(No Model.) 2 Sheets—Sheet 1.

J. FITZGERALD.

COOLING MECHANISM FOR GRINDING MILLS.

No. 255,964. Patented Apr. 4, 1882.

Fig. 1

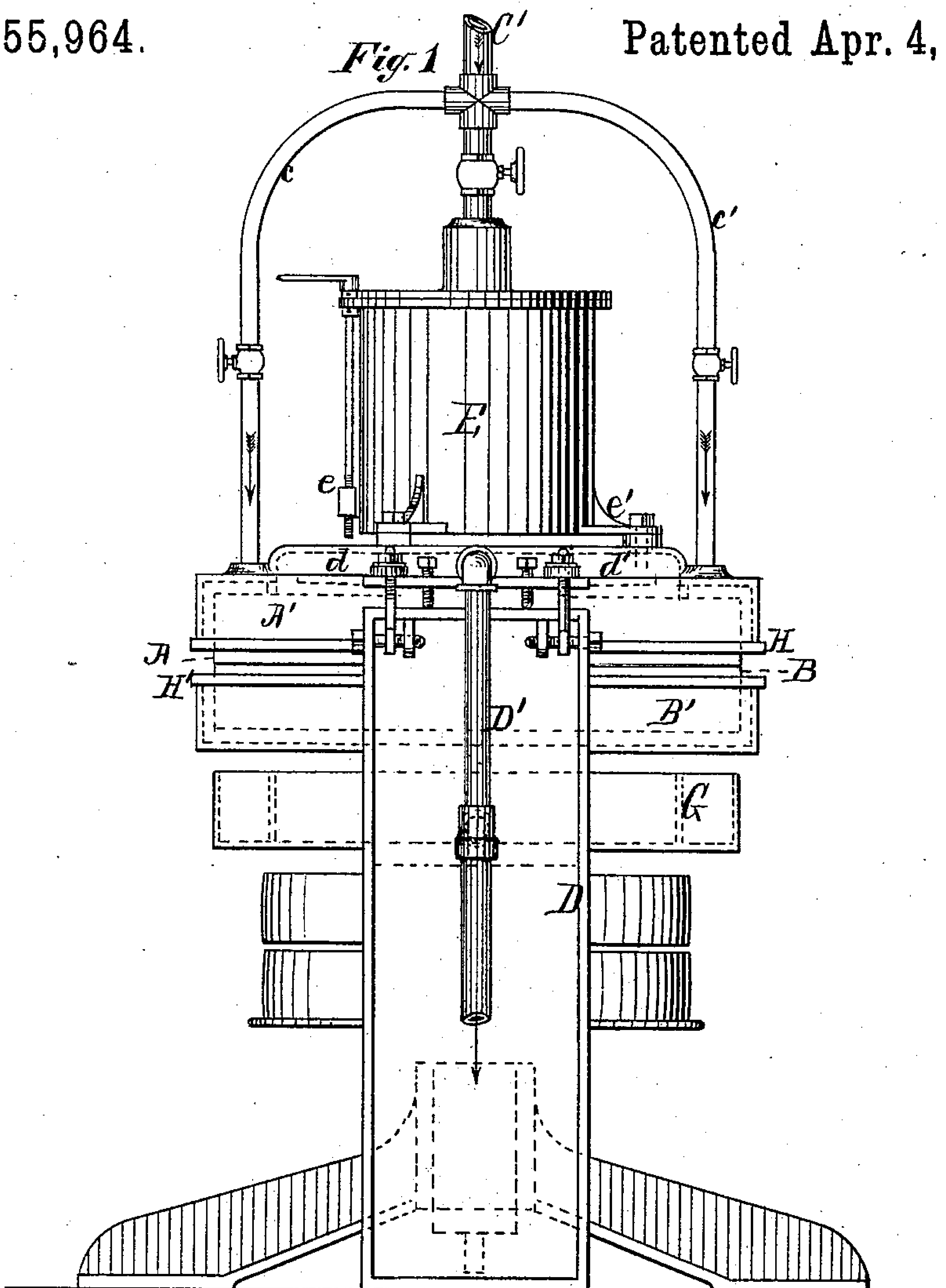


Fig. 2

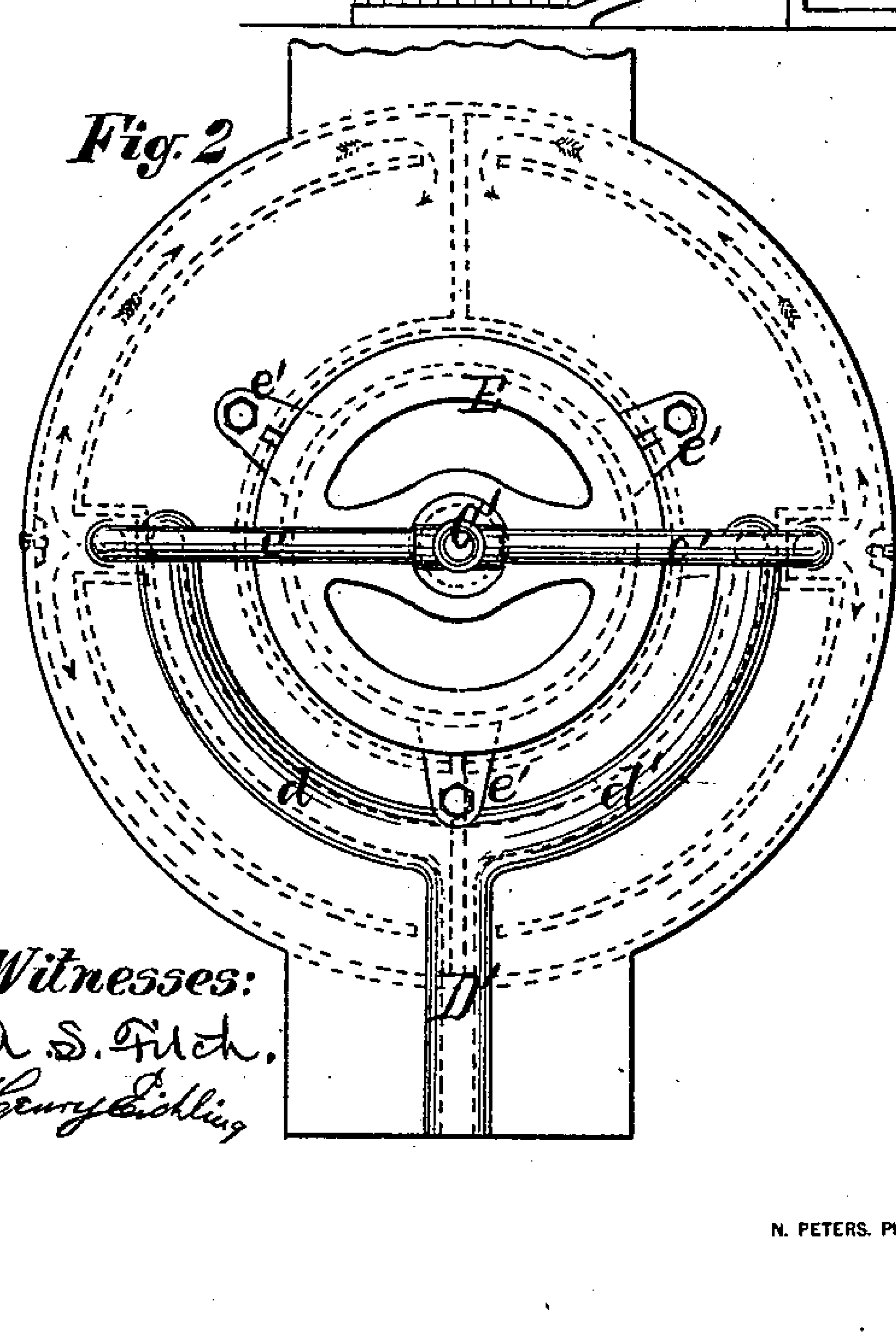
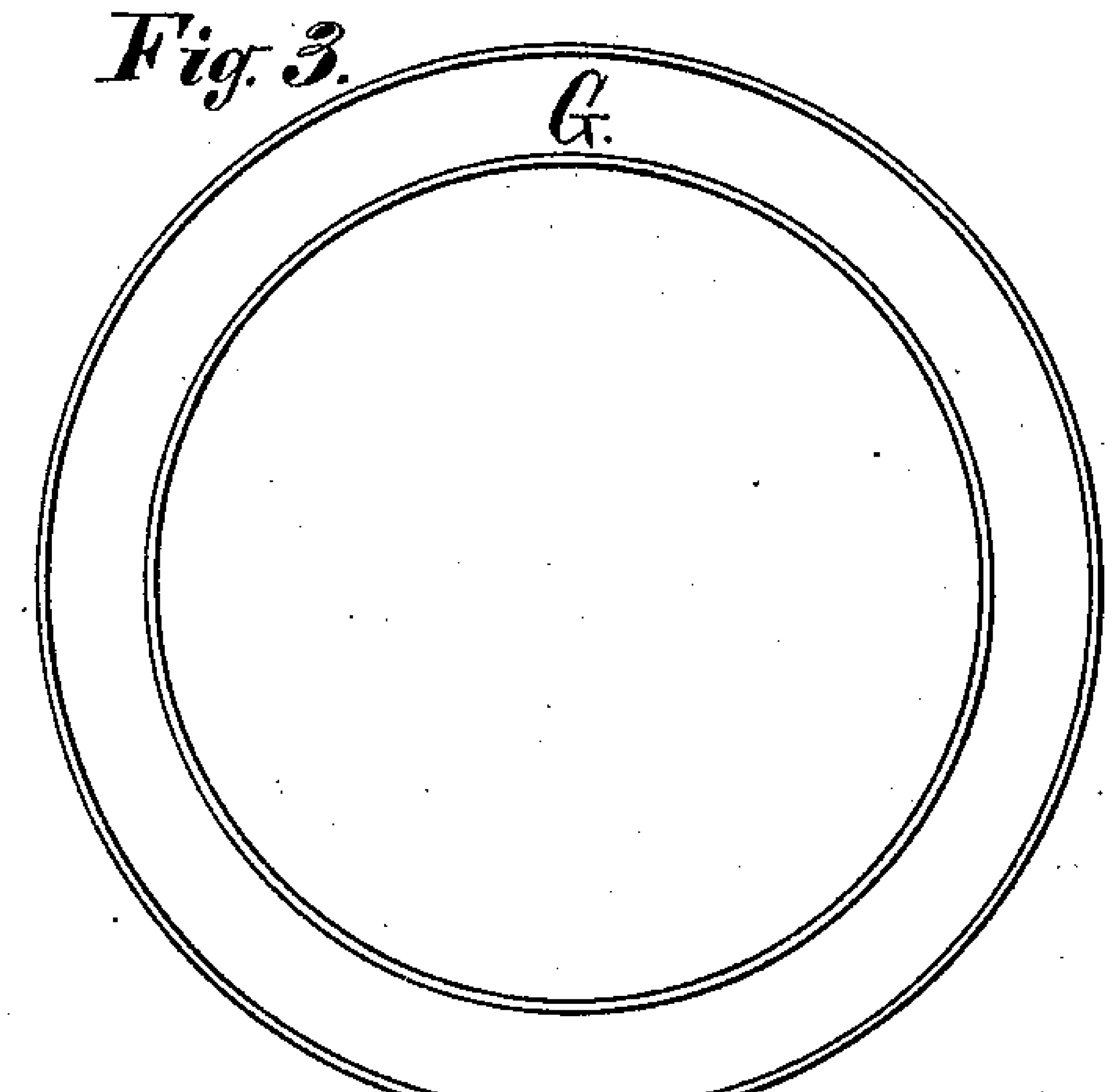


