C. C. KRITZER.

APPARATUS FOR HYDRATING LIME.

APPLICATION FILED MAR. 5, 1909.

932,789.

Patented Aug. 31, 1909.

4 SHEETS—SHEET 1.

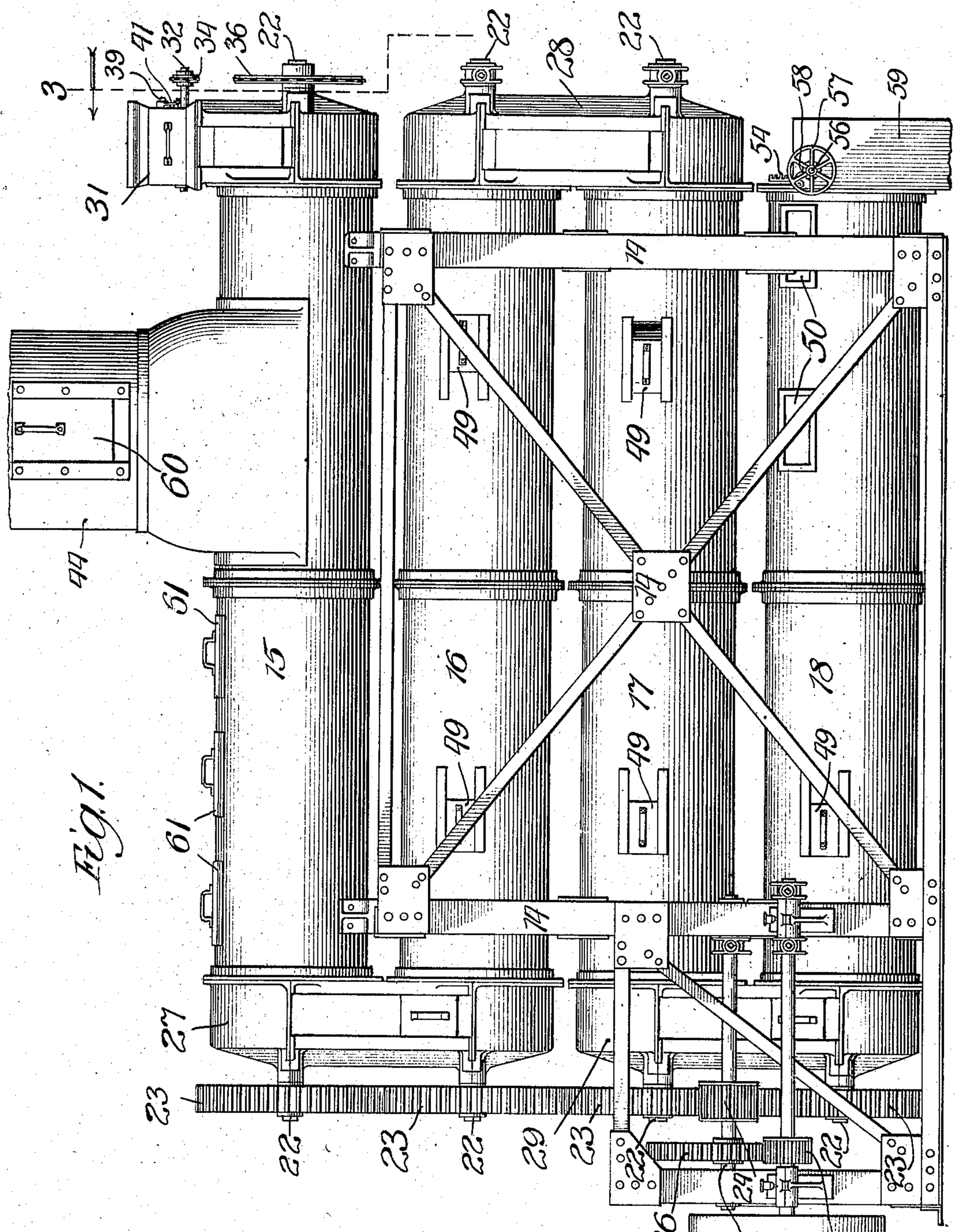

Fig. 1.

Witnesses:

John Enders

Chas. H. Bueer.

Inventor:

Charles C. Kritzer;

By Dyrenforth, Lee, Chritton and Wiles.

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4 SHEETS—SHEET 2.

Fig. 2.

