

(No Model.)

2 Sheets—Sheet 1.

W. M. FULLER & J. J. HAYES.
PULVERIZING MACHINE.

No. 352,459.

Patented Nov. 9, 1886.

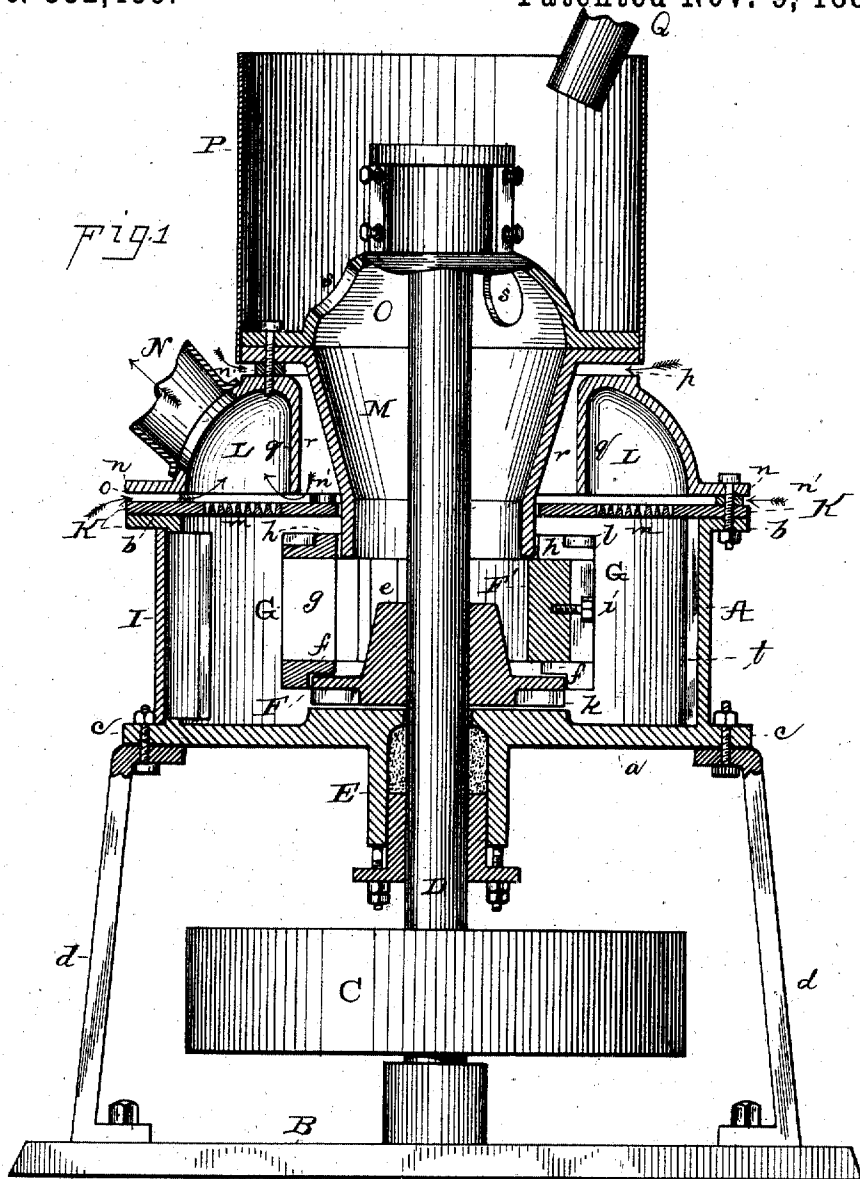


Fig. 6.



ATTEST:
W. H. Rowland
att. middle

INVENTORS:
William M. Fuller,
John J. Hayes,
By Dyer & Seely
Attys.

