(No Model.)

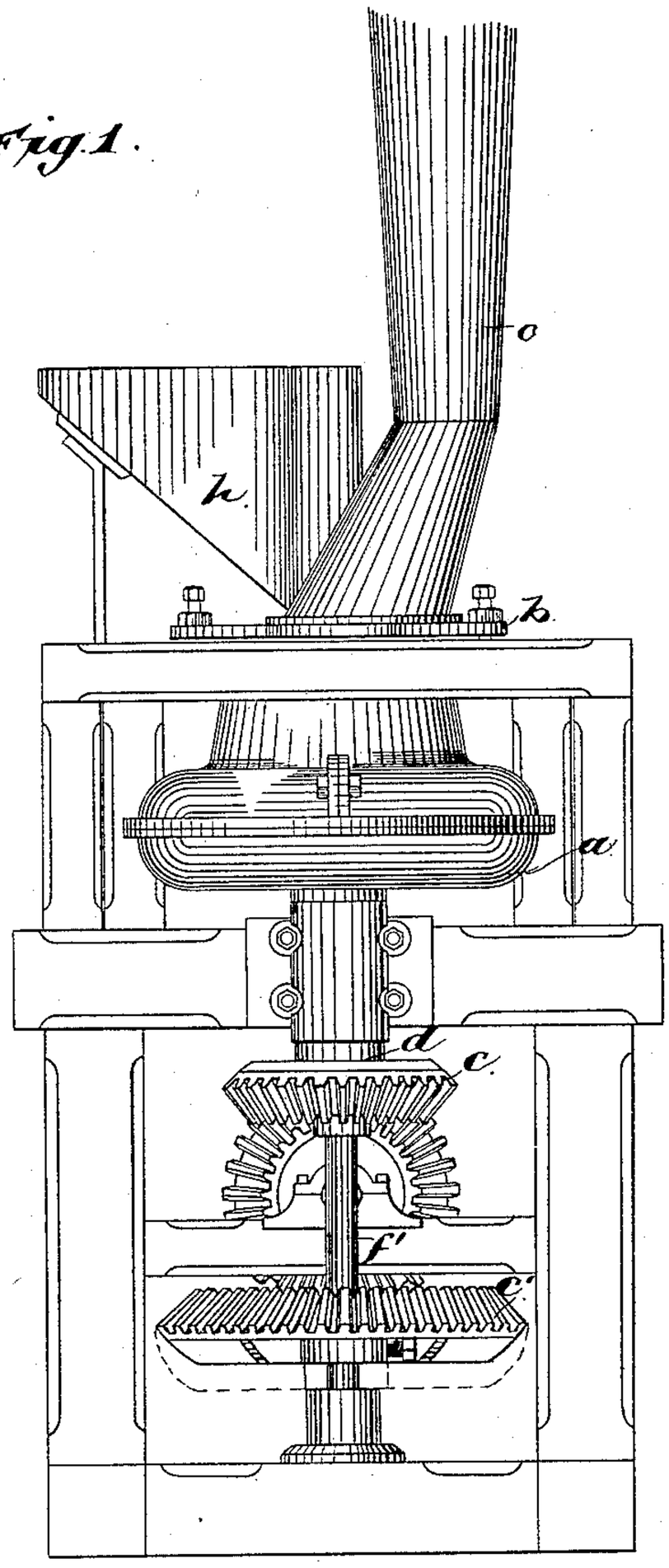
2 Sheets—Sheet 1.

J. K. GRIFFIN.

ORE PULVERIZER.

No. 318,181. Patented May 19, 1885.

Fig. 1.



Witnesses:
Russell H. Scott
Charles S. Hoyer

Inventor:
James K. Griffin.
By Munn & Co
Attys.

(No Model.) 2 Sheets—Sheet 2.

J. K. GRIFFIN.

ORE PULVERIZER.

No. 318,181. Patented May 19, 1885.

Fig. 3.

