3 Sheets—Sheet 1.

J. FITZGERALD.

Grinding Mill.

No. 235,422. Patented Dec. 14, 1880.

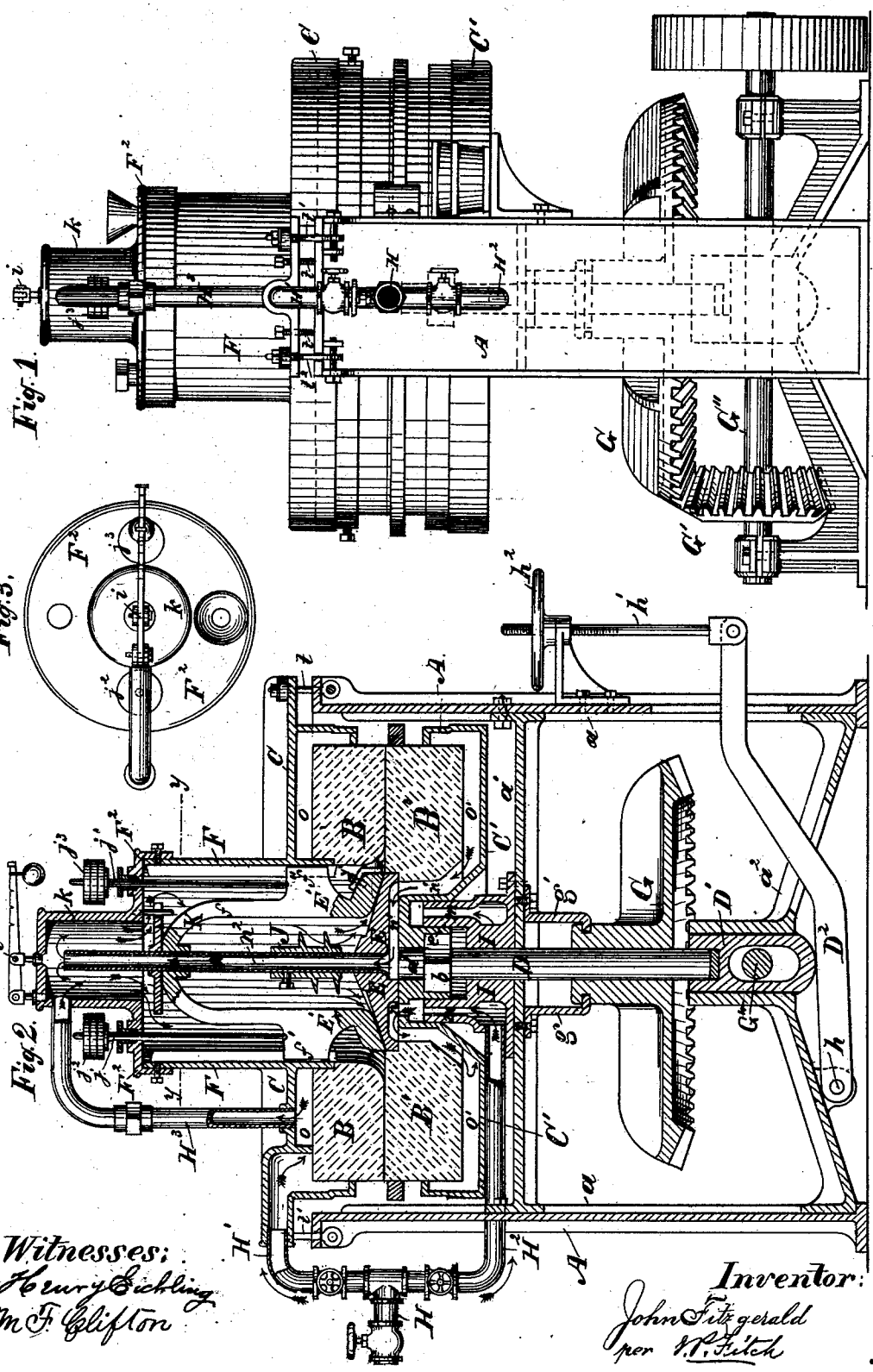


Fig. 1.

