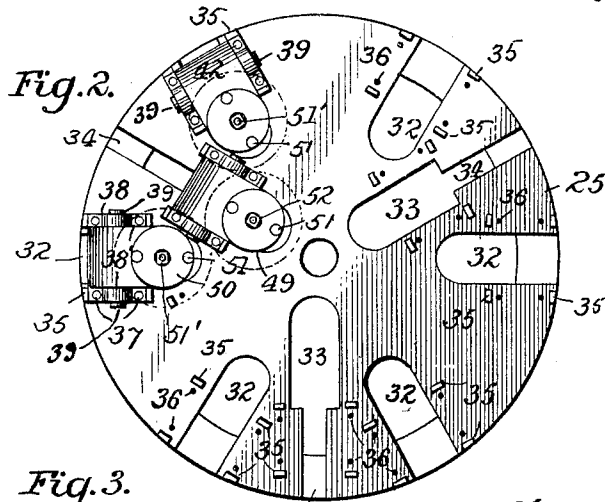
(No Model.)

2 Sheets—Sheet 2.

J. C. CLARK.
PULVERIZING MACHINE.

No. 586,835.

Patented July 20, 1897.



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UNITED STATES PATENT OFFICE.

JOHN CALHOUN CLARK, OF ATLANTA, GEORGIA.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 586,835, dated July 20, 1897.

Application filed September 26, 1896. Serial No. 607,090. (No model.)

To all whom it may concern:

Be it known that I, JOHN CALHOUN CLARK, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Pulverizing-Machines, of which the following is a specification.

This invention relates to certain new and useful improvements in crushing-mills; and it consists, substantially, in such features of construction, arrangement, and combinations of parts as will hereinafter be more particularly described.

The invention has reference more particularly to that class of crushing-mills in which suspended rods or shafts having crushing-rollers at their lower ends are operated to swing outward by centrifugal force to effect a crushing of the material between the surfaces of the rollers and that of a ring or disk supported in an adjacent position within a pan or basin wherein the rollers are supported. Without attempting to enumerate in detail all of the disadvantages and inconveniences attendant upon some former crushing-mills of this particular type suffice it to say that with many of them the output is comparatively small in mills of given size, and which is no doubt due to the limited area of grinding-surface which it is possible to bring into actual effective service at any period or fraction of time during the operation of the mill.

The object of the present invention is the provision of an increased effective crushing-surface in mills of the same size as heretofore, as well as a more perfect and rapid crushing of the material.

A further object of the invention is to simplify and cheapen the cost of the mill, to materially lessen the wear of the parts, and to render the mill of easy control.

These objects I attain by the means illustrated in the accompanying drawings, wherein—

Figure 1 is a vertical elevation, in part section, of a centrifugal crushing-mill constructed and arranged in accordance with my invention. Fig. 2 is a top plan view of the revolving plate or disk from which the roller-shafts are suspended, three of such shafts being represented in position thereon.

Fig. 3 is a transverse sectional view of the said revolving plate or disk. Fig. 4 is a sectional plan view on the line *xx*, Fig. 1; and Fig. 5 is an enlarged part sectional view in detail of one of the crushing-rolls, showing the manner of fastening the plow to the under side thereof.

My improved crushing-mill is capable of a great many different embodiments; but for all general purposes I have found that the construction and arrangement of parts substantially as herein shown fully answer my purpose and give good results in practice.

Thus 1 represents an ordinary pan or basin of suitable depth and diameter and which is provided interiorly with an annular rim or shoulder 2, upon which partially rests the under side of an annular grinding ring or die 3, that is held in place by means of fasteningscrews 4, passing through the side of the basin at intervals and entering the said ring or die, as shown. These said screws 4 first pass through the wall of an outer casing 5, surrounding the pan or basin 1, so as to leave an intermediate space or chamber 6. The said outer casing is supported in position upon suitable masonry or other support at 7, and it is held in rigid position by means of rods 8, passing through a flange 9 of the casing and extending down and secured to a suitable base (not shown) or otherwise. Fitting into suitable threaded openings formed in the upper edge of the basin at intervals are the vertical rods 10, the lower ends of which are threaded at 11 to screw into said openings, and to the upper ends of which rods the nuts 12 are applied. Surrounding each rod is a shell or tube 13, the lower end of which rests upon the upper edge of the outer casing 5, and the upper ends of these tubes or shells serve to receive and support an upper annular ring 14, through which the upper ends of the rods 10 pass. Depending from the said ring 14 is a screen 15 of suitable fineness and the lower edge of which is secured to a flange 16, projecting from the upper edge of the pan or basin 1; and surrounding the screen, so as to leave an intermediate chamber 16', is a thin metal cylinder or shell 17, extending all around the mill, as does the screen and intermediate chamber. Thus is formed or con-

stituted a chamber which practically is a part of the space or chamber 6 between the basin and the outer casing 5, and it will be understood that the fine material which results from the crushing or grinding action of the rollers in the basin passes through the screen 15 into the chamber 16' and thence down and out through the space or chamber 6 into a hopper 18, the lower end of which is in communication with any ordinary screw conveyor 19 for conducting the material away to any place desired. An exhaustor C communicates with a passage of said conveyor to any place desired. The construction and arrangement of parts thus far described are substantially the same as have been used in crushing-mills of former construction, and while this or some equivalent embodiment is practically essential to a proper working of my invention it will nevertheless be understood that I am not limited thereto in any manner whatever.