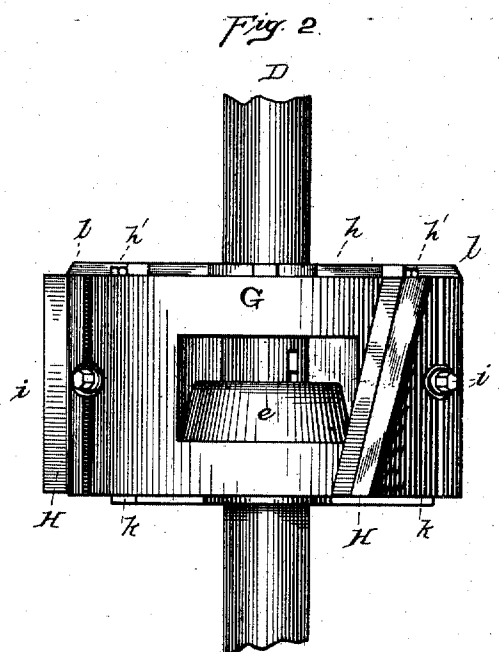
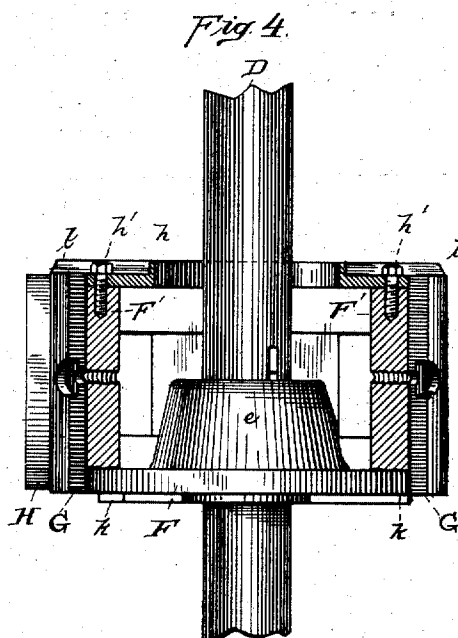
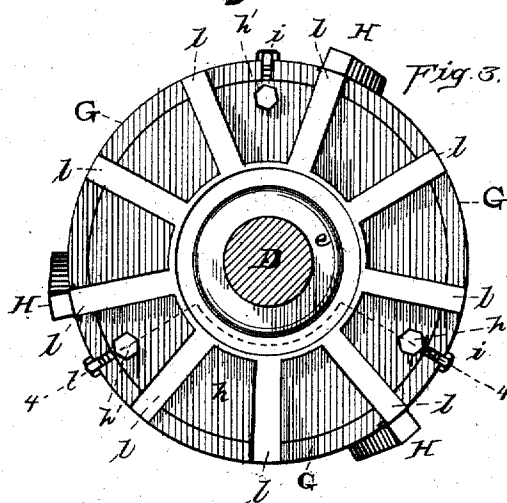
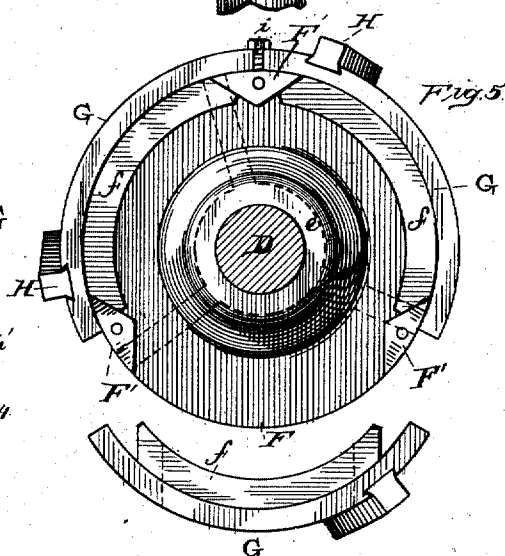
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No. 352,459.

Patented Nov. 9, 1886.



ATTEST:
E. T. Howland,
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INVENTORS:
William M. Fuller
John J. Hayes.
By Oyer & Seely
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UNITED STATES PATENT OFFICE.