Fig. 3



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

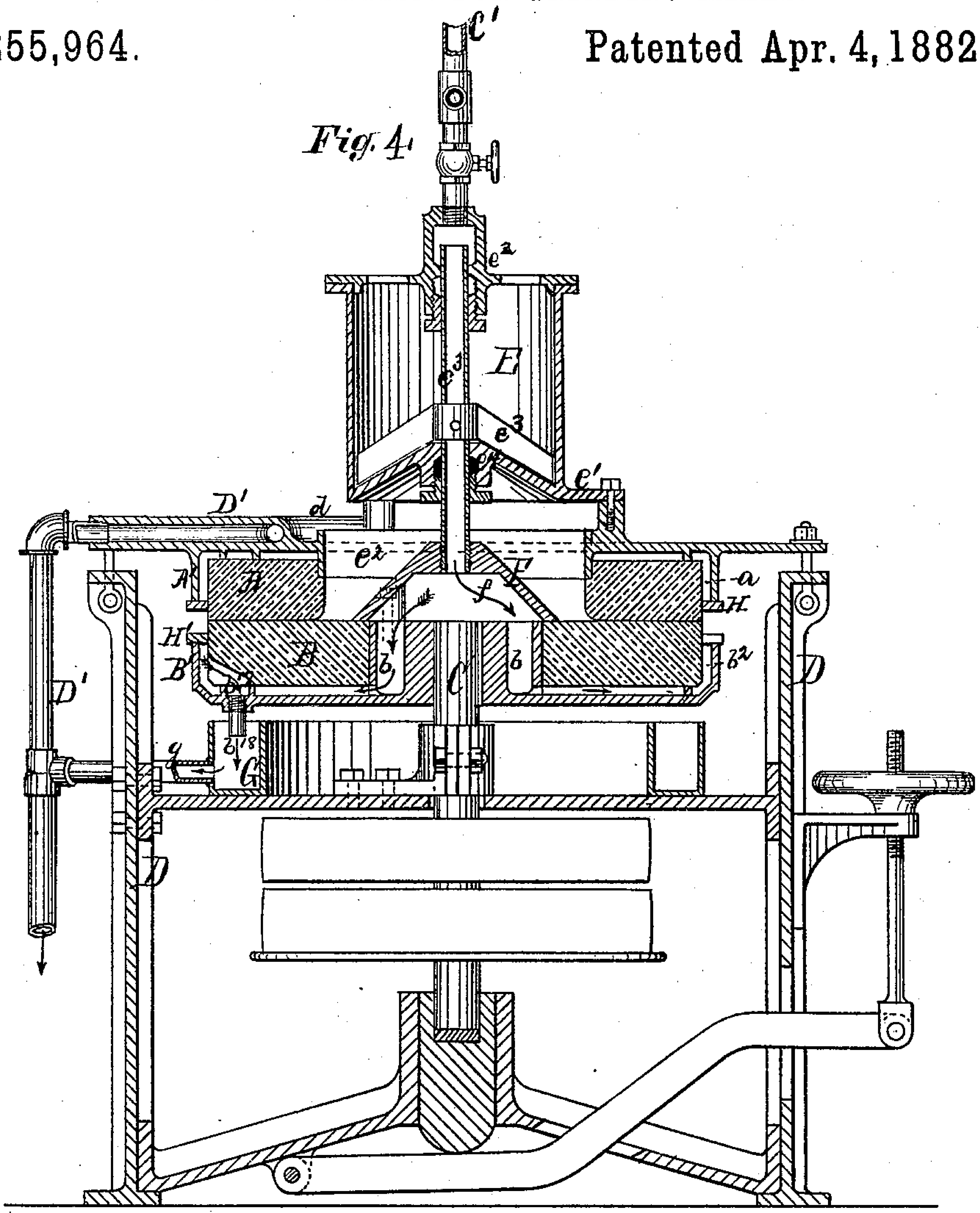


Fig. 5.