I will now proceed to describe the more valuable attributes of my invention, and while these will be referred to in connection with a certain preferred embodiment of devices it will be understood also that I am not limited to the details of construction and arrangement thereof. The main purpose is to increase the grinding-surface or capacity of the mill, and to effect which I employ the simplest means possible commensurate with strength and rapidity of operation. Similarly, as in some former mills of this type, I employ in line with the center of the pan or basin 1 a vertical main operating-shaft 20, that is suspended in an upper bearing 21 and which passes through a guide-bearing 22, and to this shaft rotation is imparted through the medium of bevel gear-wheels 23 24 and a suitable driving-shaft. Keyed or otherwise secured to the said main shaft 20, so as to bring its upper surface about flush with the upper surface of the ring 14, is a circular plate or disk 25, the diameter of which about equals the inner diameter of the pan or basin 1 at its upper edge, so as to enable the said plate or disk to rotate with the shaft 20 and just clear the inner edge of the said upper ring 14. Pendent from the plate or disk where it surrounds the main shaft is a sleeve or hub 26, which furnishes an extended bearing and strengthens connection between the two, and the lower edge of the said hub rests upon a collar 27, secured to the shaft at this point, so as to maintain the hub and disk in proper vertical position. The under side of the said plate or disk is provided with radial strengthening-ribs 28, which at their inner ends are deep enough to extend to the lower end of the hub, but which gradually taper off toward the edge of the disk, as shown. The said circular plate or disk is employed by me as a support for the rods or shafts 30 of a series of groups of grinding-rollers 31, between the surfaces of

which, as well as the surfaces of some of them and the grinding ring or die 3, the material is thoroughly and effectively crushed or reduced. Each group of crushing-rollers 70 may be constituted of any desired number, more or less, as may be desired, and in this respect it will be noted that I do not restrict myself.

For convenience of illustration I have 75 shown three rollers to a group and have shown three groups, thus making nine rollers in all. It is the purpose in operation that the periphery or grinding-surfaces of the rollers of each group shall operate against or upon each other 80 to grind the material and that the surfaces of the outer rollers *a* of each group shall also operate against or upon the grinding-ring 3 at the same time. To effect this action, the outer rollers *a* of the several groups must be carried 85 outward against the ring 3 by centrifugal force, and in like manner the inner roller *b* of each group must be carried outward against the outer rollers in a similar way, so as to constantly maintain the proper grinding 90 effect. The shafts 30 of the said grinding-rollers 31 could be suspended from the circular plate or disk 25 in many different ways and through the medium of variously-constructed devices and still be within the scope 95 of my invention; but preferably I resort to the construction and arrangement of devices substantially the same as those for which I have received Letters Patent No. 561,491, and dated June 2, 1896, although I have slightly 100 modified such devices to better suit some of the requirements of the present case. In order to enable the said devices (which will presently be described) to be used, as well as to effect the proper relative arrangement 105 of the shafts and their rollers, the said circular plate or disk is formed with a suitable number of equidistant radial slots or openings 32, extending inward from the edge of the disk to a point about midway between the edge 110 and the central axis thereof, and also with half as many similar slots or openings 33, each disposed in a position intermediate of two of the first, so as to alternate therewith, and being set back from the said first-named 115 slots or openings, with their inner extremities reaching quite near to the central opening of the disk. Each of the said slots or openings 33 has leading thereto in a direct line from the edge of the disk a narrower slot or opening 34 to permit insertion of the shaft of the inner roller of each group prior to the placing in position of the shafts of the outer rollers of the several groups. Immediately adjacent the edges of each of the said slots or 125 openings 32 and 33 the plate or disk 25 is provided with a lug or projection 35, and between each pair of these lugs are formed the threaded openings 36, which receive the ends of screws 37, that secure in place the removable cap-plates 38, which in part constitute the bearings 38' for the trunnion-pins 130

39, resting on either side of the openings 32 and 33 and serving as the swinging support of the shafts of the rollers. The preferred devices for supporting the upper ends of the shafts, to which general reference has heretofore been made, will now be specifically referred to. Supported in each of the slots or openings 32 and 33 is a swinging cylindrical box 40, that is formed a short distance from its upper end with an internal shoulder 41, and which is enlarged or offset at one side at 42 to produce a thickened portion, through which the said pin 39 passes, with its ends resting in the bearings 38', as explained. As in my former patent referred to, each of these swinging boxes is bored out to receive a hollow brass 43, with a flange 44 at the upper end resting upon the shoulder 41 within the box, and upon the upper end of the brass is an annular bearing-surface (preferably a ball-bearing) 46 for the head 47 of the shaft 30. As shown, there is an underfacing beneath the head of the shaft, consisting of a cast-iron ring 48, which rests upon the top of the brass, and also, as shown, the internal diameter of the swinging box at the top is sufficiently enlarged at 49 to slightly more than accommodate the shaft-head, and thus to form an oil-chamber *d* above and surrounding the said head.

