

J. RAKOWSKI.  
GRINDING MILL.  
APPLICATION FILED AUG. 30, 1902.

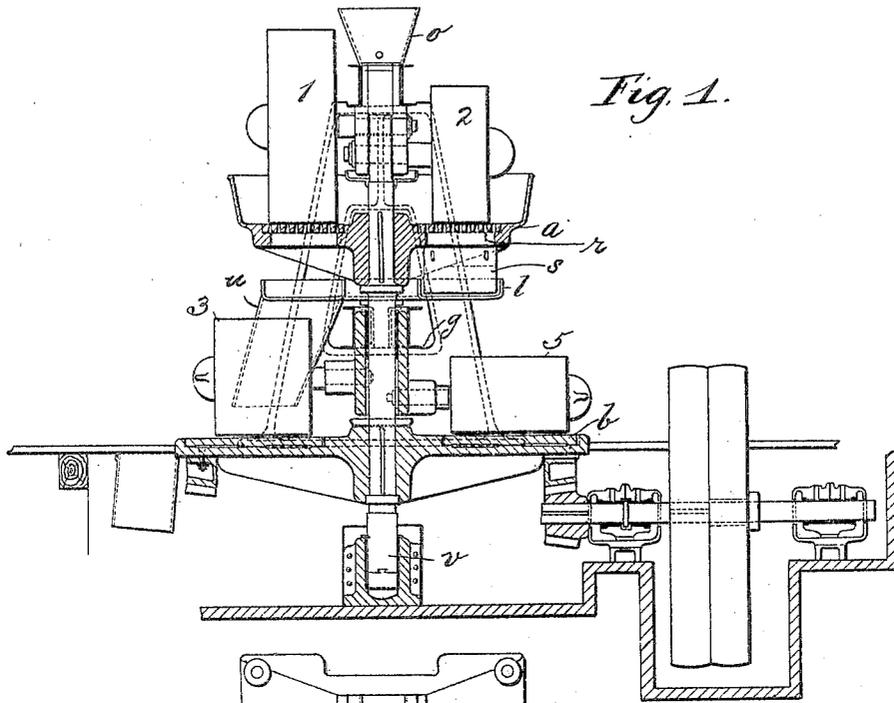


Fig. 1.

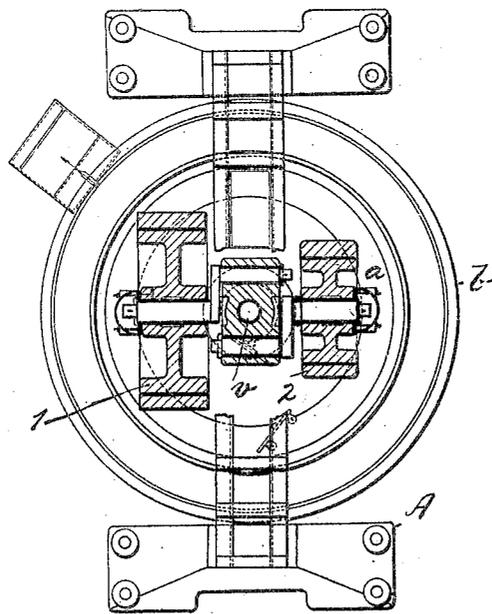
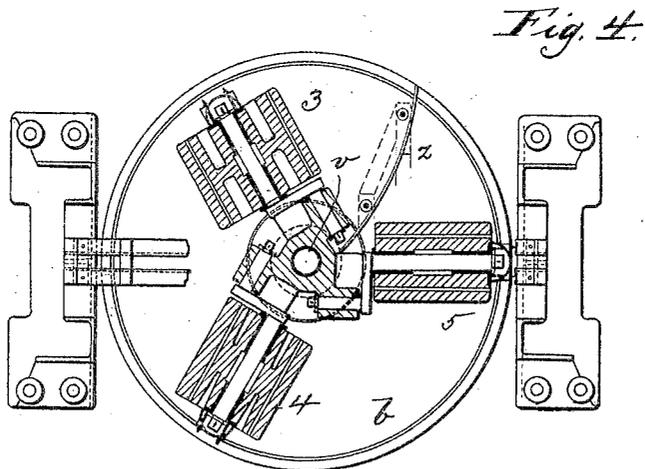
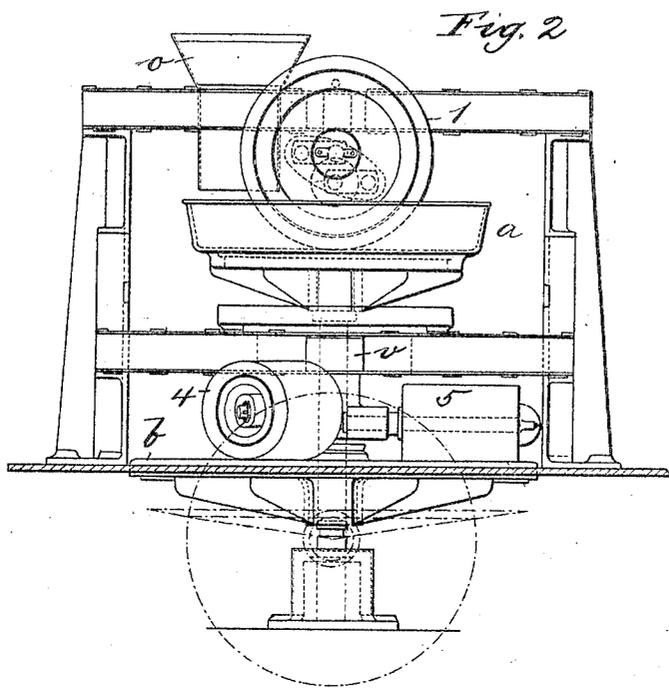