WILLARD M. FULLER, OF NEW YORK, AND JOHN J. HAYES, OF BROOKLYN, ASSIGNORS TO THE AMERICAN PULVERIZER COMPANY, OF NEW YORK, N. Y.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 352,459, dated November 9, 1886.

Application filed November 27, 1885. Serial No. 184,001. (No model.)

To all whom it may concern:

Be it known that we, WILLARD M. FULLER, of New York city, in the county and State of New York, and JOHN J. HAYES, of Brooklyn, in the county of Kings and State of New York, have jointly invented a certain new and useful Improvement in Pulverizing-Machines, of which the following is a specification.

The object we have in view is to produce a machine for pulverizing rock of all kinds and other hard substances by the attrition of masses of the material in motion, which machine will be self-discharging as well as self-feeding, will not clog or choke in its operation, will have the minimum of wearing parts, which will be accessible and arranged for easy replacement, and generally will be rapid and efficient in operation, durable in wear, and simple and cheap in construction.

In the accompanying drawings, forming a part hereof, Figure 1 is a vertical section of the machine; Fig. 2, an elevation of the revolving center removed from the grinding-cylinder, with the shaft broken off above and below the center; Fig. 3, a top view of such revolving center, with the shaft in horizontal section; Fig. 4, a vertical section of the revolving center on the line 4 4 in Fig. 3, with bottom disk in elevation; and Fig. 5, a top view of the revolving center, with the top ring removed and one of the pocket-frames taken off and shown also in top elevation.

A is the grinding-cylinder, which is a cylindrical casting open at top and having a bottom floor, *a*, and top and bottom peripheral flanges, *b c*. The grinding-cylinder is supported by braces *d* from a bed-plate, B, to give room between the cylinder and bed-plate for pulley C, which is fixed to a shaft, D, stepped on the bed-plate and passing centrally and vertically through the grinding-cylinder, the point where the shaft passes through floor *a* of the cylinder being preferably protected by a stuffing-box, E.

Within the grinding-cylinder is keyed upon the shaft the revolving center. This, in a general way, is a cylinder closed at its bottom, having the material to be pulverized fed into its top, and throwing such material outwardly by centrifugal action through openings or pockets in its sides. This revolving center is

composed of a disk, F, having a hub, *e*, for keying to the shaft. From the upper side of disk F, at its edge, rise three posts, F', which are cast in one piece with said disk, and are arranged at equal distances apart upon the disk. The posts F' are triangular in cross-section, as shown in Fig. 5. The spaces between the posts form the lateral openings in the center. These openings are occupied by three frames, G, which are of the form shown, and fit the disk F between the posts and extend outside the same to their centers, where they meet and form the circumference of the revolving center. The frames G have flanges *f* extending inwardly from the frames around the openings therein, such flanges covering the edge of the disk F and forming the walls of the pockets or passages out through which the material is discharged from the revolving center. The frames G are held by stud-bolts *i*, screwed into the posts F' at the meeting edges of the frames. The top of the revolving center is formed by an annular plate, *h*, which is secured by stud-bolts *h'* to the tops of the posts F'. The disk F has radial ribs *k* on its under side, and the top ring, *h*, is provided with similar ribs, *l*, on its upper side to throw the material outwardly and take the pressure off of the shaft and off of the walls of the stationary feed-channel, about to be described.

The frames G carry removable wearing-plates H on their working-sides, which are the rear sides of the pockets with respect to their direction of rotation. These plates, preferably, are held in dovetail grooves extending entirely across the faces of the frames on the rear sides of the pocket-openings.

The plates H may be slightly tapering to prevent them from dropping out of the grooves, and they also, preferably, are set on a slight angle, with their lower ends somewhat in advance of their upper ends, so as to tend to throw the material upwardly as the center revolves.