Fig. 3.

Fig. 2.

Witnesses:
Henry Sichling
M. F. Clifton

Inventor:
John Fitzgerald
per V. P. Fitch
Atty.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

3 Sheets—Sheet 2.

J. FITZGERALD.

Grinding Mill.

No. 235,422. Patented Dec. 14, 1880.

Fig. 4.

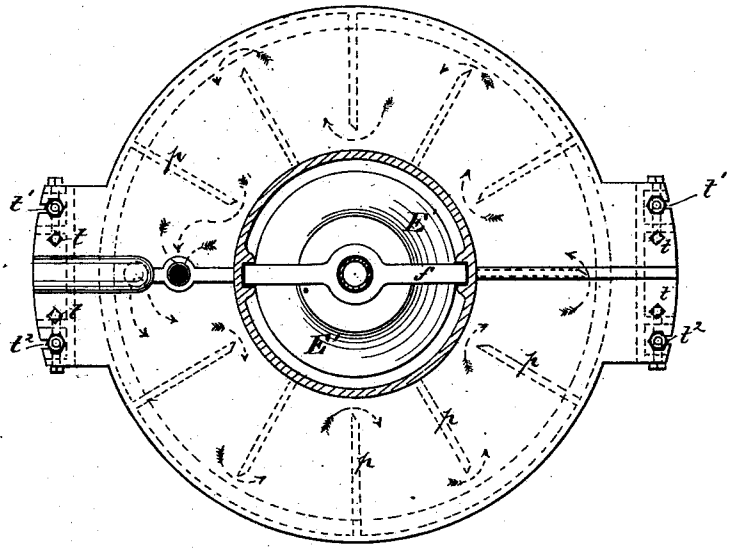
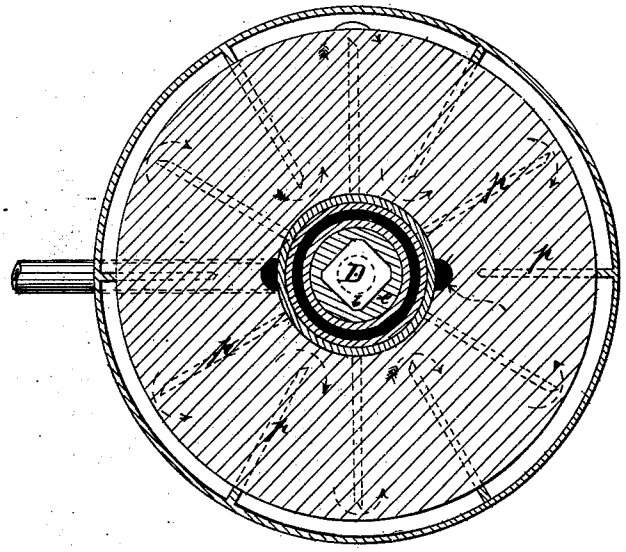


Fig. 5.



Witnesses:

Henry Eichling
A. S. Fitch

Inventor

John Fitzgerald
per A. S. Fitch. Atty

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

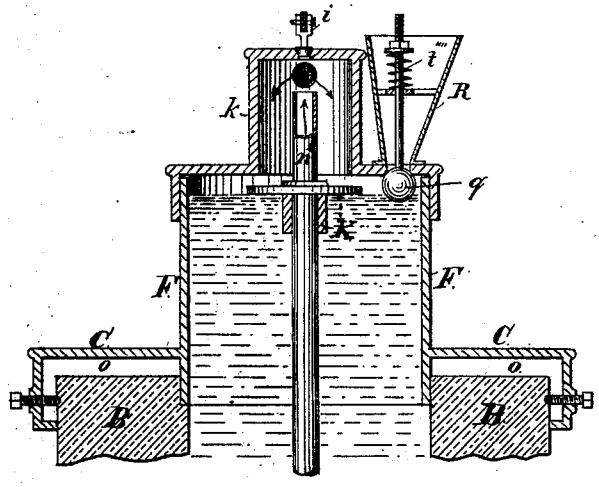
3 Sheets—Sheet 3.