Fig. 3.

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By *[Signature]* W. E. Coulter,  
Attorney.

# UNITED STATES PATENT OFFICE.

JULJAN RAKOWSKI, OF WARSAW, RUSSIA.

## GRINDING-MILL.

No. 802,407.

Specification of Letters Patent.

Patented Oct. 24, 1905.

Application filed August 30, 1902. Serial No. 121,695.

*To all whom it may concern:*

Be it known that I, JULJAN RAKOWSKI, residing at Warsaw, Russia, have invented certain new and useful Improvements in Grinding-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In grinding-mills as usually constructed the runners have not been graduated with respect to size, and the whole of the material ground was not passed simultaneously from beneath one runner successively to the next one. Also the material when completely ground was not immediately and entirely removed from the grinding-surfaces.

It is the object of the present invention to overcome the above-recited disadvantages and enable the grinding operation to be performed quickly, thoroughly, and economically by causing the material to be reduced into small particles gradually in a variety of ways simultaneously, as by crushing, cutting, tearing, and rubbing.

The invention consists in the novel construction, arrangement, and combination of parts, as hereinafter fully described, illustrated in the drawings, and pointed out in the appended claims.

In the drawings, Figure 1 is a vertical section of my crushing-mill. Fig. 2 is a front view of same, and Figs. 3 and 4 are plans of the two grinding-platforms.

A indicates a suitable supporting-framework for the operative parts.

*v* indicates a vertically-arranged shaft mounted in suitable bearings in the framework and in a step-bearing *v'*.

*a* and *b* indicate grinding tables or platforms. There may be any desired number of these platforms, though in the present instance I show but two. The platforms are fixedly secured to the shaft *v*, so as to rotate therewith.

1, 2, 3, 4, and 5 are runners mounted upon the main shaft, so as to cooperate with the platforms to effect the grinding of the material. The runners are mounted so as not to rotate with the shaft *v*—that is to say, they are rotatably mounted on short shafts *x*, which are carried by the supporting-frames *g* in a manner to permit the runners to have a vertical movement independently of each other.

The grinding-surfaces of the platforms may

in practice be grooved or roughened, as desired. As will be seen, the platforms are mounted one above the other, the runners 1 2 cooperating with the upper perforated platform and the runners 3, 4, and 5 with the lower solid platform.

*o* indicates a feed-hopper through which the material to be ground is fed, the hopper being arranged in a plane to one side of the center of the shaft *v* and with its discharge end adjacent to the runner 1, as seen in Fig. 2, and thus said hopper will discharge the material onto the upper platform in proximity to the runner 1, whereby the latter will be the first to act upon said material.