The grinding-cylinder has an opening in its side covered by plate I, which opening is large enough to admit the passage of a frame, G, through it. These frames can be taken out and the wearing-plates renewed, or the frames themselves renewed, through the opening in

the grinding-cylinder without taking the machine apart. This opening is also used to clean all the material out of the machine when desired for any purpose.

5 Upon the top flange, *b*, of the grinding-cylinder is secured an annular discharge-plate, K, and upon this plate is mounted an annular dust-chamber, L, which in turn carries the feed-magazine M, surrounding the shaft and extending downwardly through the dust-chamber L and plate K into the top of the revolving center, where it is hugged closely by the top ring, *h*, of the center. The plate K divides the grinding-cylinder from the dust chamber.

10 It is perforated with holes or slots *m*, forming a grating which connects the grinding cylinder with the dust chamber throughout their adjoining portions. These perforations flare upwardly, as shown in Fig. 6, so that they cannot become clogged, all material which enters them having a free and enlarging passage upwardly. The perforations *m* are made quite small or narrow at their lower ends next to the grinding-cylinder—say one thirty-second ($\frac{1}{32}$)

25 of an inch in width or diameter—so as to prevent coarse material from working through them. The flange *n* of the dust-chamber is raised off of the plate K by thimbles or blocks *n'* on the fastening-bolts, leaving an air-space, *o*, entirely around the lower outer edge of dust-chamber. An air-space, *p*, is also left by similar means between the flange of feed-magazine M and the top of dust-chamber. This admits air into an annular channel formed between

35 the magazine M and the downwardly-hanging inner wall, *g*, of the dust-chamber. The wall *g* does not extend quite down to plate K, thus forming an air-space, *r*, entirely around the inner lower edge of the dust-chamber. A pipe, N, connects one side of dust-chamber L with an exhaust-fan, as usual, (not shown,) for drawing off the dust.

A cap, O, is mounted on the upper end of the feed-magazine to carry the upper bearing for the shaft. This cap has large openings, *s*, for the free passage of the material to be pulverized from the hopper P, which surrounds the cap, into the feed-magazine.

The operation of the machine is as follows:

50 The pulley is belted to a suitable source of power, and the center revolved at a high rate of speed. The material to be pulverized is allowed to run into the hopper and fill it, and from the hopper it passes to the feed-magazine and through the revolving center outwardly into the grinding-cylinder until the machine is full. No regulation of the feed is required, the machine taking care of all material that can run into it by gravity. By the revolution

60 of the center a body of the material becomes packed in the grinding cylinder and is stationary therein, being prevented from revolving by vertical ribs *t* on the walls of cylinder. Another body of material is carried around

65 by the revolving center, and is at the same time thrown outwardly by centrifugal action. By the attrition of the stationary and moving

masses the grinding is performed, new material being constantly supplied through the revolving center. The material where the grinding takes place being in motion, the lighter or ground material works to the top, being also assisted by the oblique arrangement of wearing plates. It is forced through the grating in plate K into the dust-chamber, and is removed from such chamber by the air-currents, which sweep over the surface of plate K from both sides through openings *o* *r* and pass out through pipe N. This feature of having the pulverized material forced vertically out of the grinding-cylinder by means of the obliquely-arranged wearing-plates, and without forcing an air-blast through such grinding-cylinder, is entirely novel in attrition-mills, and possesses numerous advantages, of which may be mentioned the simplicity of construction which it permits and the uniformity of action secured. The feature of discharging the material into a dust-chamber, from which it is withdrawn by an exhaust-fan, the air entering and leaving the dust-chamber without passing through the grinding-cylinder, is also an advantageous construction. After the dust leaves the machine it is separated in any suitable or known way, and the coarser portion returned to the hopper for regrinding.

The machine, although described as a dry pulverizer, is equally well adapted for wet pulverizing. It is only necessary that water should be allowed to run into the hopper through a suitable pipe, Q. The air-openings *o* *p* would be closed by taking the thimbles *n'* off of the bolts, and pipe N would be led down to a suitable receptacle instead of to the exhaust-fan. The water and ground material would be thrown by the action of the machine up into chamber L and out pipe N.