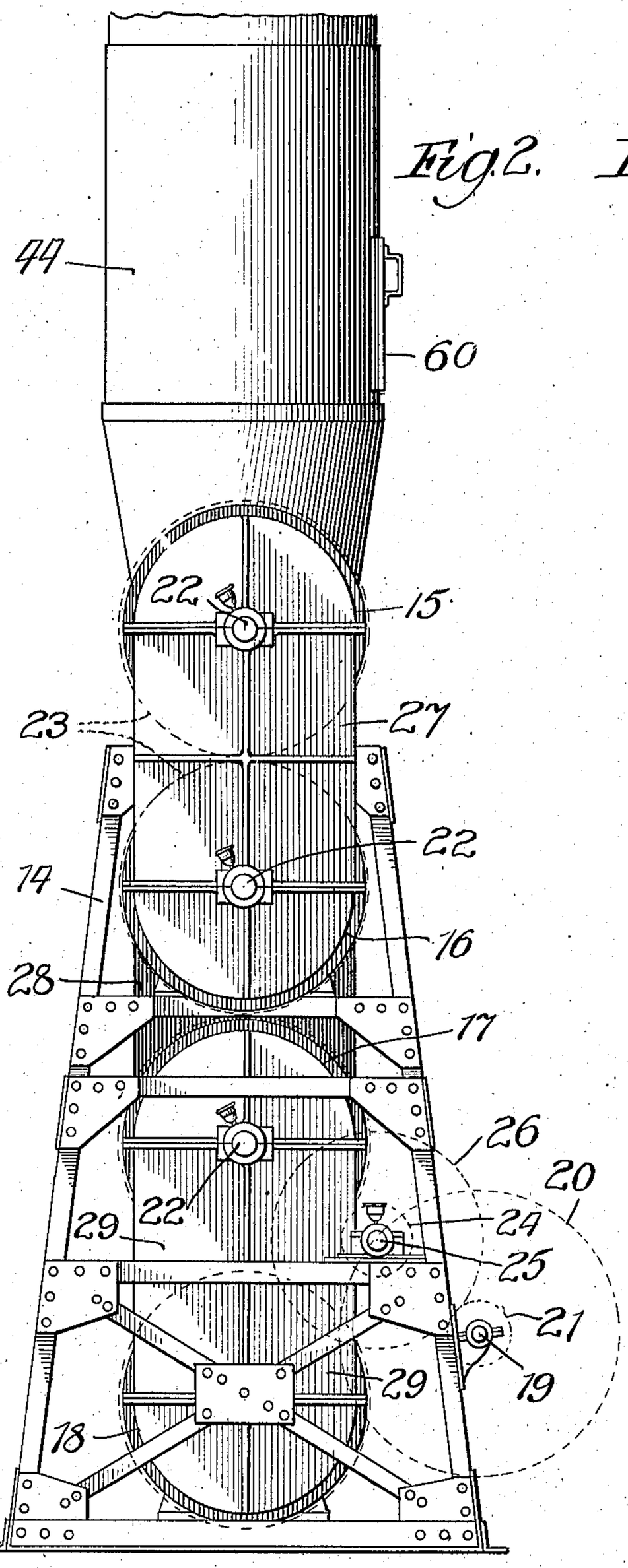
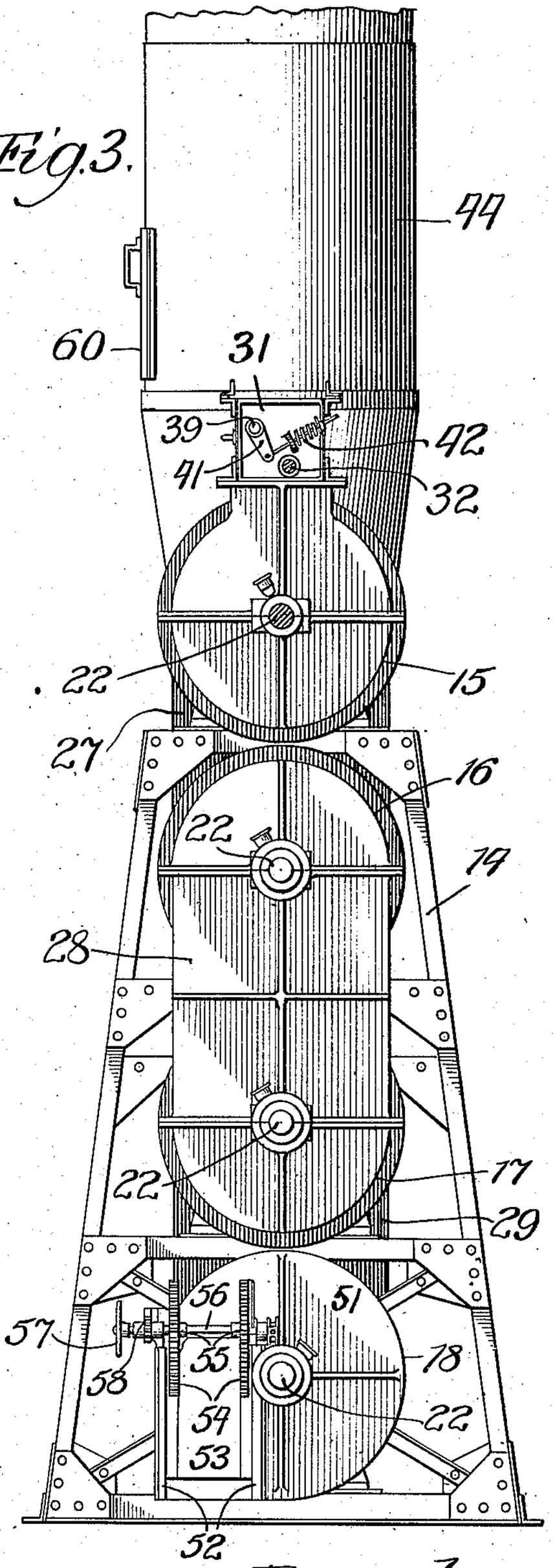