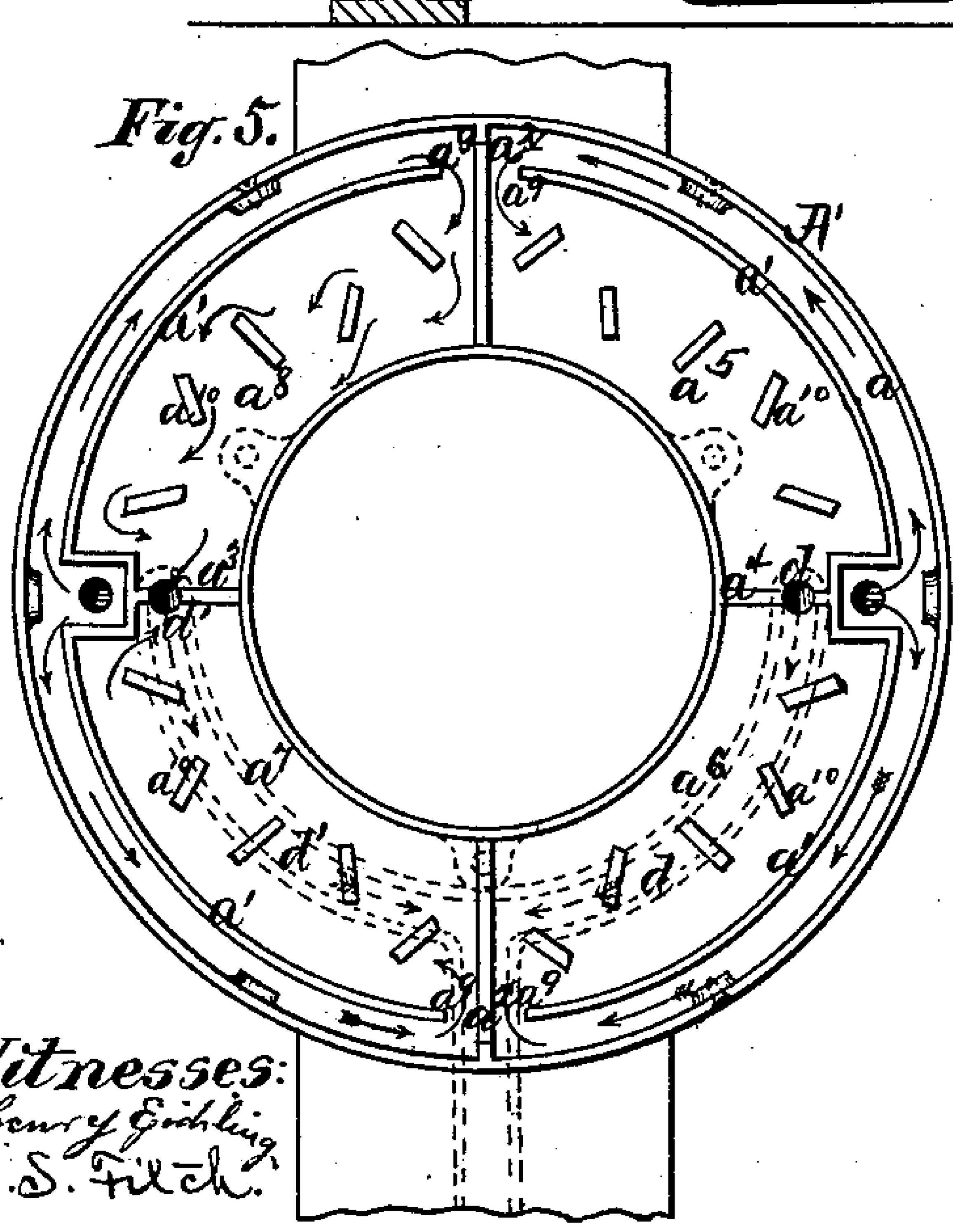