What we claim is—

1. In a pulverizing-machine acting by attrition of masses of the material, the combination, with a grinding-cylinder having a closed bottom, a revolving center in such cylinder, a feed-magazine delivering material into the top of said center, and a plate over the top of said grinding-cylinder having a central opening to permit the entrance of such feed-magazine, and provided around this central opening with perforations forming exits for the discharge of the pulverulent material, substantially as set forth.

2. In a pulverizing-machine acting by attrition of masses of the material, the combination, with a grinding-cylinder having a closed bottom, a revolving center in such cylinder, a feed-magazine delivering material into the top of said center, a discharge-plate over the top of the grinding-cylinder having a central opening to permit the entrance of said feed-magazine, and provided around this central opening with perforations forming exits for the discharge of the pulverulent material, and an annular dust-chamber surmounting such discharge-plate, substantially as set forth.

3. In a pulverizing-machine, the combination, with the grinding-cylinder, of a discharge-

plate provided with perforations forming exits through which pulverulent material is discharged from said grinding-cylinder, and a dust-chamber covering said discharge-plate and provided with air inlet and outlet openings, whereby air-currents may be formed directly through such dust-chamber for carrying off the pulverulent material, substantially as set forth.

4. In a pulverizing-machine, the combination, with a grinding-cylinder having a closed bottom and the revolving center, of a plate closing the top of the grinding-cylinder, and provided with perforations forming discharge-exits, a central feed-magazine delivering the material to be ground through the center of such plate to the revolving center, and the annular dust-chamber surmounting the grinding-cylinder and covering such discharge-exits, and having air inlet and outlet openings, substantially as set forth.

5. In a pulverizing-machine acting by attrition, the combination, with the grinding-cylinder, the revolving center therein, and the top plate covering said grinding-cylinder and having perforations forming discharge-exits, of the central feed-magazine, the annular dust-chamber mounted upon and raised off of said plate, and forming therewith air-inlet openings admitting air to the surface of the discharge-plate at both its outer and inner edges, and the exhaust-pipe from such dust-chamber, substantially as set forth.

6. In a pulverizing-machine acting by attrition, the revolving center provided with the removable frames forming pockets, substantially as set forth.

7. In a pulverizing-machine acting by attrition, the revolving center provided with the removable frames forming pockets, and removable wearing-plates carried by such frames, substantially as set forth.

8. In a pulverizing-machine acting by attrition, the revolving center provided with plates forming oblique working-surfaces tending to throw material upwardly as the center revolves, substantially as set forth.

9. In a pulverizing-machine acting by attrition, the combination of the disk F, having posts F', with frames G, and the annular plate h, forming the revolving center, substantially as set forth.

10. In a pulverizing-machine acting by attrition, the revolving center provided with radial ribs on top and bottom of same to throw material away from center, substantially as set forth.

This specification signed and witnessed this 14th day of November, 1885.

WILLARD M. FULLER.
JOHN J. HAYES.

Witnesses:

A. W. KIDDLE,
E. C. ROWLAND.

Correction in Letters Patent No. 352,459.

It is hereby certified that Letters Patent No. 352,459, granted November 9, 1886, upon the application of Willard M. Fuller, of New York, New York, and John J. Hayes, of Brooklyn, New York, for an improvement in "Pulverizing-Machines," was erroneously issued to "The American Pulverizer Company, of New York, New York," as owner of the entire interest, whereas the said Letters Patent should have been issued to said *John J. Hayes and the American Pulverizer Company of New York, New York*, said American Pulverizer Company being the assignee of one-half interest only in said invention; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 16th day of November, A. D. 1886.

[SEAL.]

D. L. HAWKINS,
Acting Secretary of the Interior.

Countersigned:

R. B. VANCE,
Acting Commissioner of Patents.