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

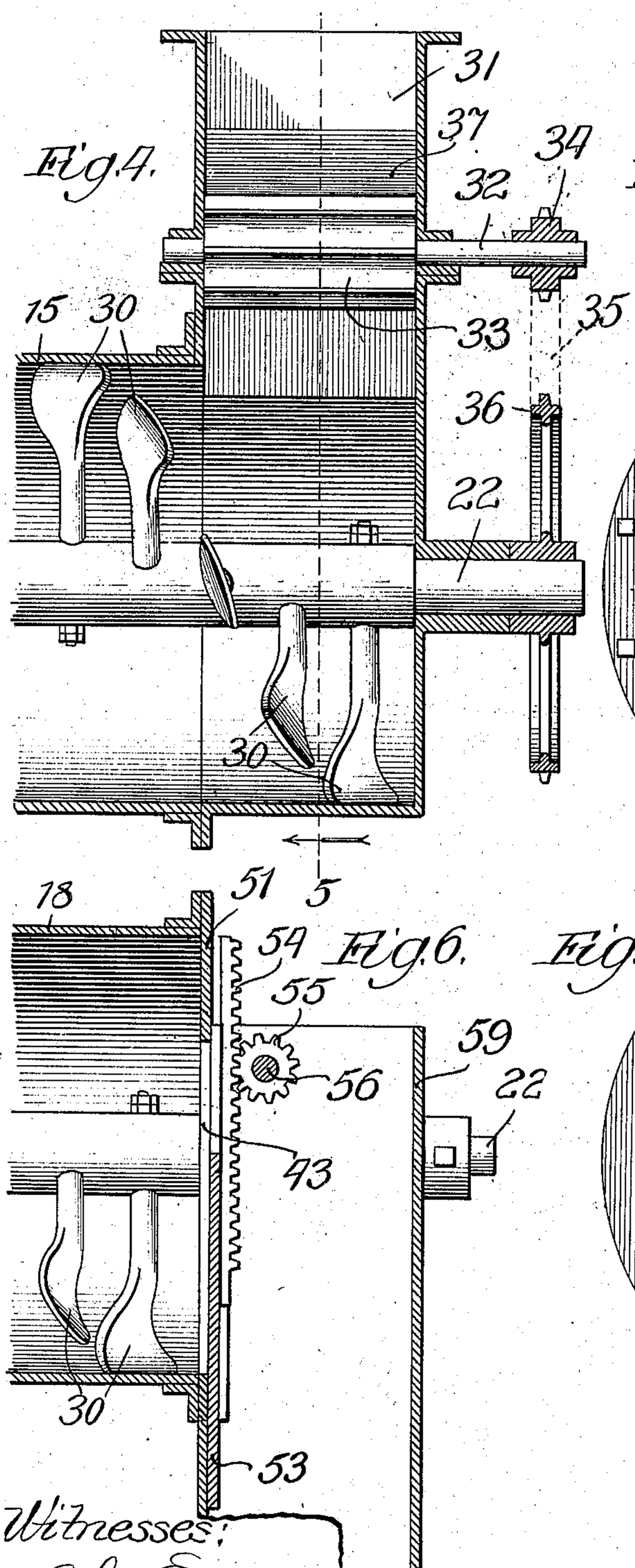

Fig. 5.