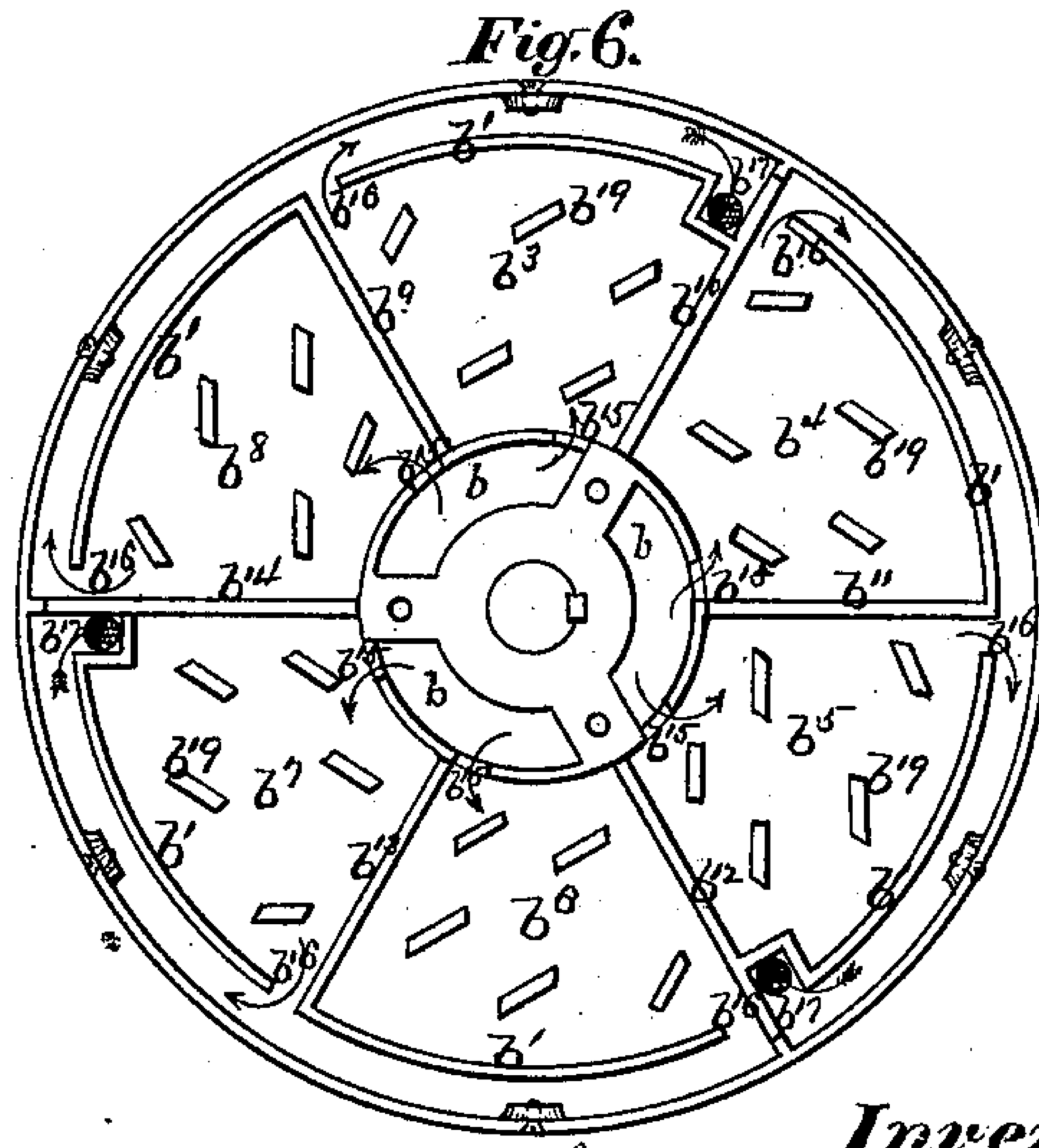


Fig. 6.