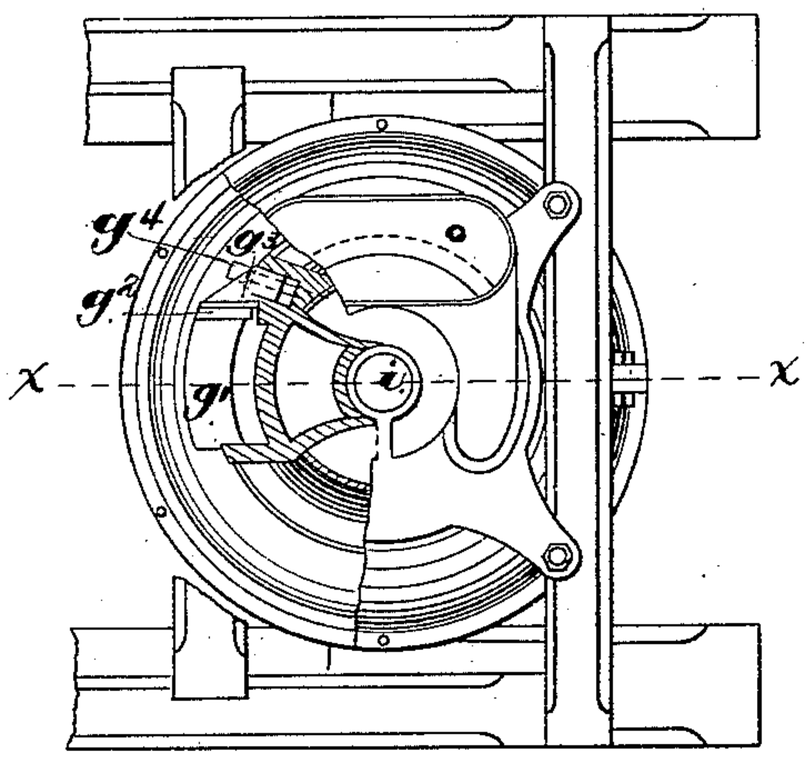


Fig. 2.

Witnesses:
Russell A. Scott.
Charles S. Heyer.

Inventor:
James K. Griffin.
By Edmunds & Co.
Atty.

UNITED STATES PATENT OFFICE.

JAMES K. GRIFFIN, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE GRIFFIN MANUFACTURING COMPANY.

ORE-PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 318,181, dated May 19, 1885.

Application filed March 19, 1885. (No model.)

To all whom it may concern:

Be it known that I, JAMES K. GRIFFIN, a citizen of the Dominion of Canada, and residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Ore-Pulverizers, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to mechanism for the reduction of ores and other substances by attrition, and for the removal of the reduced material from the line of attrition as fast as it is sufficiently ground, by a current of air directed through alternate passages of a central conveyer directly upon the line of attrition between opposing surfaces of the substance, as will be hereinafter more fully described, and pointed out in the claims.

In the drawings, Figure 1 represents a front elevation of the machine. Fig. 2 represents a longitudinal vertical section of the same. (The section of the shell is taken on the line *x x*, Fig. 3.) Fig. 3 represents a top plan of the shell and connections, partly sectional.

The letter *a* indicates a shell or case made preferably of upper and lower sections bolted together at the peripheral edges and forming a close tight-bottomed receptacle. It is made open at the top and revolves as closely as may be beneath the cap-plate or cover *b*. This cover is bolted to the machine-frame, and is provided with openings for the passage of the material to and from the machine, as hereinafter described.

Within the shell or case *a* is a rotating conveyer, *e*, which is fast on a shaft, *f*. This shaft is journaled in bearings in a tubular shaft or sleeve, *d*, and in a lower step bearing on the frame. A bevel gear-wheel, *c*, is fast on the sleeve *d*, and a bevel gear-wheel, *c'*, is fast on the shaft *f*, so that suitable gears on a driving-shaft may mesh with gears *c c'* for rotating the shell *a* and the conveyer *e* independently of each other. Preferably the gearing is so arranged that the shell *a* shall have twice the rotative speed of the conveyer *e*, and so that the shell and conveyer rotate simultaneously in opposite directions. The rotative speed of the shell and conveyer, respectively, may be varied to suit the requirements of different classes of material, and effective results have been obtained by rotating the shell and conveyer in the same direction, when the speed of the shell considerably exceeds that of the conveyer; or the conveyer may remain stationary, the shell rotating around it, as hereinafter described. The conveyer *e* is divided vertically and radially, preferably into four passages, arranged in opposite pairs, two opposite passages, *g g*, being arranged so as to connect with the central passage, *i*, which opens into the hopper *h* to conduct therefrom the crude substance down to the outlets of the passages *g*. These outlets face the inner periphery of the shell *a*, and have, preferably, a rectangular form and a marginal contour conforming horizontally to the curve of the shell. The edges of the outlets of the passages *g g* may be formed of separate adjustable plates *g'*, connected by adjustable end plates, g^2, and movable outwardly from the center in parallel grooves, in which they are firmly held by wedging-keys g^3, crowded against the end plates and secured by binding-screws g^4, (shown by dotted lines,) passing through the key.

In the construction of machines for different purposes the space between the outlets and the inside of the shell may be varied according to the quality of the material to be compacted or consolidated therein, as some substances require more space than others for the formation of a firm annular wall, as hereinafter described.

The compartments *k k* of the conveyer *e*, which alternate with the passages *g g*, are each divided centrally and horizontally by a plate, *m*, so that the space under it connects with the passages *p p*, and the space above it with the exhaust-pipe *o* to provide a passage around the plate *m* for a current of air, which may be forced by an air-blower or other suitable device.

The relative proportions of the various parts of the machine are varied to suit the size and quality of the material to be reduced, and may be of other suitable form, as preferred.