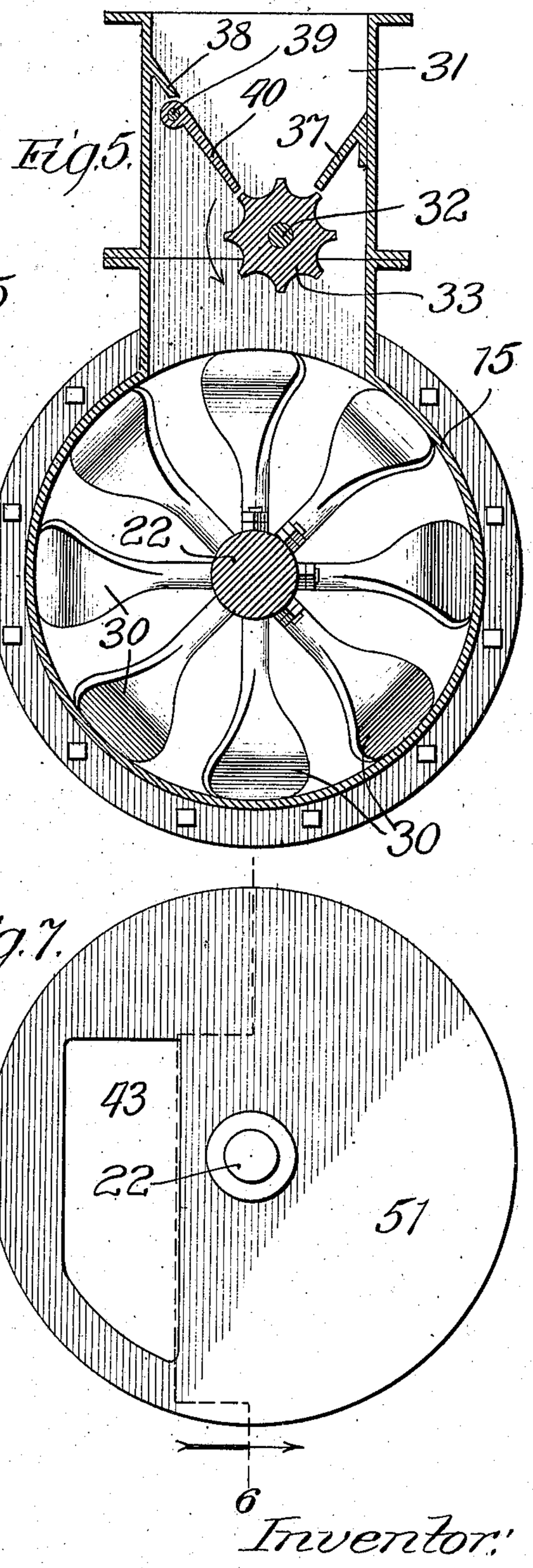

Fig. 6.

Fig. 7.

Witnesses:

John Enders

Chas. H. Buell

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4 SHEETS—SHEET 4.

Fig. 8.

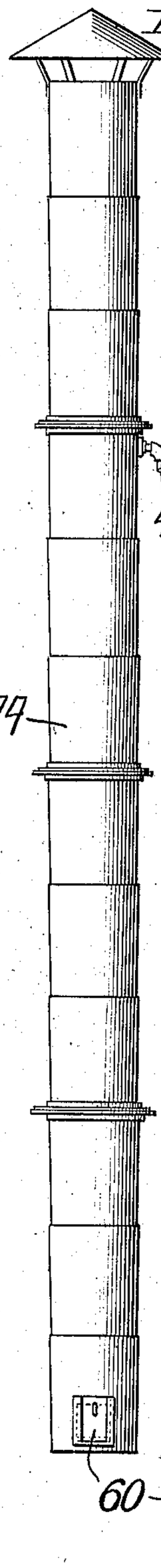

Fig. 9.

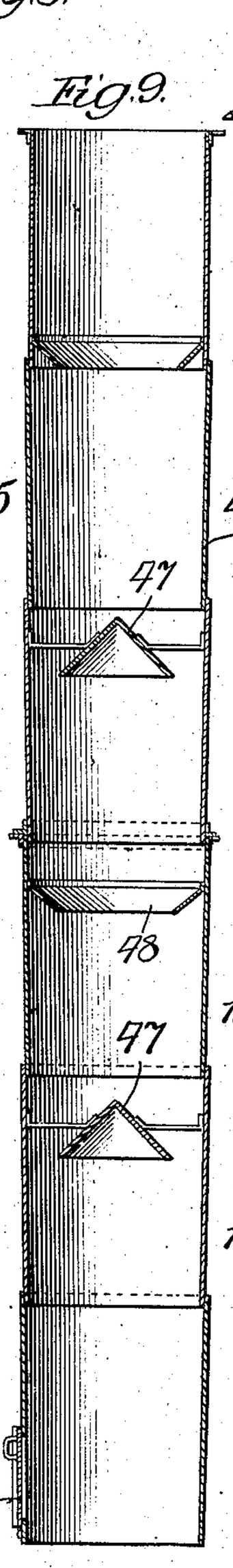

Fig. 10.