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United States Patent Office.

JOHN FITZGERALD, OF BROOKLYN, NEW YORK.

COOLING MECHANISM FOR GRINDING-MILLS.

SPECIFICATION forming part of Letters Patent No. 255,964, dated April 4, 1882.

Application filed December 4, 1880. Renewed July 14, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOHN FITZGERALD, of the city of Brooklyn, county of Kings, and State of New York, am the inventor of certain Improvements in Cooling Mechanism for Grinding-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of the same.

My invention relates to grinding-mills; and it consists in the combination of parts and devices hereinafter particularly described, and constructed and arranged as set forth, whereby the cooling of the upper and lower grinding-stones is accomplished, and whereby either air or water may be employed at pleasure as the cooling medium, and the change may be made from one to the other, if desired, without rearrangement or alteration of the parts, all as more at length recited in the claims.

Figure 1 is a side elevation of a grinding-mill embodying my invention. Fig. 2 is a plan of the same. Fig. 3 is a plan in detail of a circular water-escape trough, which constitutes one part of my invention, and which is hereinafter fully described. Fig. 4 is a vertical central sectional view of the mill. Fig. 5 is an interior plan of the casing of the upper or stationary grinding-stone, the stone being removed to disclose fully the arrangement of the cooling-chambers and their supply and exhaust pipes. Fig. 6 is a similar view of the casing of the lower or moving grinding-stone, said stone being removed.

The object of my present invention is twofold: first, the accomplishment of the cooling of both the upper or stationary grinding-stone and the lower or moving grinding-stone; and, second, such an arrangement and construction of the devices employed to accomplish the cooling of the stones that said devices are adapted for the use of either air or water as the cooling medium, and that a change may be made from one to the other without alteration or rearrangement of said devices, and also whereby the centrifugal force generated in the lower or revolving grinding-stone is utilized to facilitate the circulation of the cooling medium over and around the stone, and more particularly when water is employed, said cooling medium being admitted to the cooling-chambers at the center of the stone and discharged at the periphery.

A is the upper or stationary grinding-stone, and B the lower or moving grinding-stone.

A′ is the casing which contains the cooling-chambers of the upper stone, A, and in which the same is supported and centered, which is preferably accomplished by means of set-screws, as shown.

B′ is the casing which contains the cooling-chambers of the lower stone, B, and in which the same is seated and centered, preferably by means of similar set-screws, as shown.

C is the spindle upon which the lower stone, B, is hung, and by means of which it is revolved.

D is the frame which supports the various parts.

E is the hopper into which the material to be ground is placed, and from which it is fed through the adjustable gate e to the stones A B, the said hopper being supported by lugs e', bolted to the top of the frame, as shown, and the material passing to and between the stones through the opening e^2 in the upper grinder, A, and its casing A′. A conical plate or disk, F, is secured upon the center of the lower or moving stone, B, and is held in place by bolts passing into the casing B′ of the said lower stone, and the inclined outer face of this plate serves to guide the material to be ground between the stones. The interior of this plate is preferably chambered, as at f, and this chamber communicates with the chamber b at the center of the casing B′ of the lower stone, which chamber is about the hub of said casing and stone, as shown in Fig. 4.

To accomplish the cooling of the upper or stationary stone, A, I employ the following devices: Water or air is admitted under pressure through the main supply-pipe C′, and passes from thence through the branch pipes c c', which may be more or less in number, as will be hereinafter apparent, to the cooling-chambers about the upper stone. These chambers are constituted as follows: The casing A′ of the stone A is of somewhat greater diameter than the stone itself, so that a space or chamber, a, exists between the outer edge of the stone and the outer circumferential wall or flange of the casing. Upon the interior face or roof of the casing is cast, fixed, or otherwise formed a circular projection, a', which is so placed that when the stone is seated in the casing the projection will fit upon the upper facing or back of the stone at or near to the outer edge thereof, as seen in Fig. 4, whereby a chamber upon the back of the stone and a separate and distinct one on the circumference are constituted.