It will be observed that the runners are made of varying diameters and widths, the decrease in the diameters being accompanied by an increase in the widths—that is to say, the smaller the diameter of a runner the greater the width thereof. The object of making the runners of varying diameters and widths, as just mentioned, is as follows: As the unground or large pieces of material occupy more superficial area or surface room than if they were ground, they are fed to a runner 1, as of large diameter and small width, because such a runner is best adapted to grasp and draw in, as it were, the material between said runner and the grinding-table, and its narrow width will yet be sufficient during the first breaking step, because the material occupies less superficial area. As the material becomes broken by the first runner 1, and thus becomes flattened out more or less, so as to occupy more superficial area, the second runner 2 is thus made somewhat wider, and as the partially-ground matter does not now require quite so heavy a runner the runner 2 is thus made of less diameter to reduce its weight somewhat. The matter after having been further crushed or broken by runner 2 occupies still more surface room, and thus the succeeding runner 3 is made even wider than runner 2 and of less diameter than the latter to further reduce the weight, and this idea of varying the widths and diameters of the runners is preserved for all the runners that might be used in the machine. In view of what has just above been stated I vary the diameters and correspondingly increase the widths of the runners in the order in which they will act upon the material in the grinding operation. As the material is first acted upon by the runner 1, I make said runner of the largest diameter and least width. As the

material is then acted upon in order by the runners 2, 3, 4, and 5, I make said runners of gradually-decreased diameters, but increased widths.

5 The material fed by the hopper *o* will be first acted upon by the runner 1. Owing to the sufficiently great diameter of the runner, as well as the correspondingly uneven perforated or grooved grinding-surface *a* of the  
10 platform, the matter is acted upon easily and surely, and simultaneously the matter is crushed by the great weight of the runner after having been broken by it. The crushed  
15 matter is then passed, for the purpose of further comminution, to the runner 2, having a smaller diameter, broader and more even grinding-surface. The velocity of the two  
20 working surfaces increases with the increasing distance from the main shaft, and the grinding-surfaces of the runners become larger, and in consequence the matter is not only crushed, but is rubbed through more  
25 and more. If the grinding-surface is provided with grating or grooves, the matter is cut and torn on the top of it. As the diameters of the runners can be made gradually smaller  
30 and smaller with the increasing comminution of the matter, and therefore are made smaller, so the further comminution is increased and promoted as the convex surfaces of the runners enter more easily into the matter being ground.  
35 After having been acted upon by the runner 2 the partially-ground material is fed through the perforations in the platform *a* into a vessel or receiver *l*, arranged intermediate the two  
40 platforms, and the material is swept through an opening in the bottom of the vessel *l* by means of blades *s*, acting as scrapers, said blades being secured to the main shaft and  
45 moving in proximity to the bottom of the vessel *l*. The material falling through the opening in the bottom of the vessel *l* is conducted by an inclined chute *u* onto the lower platform  
50 at a point where it will be acted upon by the runner 3, and it is then acted upon in succession by the runners 4 and 5. As soon as the ground matter has left the last runner 5 it is immediately and completely removed from the grinding-surface by means of a scraping-blade  
55 *z*, secured to the main shaft. Instead of employing two grinding tables or platforms arranged one above the other and with the described arrangement of runners I could employ but one table or platform, with the various runners arranged to cooperate therewith, to produce the gradual comminution or grinding of the material.

The chief aim of the work of a crushing-mill is the complete comminution of the grind-

ing matter, and if there be a thorough uniformity in the moistening at the same time the mill is much more valuable. My improved mill fulfils the desired requirements.

The described construction of a crushing-mill constitutes a uniform system of many principles, which mutually influence each other.

The mill can be built of any suitable materials.

What I claim, and desire to secure by Letters Patent, is--

1. In a grinding-mill, the combination with grinding-platforms arranged one above the other, of runners arranged to cooperate with said platforms to effect the grinding of the material, the runners having successively-decreased diameters and corresponding increased widths, and being so arranged that the material will be first acted upon by the runner of greatest diameter and then by the remaining runners in the order of their decreased diameters, and means for feeding the partially-ground material from one platform to the other.

2. In a grinding-mill, the combination with a grinding-platform, of a centrally-arranged shaft, and a series of horizontal runners arranged around the shaft and movable vertically thereon, said runners being of successively-decreased diameters and corresponding increased widths, said runners being so arranged that the material will be first acted upon by the runner of greatest diameter and then by the remaining runners in the order of their decreased diameters.

3. In a grinding-mill, the combination with grinding-platforms arranged one above the other, the upper platform being perforated, of a receptacle arranged intermediate the platforms and having a discharge-chute adapted to discharge into the lower platform, means for conveying the partially-ground material falling into said receptacle to the discharge-chute, and runners arranged to cooperate with the platforms, said runners being of successively-decreased diameters and corresponding increased widths and being so arranged that the material will be first acted upon by the runner of greatest diameter and then by the remaining runners in the order of their decreased diameters.

In testimony whereof I affix my signature in presence of two witnesses.

JULJAN RAKOWSKI. [L. s.]

Witnesses:

FETOS RICHTO,  
M. W. STANEWSKI.