J. FITZGERALD.

Grinding Mill.

No. 235,422. Patented Dec. 14, 1880.

Fig. 6.



Witnesses:

Henry Cushing

A. S. Fitch

Inventor:

John Fitzgerald

by S. P. Fitch

his Atty.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN FITZGERALD, OF BROOKLYN, NEW YORK.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 235,422, dated December 14, 1880.

Application filed November 4, 1879.

To all whom it may concern:

Be it known that I, JOHN FITZGERALD, of Brooklyn, Kings county, New York, have invented certain Improvements in Grinding-Mills, of which the following is a specification, reference being had to the accompanying drawings, forming part of the same, in which—

Figure 1 is a side elevation of a mill containing my improvements. Fig. 2 is a central vertical section of the same. Fig. 3 is a plan or top view of the hopper and dome, as shown in Fig. 2. Fig. 4 is a view looking down on a cross-section on line *y y*, Fig. 2. Fig. 5 is a horizontal section through the lower stone of the mill, about midway between the upper and under surface. Fig. 6 is a detailed view, in section, of my hopper and its dome, and showing the supplementary feeding-hopper and its valve, whereby the main hopper is fed with material to be ground at the same time that the air in the said hopper is prevented from escaping.

When grinding-mills are run at a high speed the stones are liable to become objectionably heated. The object of my improvement is to effect their cooling by the circulation of air or water around and between them.

A represents the frame on which the working parts are mounted, consisting of upright posts *a*, tied together by cross-bars or girders a' a^2. The upper stone, B, is suspended to an iron plate, C, to which it is firmly secured, the said plate resting upon and made fast to the upper ends of the posts *a*, the stone being thus made stationary. The lower stone, B′, rests on and is secured to a plate or casing, C′, which is formed, as shown plainly in section in Fig. 2, to fit at its center onto a spindle, D, the said spindle at *b*, near its upper end, being squared and fitted into a rectangular flange that projects from the under side of the center of the said casing C′. The central opening in the casing is round, fitting the portion *d* of the spindle, the said casing with the lower stone thus resting on the spindle D, by which it is rotated.

E is a supplemental grinder and mixer, which may be made of iron, being a disk that covers the central opening in the lower stone, B′, and rests upon and is made fast to it. Its upper face is conical, as shown, and is provided with furrows constituting it a grinding-surface. This revolves with the stone B′.

E′ is an upper grinder, the under surface of which is furrowed and made concave to fit onto the conical surface of the grinder E. It is in the form of an annulus or ring, with a large internal diameter, as shown in Fig. 2, and the concavity of the under or grinding surface is somewhat greater than the convexity of the lower grinder, E, and the under inner edge is beveled or rounded off, as shown, so that the substance or material to be ground will make its way through the center of E′ out between the grinders. The grinder E′ is provided with a yoke, *f*, which rises from the grinder, within the hopper F, that is connected with the top plate or casing, C. On two opposite sides of the inner wall of this hopper are ribs forming ways, in which lugs or projections f' f^2 on the yoke work. This arrangement, while it permits the grinder E′ to have a vertical movement, prevents it from revolving.

It is also evident that by this arrangement the upper auxiliary grinder, E′, is detached from and unconnected with the upper stone, B, so that it is possible for a space or chamber to exist between the adjacent faces of the grinder E′ and stone B, and these parts are so constructed and arranged that the space *x* shall exist between the outer edge of E′ and the interior edge of B, so that communication is established between the grinding-surfaces of B and B′ and the interior of the hopper F, above the upper auxiliary grinder, E′. By this means the material to be ground, passing down between the auxiliary grinders E E′ to the stones B B′, if it is not crushed fine enough to enter between said stones, will be crowded up into the space *x*, and thence will pass up over the ring-grinder E′ into the hopper, and will then pass again through the auxiliary grinders E E′ to be recrushed.