The chamber a about the circumference of the stone is then divided into subchambers by means of the radial partitions a^2, and these subdivisions may be more or less in number; but I find that for all practical purposes a subdivision into two distinct subchambers by means of diametrically-opposite radial partitions, as shown in Fig. 5, is preferable. Into each of these circumferential chambers, and preferably midway between the ends thereof, opens one of the supply-pipes c c', through which the cooling medium is admitted, and as many supply-pipes as there are subdivisions should be provided. The chamber constituted upon the back of the stone, as hereinbefore described, is then divided into subchambers by means of the radial partitions a^3 a^4, extending from the interior circumferential wall of the casing to the circular projection or partition a', and by means of the partitions a^2, which are carried inward to the interior circumferential wall, as shown in Fig. 5. These subdivisions may be more or less in number; but I find it preferable to arrange them as shown in Fig. 5, to constitute four subchambers, a^5 a^6 a^7 a^8, and to have them in pairs in their positions relative to the subdivision of the circumferential chamber. At the ends of each subdivision of the chamber a which are most remote from the supply-pipes c c' are cut or formed gates or openings a^9 in the projecting partition a', a separate one opening into each of the subdivisions a^5 a^6 and a^7 a^8, constituting the pair adjacent to each subdivision of a.

D′ is the discharge or escape pipe leading from the cooling-chambers of the upper stone, A. This pipe is conveniently provided with branches d d', leading preferably to each pair of adjacent subdivisions a^5 a^6 and a^7 a^8, as shown, the partitions a^3 a^4, which separate said pairs, being in this arrangement preferably cut away, as shown, so that communication is had to a single one of the branch pipes of D′ from both of the subdivisions constituting the pair, as shown. I prefer that there should be within each of the subdivisions a^5 a^6 a^7 a^8 irregularly-placed projections or lugs a^{10}, which are cast or otherwise formed or fixed upon the interior face of the casing and extend to the upper face of the stone A, and which serve to break up and thoroughly distribute the cooling medium over the face of the stone.

It is evident that the cooling medium, whether air or water, entering through c c', will pass through each of the subdivisions of the chamber a around the circumference of the stone to the gates at each of the opposite ends thereof, and through these gates into each of the pairs of chambers a^5 a^6 and a^7 a^8, over the upper face of the stone, and thence out through d d' to the discharge-pipe D′, and that this circulation being maintained, the effectual cooling of the upper stone will be accomplished. It is also evident that the stone A being stationary, and consequently the circulation of the cooling medium being caused by the pressure or headway thereof, with no centrifugal force to impede or overcome it, the circulation of the cooling medium may be the reverse of that specified without materially changing the principle of my described invention.

To effect the cooling of the lower or moving stone, B, I employ the following devices: The main supply-pipe C′ leads to a stuffing-box, e^2, in the roof of the hopper, and from this box, and having play therein to permit the wear of the stones to be taken up, the pipe c^3 leads down through the hopper, a stuffing-box, e^4, being arranged in the opening in the floor thereof, through which the said pipe passes to and through the crown of the plate F, with the chambered interior f of which it communicates. By this means the cooling medium, be it air or water, is admitted under pressure to the cooling-chambers of the lower stone, B. These chambers are constituted as follows: About the hub of the casing which holds the stone is formed the chamber b, as shown plainly in Fig. 6. Upon the interior face of the casing B′ is cast or otherwise formed or fixed the circular projection b', which is so placed that when the stone is seated in the casing the projection b' will fit upon the back of the stone at or near the outer edge thereof, thus forming a chamber or space between the back of the stone and the interior face of the casing, and the diameter of the casing being somewhat greater than the diameter of the stone, a space or chamber is constituted between the edge of the stone and the outer circumferential wall of the casing, as seen at b^2.

The space or chamber formed on the face of the stone by the projection b', I divide into chambers b^3 b^4 b^5 b^6 b^7 b^8 by means of the radial partitions b^9 b^{10} b^{11} b^{12} b^{13} b^{14}, and these chambers or divisions may be more or less in number; but I find it preferable that they should be as shown and specified for the most effectual operation of my invention. The circumferential space b^2, I also then divide into chambers, and I find it preferable so to divide this space that the chambers upon the back of the stone are arranged in pairs in their relation to the subdivisions of the circumferential chamber b^2, and this I accomplish by extending each alternate one of the before-named radial partitions out to a junction with the face of the circumferential wall of the casing, as shown plainly in Fig. 6.

If desired, the chamber b^2 may be divided into chambers equal in number to the subdivisions of the chamber on the back of the stone. Into each one of the chambers on the face of the stone constituting a pair are gates b^{15}, opening from the central hub-chamber, b, and at a point in each of said chambers most remote from said gate b^{15} in the partition b' is a gate, b^{16}, opening into the circumferential chamber, the gates of two adjacent chambers preferably opening into the same subdivision of said chamber b^2. At the point in each subdivision of said circumferential chamber most remote from the gates b^{16}, and leading into into it from the chambers b^3 b^4, &c., are discharge-openings b^{17} in the plate or wall of the casing, and said discharge-openings are preferably provided with downwardly-extended short pipes or nozzles b^{18}, as shown in Fig. 4, which range in their revolution with the stone B over a circular trough, G, which is supported on a cross-piece of the main frame. From this trough an overflow-pipe, g, extends to the main discharge-pipe D', Fig. 4.