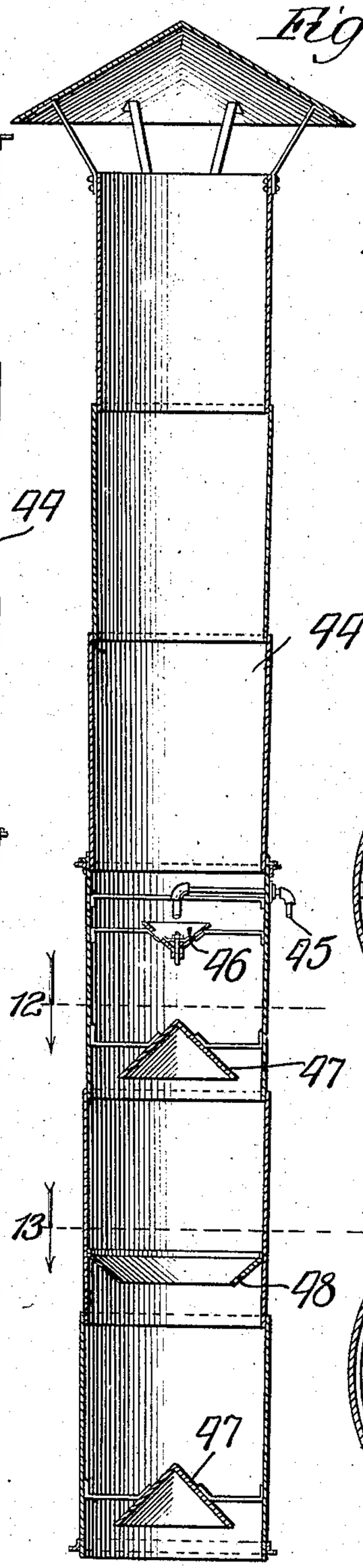

Fig. 11.

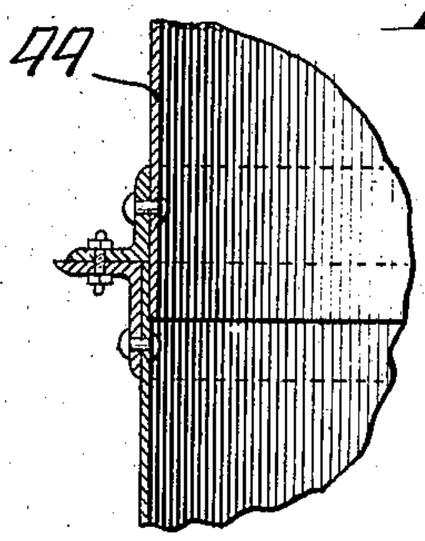

Fig. 12.