Upon the outer rim of the ring-grinder E′, I place one or more wings, which project from the face of E′ and extend downward along said face in the space *x* between said face and the adjacent surface of B. These wings are preferably formed of strips of angle-iron, as shown at *y′*, Fig. 2, where one is seen bolted onto the outer rim of E′ in the space *x*. These

wings are so attached to the ring-grinder E′ that they may be inclined more or less on the face of E′ to dip to a greater or less degree downward toward the bottom of the space or chamber *x*. These wings or inclined projections *y* thus operate, when E′ is rotating, as scoops or inclines to force or carry the material which finds its way into the chamber *x*, in which they travel, upward and over E′ into the hopper again. This prevents any clogging in the space *x*, and any coarse particles of the material being ground are readily carried up out of said space or chamber and returned with the general mass to the grinders E E′.

The tendency of the screw-stirrer J is to gather the material in the hopper toward the center and to crowd it down through the central opening of E′ to and between the grinders E E′, while the wings or inclines *y′* on the outer face of E′, moving in the chamber *x*, will operate to force upward and into the hopper all particles of the material which are not fine enough to enter between the stones B B′.

G is a beveled gear, which is hung on brackets *g g′*, which take into an annular groove in the hub of said gear, as shown in Fig. 2. The said gear is driven by a pinion, G′, on the driving-shaft G². The spindle D passes loosely through the hub of G, to which it is feathered, and is stepped on a sliding block or step, D′, the said block resting on a lever, D², which is pivoted at one end, at *h*, to the cross-bar a^2, the opposite end being connected to a screw-rod, *h′*, that passes through a bracket, with a nut hand-wheel, h^2, whereby the block D′, the spindle D, and consequently the stone B′ and grinder E, may be raised and lowered to adjust the stones for grinding.

From the center of the cap or cover F² of the hopper F rises a dome or cylinder, *k*, closed at the top and provided with a weighted valve, *i*.

j and *j′* are rods which run through stuffing-boxes down through the cap F², and rest at their lower ends on the projections *f′ f‴* on the yoke *f*. On the upper ends of these rods are weights j^2 j^3, which serve to press the grinder E′ upon E.

I will now proceed to describe the devices by which air or water is circulated over and around the stones, whereby they are cooled.

Between the upper and lower surfaces, respectively, of the stones and the casings C and C′ heretofore mentioned there are spaces or chambers *o o′*, as shown in Fig. 2. In these chambers are placed series of radial partitions *p*, arranged to abut alternately against the outer and inner walls of the chambers, as seen in dotted lines in Figs. 4 and 5. Thereby air or fluid circulating around these chambers will be made to take a zigzag course around the open ends of the partitions. Air or fluid is introduced into these chambers through the pipe H, which branches, one branch, H′, leading into the chamber *o* over the stone B, and the other branch, H², through an annular chamber, *m*, in the cylinder I, which is secured on the lower bar, *a′*, and projects upward into the center of the casing C′. From this annular chamber the air passes through an opening, *n*, in the said casing down into the chamber *o′*; thence, after passing around the said chambers past the partitions, passes out through a channel, *n′*, into a pipe, n^2, which runs through the center of the grinder E, and rises and opens into the dome *k*. The course of the air is indicated by arrows in Fig. 2. The air entering through branch pipe H′ passes around the stone B, through the chamber *o*, past the radial partitions in that chamber, and escapes through the pipe H^3 into the dome *k*. The air thus coming into the dome through the pipes *n* and H^3 is forced downward upon and into the contents of the hopper F, and makes its way, mingled with said contents, between the grinders E and E′ and the stones B and B′. The stones and grinders are thus surrounded by a moving current of cold air, whereby they are kept cool.