I find it preferable to arrange the irregularly-placed projections b^{19} in the chambers on the face of the stone, to serve the same purpose as that named for the projection a^{10}.

It is evident that the cooling medium, whether air or water, admitted under pressure to the chamber b, will pass through the gates b^{15} into each chamber of the several pairs, be they more or less in number, on the back of the stone, and, circulating through these chambers over the back of the stone, will pass thence from each pair through gates b^{16} to one of the subdivisions of the circumferential chamber, and thus around the circumference of the stone, and from thence will escape through the openings b^{17}, and that when water is the cooling medium it will be caught in the trough G and carried from thence to the main discharge-pipe D'.

In cooling devices which admit the cooling medium at the periphery of the stone and discharge it at the center, or which return it to the center for discharge, the centrifugal force generated by the revolution of the stone has to be overcome by pressure or headway given to the cooling medium; but it is evident that by means of my described devices and their construction and arrangement upon said stone, the cooling medium being admitted to the chambers at the center of the stone and wholly discharged at the periphery thereof, I am enabled to utilize the said centrifugal force in assisting the rapid and complete circulation of the cooling medium over the face of and around the circumference of the stone, and to facilitate its discharge, which takes place wholly at the periphery of the stone.

It is also evident that either water or air may be employed as the cooling medium, or that a change may be made from one to the other at pleasure without altering, rearranging, or disturbing my described devices.

The circumferential chambers on each of the stones A and B are closed in by means of rings H H', respectively, which are fitted upon the periphery of the stones and secured to the outer walls or flanges of the casings, as seen in Fig. 4.

Upon the pipe c^3 within the hopper E may be secured the stirrer and mixer e^3, which will thus revolve with the pipe c^3 within the hopper and assist in feeding the material to be ground to the stones.

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

1. In a grinding-mill, the combination, with the upper or stationary grinding-stone, A, of the casing A' and ring H, said casing being of greater diameter than the stone, and having the circular projection a' upon its inner face, as described, thus constituting a circumferential chamber, a, about the periphery and a chamber upon the back of the stone, said circumferential chamber being divided by radial partitions into chambers more or less in number, each subdivision being provided with an inlet-pipe about midway between the ends thereof, and with a gate at each end thereof opening into one of each of the chambers into which the aforesaid chamber on the back of the stone is divided by means of radial partitions, as shown, and which subdivisions are of such a number and arrangement relatively to the subdivisions of the circumferential chamber as to be in pairs, as specified, each pair being provided with a common outlet-pipe, all as described, and for the purpose set forth.

2. In a grinding-mill, the combination, with the lower or moving stone, B, of the casing B' and ring H', said casing being of greater diameter than the stone, and having the circular projection b' upon its inner face, as described, thus constituting a circumferential chamber, b^2, about the periphery of the stone and a chamber upon the back of the stone, said chamber on the back of the stone being divided by radial partitions into chambers more or less in number, each subdivision having an inlet-gate, b^{15}, leading into it from a chamber, b, about the hub or center of the stone, and a gate, b^{16}, leading from it at a point in its opposite wall most remote from said inlet-gate into a subdivision of the aforesaid circumferential chamber on the periphery of the stone, which subdivision is provided with a discharge-opening, b^{17}, at a point in the wall thereof most remote from the gate b^{16}, as described, and for the purpose specified.

3. In a grinding-mill, the combination, with the lower or moving stone, B, of the casing B' and ring H', said casing being of greater diameter than the stone, and having the circular projection b' upon its inner face, as described, thus constituting a circumferential chamber, b^2, about the periphery of the stone and a chamber upon the back of the stone, said chamber on the back of the stone being divided by radial partitions into chambers more or less in number, each subdivision having an inlet-gate, b^{15}, leading into it from a chamber, b,

about the hub or center of the stone, and a gate, b^{16}, leading from it at a point in its opposite wall most remote from said inlet-gate into a subdivision of the aforesaid circumferential chamber on the periphery of the stone, which subdivision is provided with a discharge-opening, b^{17}, and pipe b^{18} at a point in the wall thereof most remote from the gate b^{16}, together with the trough G, as described, and for the purpose specified.

In witness whereof I hereunto set my hand this 2d day of December, A. D. 1880.

JOHN FITZGERALD.

In presence of—
HENRY EICHLING,
A. G. N. VERMILYE.