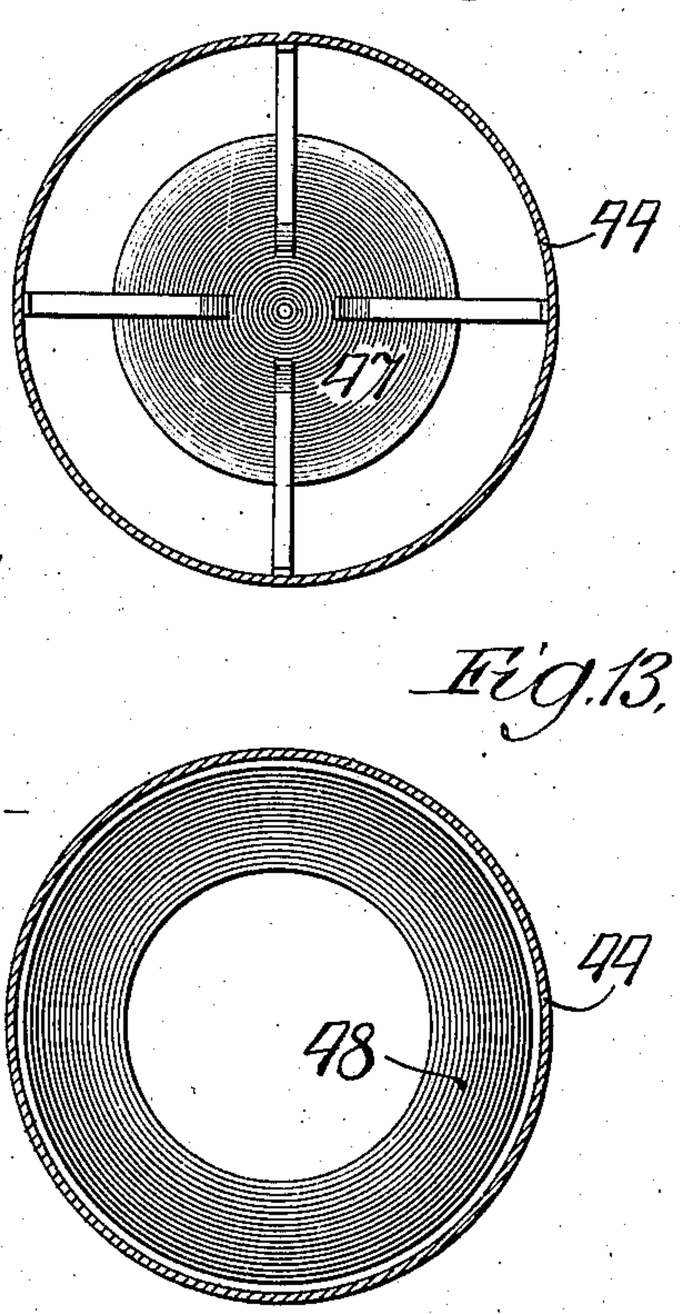

Fig. 13.

Witnesses:

John Enders

Chas. H. Buell.

Inventor:

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UNITED STATES PATENT OFFICE.

CHARLES C. KRITZER, OF CHICAGO, ILLINOIS.

APPARATUS FOR HYDRATING LIME.

932,789. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed March 5, 1909. Serial No. 481,467.

To all whom it may concern:

Be it known that I, CHARLES C. KRITZER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Apparatus for Hydrating Lime, of which the following is a specification.

My invention relates to improvement in apparatus for the production of dry, pulverulent hydrate of lime, and refers more particularly to a construction of machine having large capacity and capable of turning out a uniform product of high grade with great rapidity and economy.

Among the salient objects of my invention are to provide apparatus by means of which the operations of slaking and drying the lime may be continuous and under absolute control, wherein lime-dust losses are avoided, and vapors generated by chemical reactions are conserved and retained in the hydrated product.

In the accompanying drawings—Figure 1 is a side elevation of my improved machine, the upper part of the stack being broken away; Fig. 2, an elevation of one end of the machine; Fig. 3, a partly sectional elevation of the other end of the machine, the section being taken on line 3 of Fig. 1 with the hood or spout at the discharge opening removed; Fig. 4, an enlarged, longitudinal, broken section through the feeding end of the upper drum; Fig. 5, a section on line 5 in Fig. 4; Fig. 6, a section on line 6 in Fig. 7; Fig. 7, an enlarged view in elevation of the head of the lower drum showing the discharge opening; Fig. 8, a view in elevation of the stack on a reduced scale; Fig. 9, a section of the lower half of the stack; Fig. 10, a section of the upper half of the stack; Fig. 11, a broken and enlarged fragmentary section illustrating the manner in which the stack sections are joined; and Figs. 12 and 13, enlarged plan sections taken respectively on lines 12 and 13 in Fig. 10.

Mounted in a suitably braced skeleton frame 14 is a series of four longitudinally extending and stationary chambers or drums 15, 16, 17 and 18 located one above the other, as shown.

19 is a drive shaft equipped with a power pulley 20 and carrying a pinion 21. Extending through each of the drums and suitably journaled therein is a rotary shaft 22, the shafts carrying drive gears 23, meshing with each other, and all driven from a pinion 24 on a countershaft 25 which carries a gear 26 meshing with the pinion 21 on the main drive shaft 19. At the left-hand end in Fig. 1 the drums 15 and 16 are in communication through a stationary chute or hood 27 into which the said drums open at their ends; and in the same way the drums 16 and 17 are in open communication through a chute or hood 28, and the drums 17 and 18 are in open communication through a chute or hood 29. Each of the shafts 22 carries a spirally arranged series of stirring and advancing blades 30, the series in each instance extending approximately the full length of the drum. All the blades are slightly dished, as shown.

Mounted upon the right-hand end of the drum 15 is a feed-hopper 31 constructed as indicated most plainly in Figs. 4 and 5. Extending through the hopper is a shaft 32 provided with a grooved feed-roller 33. The shaft 32 carries the sprocket pinion 34 driven by a chain 35 from the sprocket-wheel 36 on the upper shaft 22. Extending from one hopper-wall nearly to the grooved roller 33 is a stationary deflecting plate 37, and on the opposite hopper-wall is a short stationary deflecting plate 38. Extending beneath the lower edge of the deflector 38 is a shaft 39 to which is secured a plate 40 forming a swinging extension of the plate 38 reaching nearly to the feed-roller 33. The shaft 39 beyond one end of the hopper carries a crank-arm 41 connected through an adjustable spring-device 42 (see Fig. 3) with a stationary part of the hopper, the spring-device operating normally to hold the plate 40 yieldingly in adjusted position, as indicated in Fig. 5.