The casings of the stones may be made to include in the chambers *o o′* a space around their peripheries, thus enlarging the surface with which the cold air is brought in contact.

J is a screw-stirrer fixed on the pipe *n*, by the revolving of which the contents of the hopper F are forced down into the mill, aided by the air-pressure above. The motion of the stirrer also gives access to the air into the said contents.

The casing C, with the stone B, is vertically adjustable on the frame A by means of set-screws, and is held down onto said frame by means of screw-bolts *t* and nuts *t′* and *t²*, which may be pivoted or hinged at their lower ends to the frame and swing into slots in the casing.

R, Fig. 6, represents a mouth-piece for the introduction of the material to be ground into the hopper F. It is provided with valve *q* at the bottom, that opens downward, and is kept closed by the stress of a spring, *t‴*, which is so adjusted that it will give way to the pressure of the material in the mouth-piece and close the valve when the mouth is empty.

K is a valve in the form of a disk, which is fitted loosely upon the pipe n^2, and rests on the top of the yoke *f* when not lifted therefrom. It is constructed, when raised, to close the lower end of the dome or cylinder *k*, the design being that it shall be floated on the top of the contents of the hopper and close the said dome, so that said contents cannot rise into the dome and make their way into the air-pipes.

It is intended that a suitable air-pump or blower shall be employed to force the air into the chambers *o o′* through the pipes H′ H².

I am aware that chambers have heretofore been formed between the stones of a mill and their casings provided with radial partitions, whereby air for cooling the stones is made to pass through these chambers over the surface

of the stones in a zigzag course, and hence I do not claim this as new. I intend to limit my claims hereunder to the specific devices shown and described whereby the circulation of the air through and around the stones is accomplished.

I am also aware that heretofore mills have been constructed with devices by which a blast of air has been caused to mingle with the material to be ground as it passes between the grinders; hence I do not intend to claim this, broadly; but I wish to limit my claims hereunder to the devices whereby at the same time the air is forced into the hopper of the mill under pressure and is there mingled with the material as it passes to the grinders. The air cannot escape from the hopper in any other direction, although the material to be ground can be fed into the hopper as desired.

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

1. The combination, with the stones B B′, of the casings C C′, chambers *o* and *o′*, the pipes H′ H², the air-passages *n n′*, the annular chamber *m* in the cylinder I, and the pipes H³ and *n²*, all constructed to operate as and for the purpose described.

2. The combination of the rotating stone B′, the casing C′, chamber *o′*, and cylinder I, fitting into and forming a joint with said casing, as shown in Fig. 2 of the drawings, and provided with the annular chamber *m*, as and for the purpose specified.

3. The combination, with the stones B B′, of the hermetically-closed hopper F, provided with the spring-valve *q* in the auxiliary feeding hopper or funnel R, and pipes H³ and *n²* for conducting air under pressure into said hopper F, as described, whereby an air-pressure is applied to the contents of the hopper to force the same, mingled with the air, between the stones, and at the same time the hopper F may be fed or supplied with the material to be ground without the escape of the air under pressure in the hopper, as and for the purpose specified.

4. The combination, with the stones B B′, of the auxiliary grinders E E′, as described, the grinder E′ having the chamber *x* between its outer face and the interior face of B, and having the adjustable inclined wings or pieces *y′* on its outer rim, as described, together with the screw J, all arranged to operate as and for the purpose specified.

5. The combination, with the grinders and mixers E E′, of the yoke *f*, having lugs *f′ f″* engaging in ways on the interior of the hopper F, the rods *j j′*, and weights *j² j³*, as and for the purpose specified.

6. The combination, with the stones B B′, of the hopper F and dome *k* and air-pipes H³ and *n²*, together with the valve K, as described, and for the purpose specified.

7. The combination, with the hopper F and dome *k*, of the valve K, fitted to slide on the pipe *n²*, as and for the purpose described.

JOHN FITZGERALD.

Witnesses:
JOHN G. H. MEYERS,
M. F. CLIFTON.