The cap 50 of the chamber is held in place by screws 51, and passing through the cap centrally of the chamber but slightly out of contact with the head 47 is a cock-head bearing in the form of a screw 51' and nut 52. Within the lower threaded end of the swinging box works a follower 53, that surrounds the shaft 30 and which is used to bear upon and compress a packing-ring 54 into the lower end of the box beneath the lower end of the brass. It will be seen that the oil in the chamber will flow down around the sides of the working parts or bearings and that it will be retained by the said packing.

The grinding-rollers 31 may be of any suitable configuration, but they are preferably slightly conical, and they are secured to their respective rods or shafts 30 in any suitable manner, so as to rotate with said rods or shafts independently of the rotation of the central or main operating-shaft. It is evident that when the latter shaft is operated the outer rollers *a* of each group will be carried outward to grind the material between their surfaces and the surface of the grinding-ring 3. At the same time the inner rollers *b* will be carried against the outer rollers and effect a similar grinding action, and they also thereby multiply the number of grinding-points as well as greatly increase the area of grinding-surface. As before stated, I am not limited either to the number of roller groups or to the number of rollers in a group.

I employ suitable plows to stir up the material in the pan or basin, and as a convenient form they are made substantially of the shape of a curved shoe 56, one of them being

secured to the under side or lower end of each roller by means of short rods or bolts 57, having tightening-nuts 58 on their upper ends. 70

It is thought that many further advantages of my present invention will be appreciated without further specific mention, and therefore, without limiting myself to the precise details of construction and arrangement 75 shown,

I claim—

1. The combination in a grinding-mill, of a grinding-ring, and a rotatory group of grinding-rolls acting upon each other to grind the material, each roll adapted to swing outward by centrifugal force, and the outer rolls of the group also acting upon the ring, substantially as described. 80

2. The combination in a grinding-mill, of a grinding-ring, and a series of rotatory groups of grinding-rolls, the rolls of each group being adapted to swing outward by centrifugal force and acting upon each other to grind the material, and the outer rolls of each group acting upon the ring, substantially as described. 85 90

3. The combination in a crushing-mill, of a grinding-ring, and a series of groups of crushing-rolls suspended from a common shaft, and each roll carried by a shaft rotatable in a swinging bearing, the rolls in each group operating upon one another, and the outer rolls thereof operating upon the grinding-ring, substantially as described. 95 100

4. The combination in a crushing-mill having a grinding ring or die, of a rotating circular plate or disk, a series of groups of swinging boxes suspended from said disk, and independently-rotating shafts turning in said boxes and each carrying at its lower end a roller, the said rollers in each group operating upon one another and the outer rollers thereof upon the surface of the grinding-ring, substantially as shown and for the purpose described. 105 110

5. The combination in a crushing-mill having a grinding ring or die, of a rotating circular plate having a series of slots or openings extending inward from the edge equidistant from each other, and another series of similar slots or openings alternating with and set in from the first, swinging boxes suspended through said slots in suitable bearings, independently-rotating shafts working in the boxes and each carrying at its lower end a grinding-roller, the said rollers operating upon one another in series and upon the surface of the ring, substantially as described. 115 120

6. The combination in a crushing-mill having a grinding ring or die, of a rotating circular plate having a series of slots or openings arranged at equidistant points and extending inward from the edge of the disk, and also formed with another series of similar slots or openings alternating with and set in from the others and having continuations extending to the edge, swinging boxes working in said slots, independently-rotating shafts 125 130

working in the boxes and each carrying at its lower end a grinding-roller, the said rollers operating upon one another in series and upon the surface of the ring, substantially as described.

5 7. The combination in a crushing-mill having a grinding ring or die, of a rotating circular plate having sets of slots or openings formed therein with the slots of one set intermediate of those of the other set, lugs or
10 projections on the disk adjacent to the edges of the slots, swinging boxes suspended in bearings confined between the lugs on opposite sides of the slots, independently-rotating
15 shafts working in the boxes, and grinding-rollers carried at the lower ends of the shafts and operating upon each other and upon the

surface of the grinding-ring, substantially as described.

8. The combination in a crushing-mill having a grinding ring or die, of a series of groups of grinding-rollers suspended from a common shaft and each having an independent axis and carrying at its lower end a plow, the said rollers operating upon one another and upon the surface of the ring by centrifugal force, substantially as shown and described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN CALHOUN CLARK.

Witnesses:

A. A. SMITH,

VICTOR L. SMITH.