The driving gears are arranged to rotate the shafts 22 alternately in opposite directions and the stirring and advancing blades in alternate drums describe opposite spirals. The feed-roller 33 rotates in the direction of the arrow in Fig. 5 and the crushed lime to be hydrated when fed into the hopper 31 is delivered by the roller 33 into the feed end of the drum 15. The spiral blades 30 in said drum stir and advance the lime to the opposite end of the drum discharging it into the chute 27 whence it is stirred and advanced, by the spiral blades in the drum 16, to the chute 28. The stirring blades in the drum 17 stir and advance the lime to the chute 29, the stirring blades in the drum 18

moving the lime in the same manner to the discharge opening 43. The lime is thus caused to move through an elongated zig-zag course in the apparatus.

For the purpose of properly hydrating the crushed lime as it is advanced, it is necessary that it be mixed with water in suitably controlled quantity, and by preference, the water should be supplied in the form of a spray to saturate the mass uniformly while being initially advanced. 44 is a stack rising from the drum 15 near the feed end thereof. Extending to the upper end portion of the stack, as indicated in Figs. 8 and 10, is a water-supply pipe 45 discharging into a central over-flow cup 46. Interposed between the cup 46 and the lower end of the stack is a series of alternating spreading cones 47 and contracting rings 48 which tend to cause the water to descend in an annular spray or sheet from the cup 46 through the stack to the drum 15. Each of the drums is provided with air-inlet openings equipped with valves or slides 49, as indicated. In the lower drum 18 near the discharge end are also openings 50 which may be for the admission of air, or, if desired, they may be fitted with glass and serve merely as inspection openings.

The operation is as follows: The lime to be hydrated, crushed to a more or less degree of fineness, is fed into the hopper 31, and the speed at which the roller 33 is rotated and the adjustment of the plate or valve 40 governs the feed of the lime to the machine. Water in predetermined volume is caused to flow through the pipe 45 and descend as described into the upper or hydrating drum. The lime as it falls from the feed-roller is stirred and spread to a uniform depth as it is advanced to and beyond the lower end of the stack 44 so that it is uniformly saturated with the desired quantity of water. Slaking of the mass commences soon after it comes in contact with the water and the hydrating process continues, becoming practically complete in the movement of the mass through the drum 15. The hydrating action may continue for a time while the mass is being moved along the first drying drum 16. When the slaking is completed the drying of the mass commences and is continued while it moves into and through the lower drums. Sufficient air is admitted into the lower drum and also, if desired, into the drums above, to produce a draft of air of desired volume to take up the moisture as it is evaporated from the drying mass. As the lime drops in the end chutes from one drum to another it descends in a sheet, the draft passing through it. Thus, the lime moving from the drum 15 to the drum 16 descends through a current of air more or less saturated with moisture, which tends to aid in completing the hydrating of the lime. All the air passing into the drum 16 will be more or less laden with moisture, so that the atmosphere in said drum will, for the most part at least, be of a hydrating nature. The initial contact of the lime with the water in the upper cylinder tends to produce violent reactions in the start, resulting in a high temperature, and one of my objects is to keep down this temperature as much as possible, to prevent "burning" of the lime which would tend to darken its color and cause it to "work short." The term "working short" is applied to lime when, being of a crystalline, coarse and granular nature, it is not easily spread nor as adhesive as desired. The most desirable product is a white, impalpable powder, very soft and amorphous. The steam passing with the current through the upper drum to the stack is condensed by contact with the water, creating a partial vacuum, thereby enhancing the draft, and tending to cool down the lime at the "slaking zone" where the reactions are most violent. Thus, while the initial slaking would tend to raise the temperature, at the "slaking zone" in the upper cylinder, to or above 400° F., with a tendency to "burn" the lime, as before referred to, by means of the forced draft, created in the machine as described, the temperature at the "slaking zone" is kept below 200° F., which can do no injury to the lime.

The drying of the hydrated lime takes place very rapidly in the lower drums and I find it desirable to regulate the discharge of the lime from the machine in a manner to insure a perfectly dry product.

The outlet 43 is in the head 51 of the drum 18 and extends from the base of the drum to a height above the center thereof. On the outer surface of the head 51, at opposite sides of the opening 43, are guides 52 for a raising and lowering valve, or slide, 53 provided with racks 54. The racks are engaged by pinions 55 on a shaft 56 equipped with a hand-wheel 57 and a pawl-and-ratchet 58. The valve 53 may thus be raised and lowered and adjusted to any height and by its position govern the height to which the layer of hydrated lime may extend before it is discharged. Thus, it will be understood that the length of time during which hydrated lime is caused to remain in the lower drum may be regulated within limits sufficient to insure perfect drying before it is discharged. The outlet 43 discharges into a pipe 59 leading to the usual screens and packing devices, not shown.