In operation the crude substance is supplied from the hopper *h* through the opening *i* into the passages *g* of the rotating conveyer, and discharged therefrom by centrifugal force against the opposite inner surface of the rotating shell *a*, but without grinding effect until the shell is filled to the edges of the outlets *g*, meanwhile the centrifugal force developed by the rotation of the shell packs the material received from the conveyer *e* into an annular solid wall of sufficient firmness to resist the masses forced against and ground upon it. The whole body of this annular wall need not necessarily be of the material to be reduced. As the rotation of the shell and conveyer continues the greater solidity of the annular wall due to the greater rotative velocity of the shell gives it a resisting power sufficient to pack the material forced against it, so that the firm bodies of material in the shell and conveyer, respectively, rotating in opposite directions, are solidly ground against each other on a well-defined line of attrition outside of and off from the periphery of the conveyer and within the material. The greater the excess of rotating speed in the shell over the conveyer the more compact and solid will the respective bodies in the shell and conveyer be. For some material it is better not to rotate the conveyer, the attrition between the mass in the conveyer pressing downward by it own weight and out against the firm rotating annular wall in the shell, being sufficient for the reduction desired. This is effected by loosening the gear-wheel *c'* from the shaft *f* and dropping it out of connection with the driving-wheel upon the step, as shown by dotted lines. The solid impact and grinding of the material practically excludes the air from the line of attrition while the grinding takes place, thereby facilitating the reducing process. As the work of reduction progresses a current of air forced downward through passages *p* and under plates *m* immediately against the annular wall at its exposed surface between the passages *g*, acts as an air-brush, and by a rotating or whirling motion sweeps the reduced material clean from the surface of the annular wall, directly in the line of attrition, as fast as the reduction takes place, leaving the clean, sharp, and unclogged surfaces of compact crude material to grind against each other, while the powdered product is carried off by the same current over plates *m* upward through the exhaust-pipe *o* to any suitable settler or reception-chamber. The current of air may be changed or reversed and the reduced product carried off in any other suitable upward or downward direction through or outside of the conveyer, as at the ports *v v* in the shell, so long as the air is separately conducted directly to and upon the line of attrition. The force of the current of air is adjusted to and determines the grade of fineness in the product—the lighter the draft the finer the product, and vice versa. This is due to the fact that if the current of air is strong it takes up heavier and larger particles than when the current is weak, whereas if the current is weak the particles will be ground over and over again till fine enough to be lifted by the lighter draft.

I have demonstrated by continued use that with the shell and conveyer rotating in opposite directions at low speed, not exceeding from one hundred and fifty to two hundred revolutions per minute, very hard substances—as quartz and phosphate rock—can by my machine be pulverized in satisfactory quantities to the finest or impalpable powder without intermixture of foreign substances or injury to the machine.

I do not herein claim the method or process of reducing ores by the mechanism herein described, as on August 14, 1884, I filed an application, Serial No. 140,491, for said method or process, illustrating as a part thereof substantially the same mechanism herein illustrated and described.

This application is intended to be a division of the former application.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an ore-pulverizer, a horizontally-arranged conveyer having two or more distinct openings for the passage of the material to be reduced and for the air to carry off the same when pulverized, substantially as described.

2. In an ore-pulverizer, the combination of the conveyer having openings for the passage of the material to be reduced and for the air to carry off the same when pulverized, an outer rotating shell or case, and means for rotating the latter, substantially as described.

3. In an ore-pulverizer, the combination of a revolving conveyer having openings for the passage of the material to be reduced and for the air to carry off the same when pulverized, an outer rotating shell or case, and means for rotating both the conveyer and the shell, substantially as described.

4. In an ore-pulverizer, the combination of a conveyer having ore and air passages, and an outer rotating shell or case, said conveyer and shell being so adapted that the ore delivered through the conveyer will form with the ore adhering to the shell a line of attrition on their opposing surfaces, and means for rotating the shell, substantially as described.

5. In an ore-pulverizer, the combination of a rotating conveyer having ore and air passages, and an outer rotating shell or case, said conveyer and shell being so adapted that the ore delivered through the conveyer will form with the ore adhering to the shell a line of attrition on their opposing surfaces, and means for rotating both the conveyer and shell, substantially as described.

6. In an ore-pulverizer, the combination of an inner rotating conveyer, an outer rotating shell, independent means for rotating the con-

veyer and the shell, and a hopper, constructed and arranged substantially as described.

7. An ore-pulverizer comprising the conveyer *e*, having ore-passages *g g*, air-passages *p p*, cap *b*, adjustable plates *g' g'*, division-plates *m m*, shell *a*, shafts *d* and *f*, gearing C, and adjustable gearing C', all constructed and arranged substantially as described.

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

JAMES K. GRIFFIN.

Witnesses:
CHARLES S. HYER,
RUSSELL H. SCOTT.