Dust raised and traveling with the air currents from the lower into the upper drum is precipitated or caught by the more or less moist lime falling in sheets from one drum to another; and any lime particles set free during the slaking operation and carried

into the stack 44 by the draft will be washed down by the spraying water and thus prevented from escaping to the atmosphere.

At the base of the stack is an opening closed by a slide 60, and similar slides 61 are shown along the top of the drum 15. These may be employed for the admission of air, for inspecting the operations, or for access to the interior when desired.

While I prefer to construct the apparatus throughout as shown and described, it may be variously modified in the matter of details of construction without departing from the spirit of my invention as defined by the claims.

What I claim as new and desire to secure by Letters Patent is—

1. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment, lime-feeding means at one end of said course, water-supplying means communicating with said course for creating a slaking-zone therein toward its feeding end, and means for producing a draft of air along the course to said zone to cool the same, for the purpose set forth.

2. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment, lime-feeding means at one end of said course, water-supplying means communicating with said course for creating a slaking-zone therein toward its feeding end, and means toward the feeding end of the course for condensing vapor and producing a draft-creating partial vacuum to draw air along the course to said zone to cool the same, for the purpose set forth.

3. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment, lime-feeding means at one end of said course, stirring means for advancing the lime through said course, water-supplying means communicating with said course for creating a slaking-zone therein toward its feeding end, and means for producing a draft of air along the course to said zone to cool the same, for the purpose set forth.

4. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment provided with an inlet and outlet and stirring means for advancing the lime through said course, a vapor-outlet leading from said course near its feeding end, a water supply inlet leading to said course near said end, and means for directing air currents through said course, counter to the travel of said lime under treatment, to said vapor outlet.

5. In a lime-hydrating apparatus, the combination of an elongated inclosed zig-zag course for lime under treatment provided with an inlet and an outlet and stirring means for advancing the lime through said course, a vapor outlet leading from said course near its feeding end, a water supply inlet leading to said course near said end, and means for directing air currents through said course, counter to the travel of said lime under treatment, to said vapor outlet.

6. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment provided with an inlet and outlet and stirring means for advancing the lime through said course, a vapor outlet leading from said course near its feeding end, means for supplying water to said course through said vapor outlet, and means for directing air currents through said course, counter to the travel of said lime under treatment, to said vapor outlet.

7. In a lime-hydrating apparatus, the combination of an elongated inclosed course for lime under treatment provided with an inlet and outlet and stirring means for advancing the lime through said course, a vapor outlet stack rising from said course near its feeding end, means for directing water through the stack to said course, and means for directing air currents through said course, counter to the travel of said lime under treatment, to said stack.

8. In a lime-hydrating apparatus, the combination of a hydrating drum, means for feeding lime to the drum at one end, a vapor outlet near said end equipped with water-spraying means discharging into the drum, means for stirring and advancing the lime beneath said outlet and along the drum, and means for directing an air current through the drum to said outlet, said current moving in the direction counter to the movement of the lime.

9. In a lime-hydrating and drying apparatus, the combination of an upper hydrating drum and lower drying drum constituting a continuous zig-zag course for the lime, lime-feeding means at one end portion of the hydrating drum, a vapor outlet in the hydrating drum adjacent to said feeding means and equipped with water-spraying means discharging into the hydrating drum, means for stirring and advancing the lime beneath said outlet and through the drums, and means for directing air currents throughout the course to said outlet, the currents passing through the lime falling from one drum to the next.

10. In a lime-hydrating and drying apparatus, the combination of an upper hydrating drum and lower drying drum constituting a continuous zig-zag course for the lime, lime-feeding means at one end portion of the hydrating drum, a vapor outlet stack rising from the hydrating drum adjacent to said feeding means and equipped with water-spraying means discharging into the hydrating drum, means for stirring and advancing

lime beneath said stack and through the drums, and means for directing air currents throughout the course to said stack, the currents passing through the lime falling from one drum to the next.

11. In a lime-hydrating and drying apparatus, the combination of an upper hydrating drum and lower drying drums constituting a continuous zig-zag course for the lime, lime-feeding means at one end portion of the hydrating drum, a vapor outlet stack rising from the hydrating drum adjacent to said feeding means and equipped with water-spraying means discharging into the hydrating drum, means for stirring and advancing lime beneath said stack and through the drums, means for directing air currents throughout the course to said stack, the current passing through the lime falling from one drum to the next, and adjustable means for regulating the discharge of the lime from the lowermost drum, for the purpose set forth.

CHARLES C. KRITZER.

In presence of—
CHAS. E. GAYLORD,
RALPH SCHAEFER.