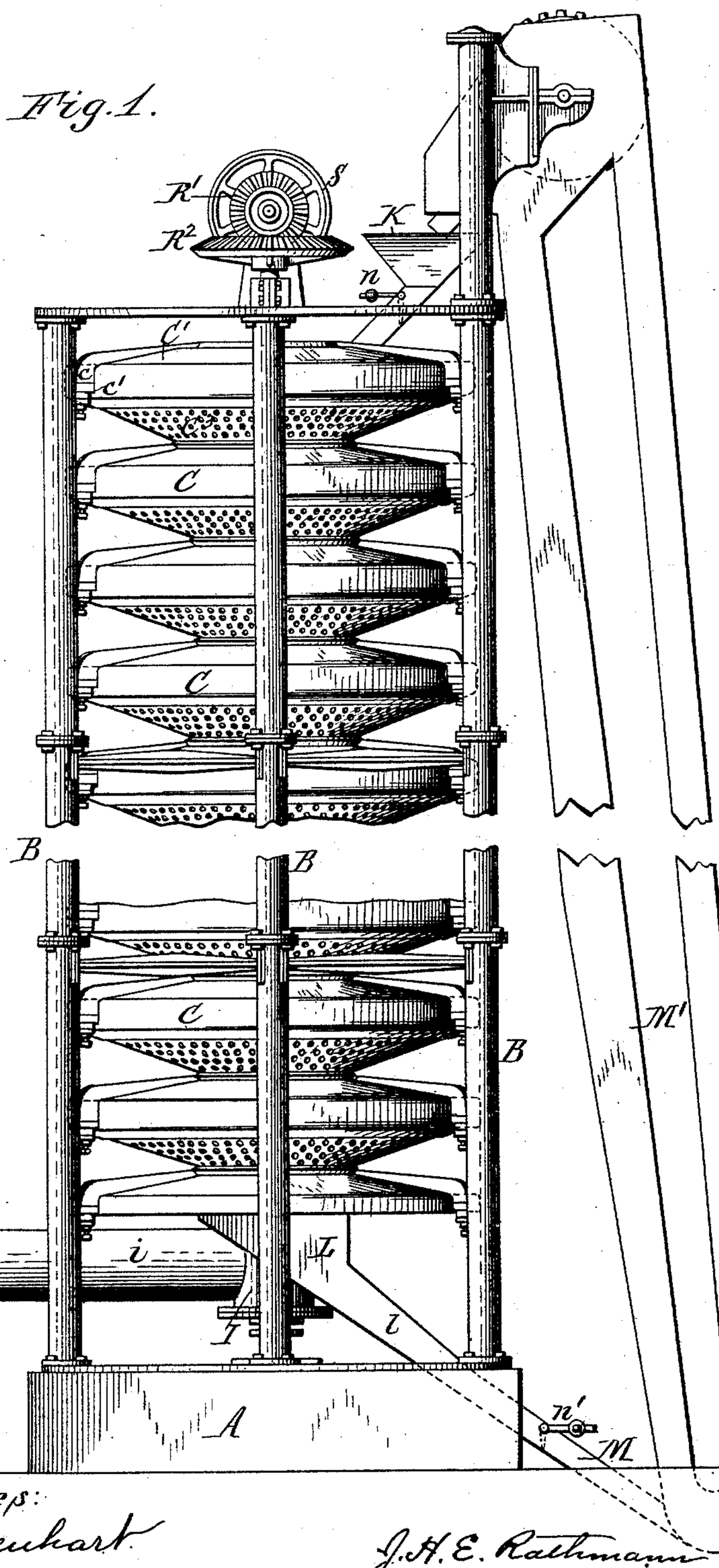
(No Model.) 5 Sheets—Sheet 1.

J. H. E. RATHMANN.

APPARATUS FOR DRYING AND GERMINATING MALT.

No. 485,355. Patented Nov. 1, 1892.

Fig. 1.



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By Wilhelm Bonner Attorneys.

(No Model.) 5 Sheets—Sheet 2.

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Fig. 2.

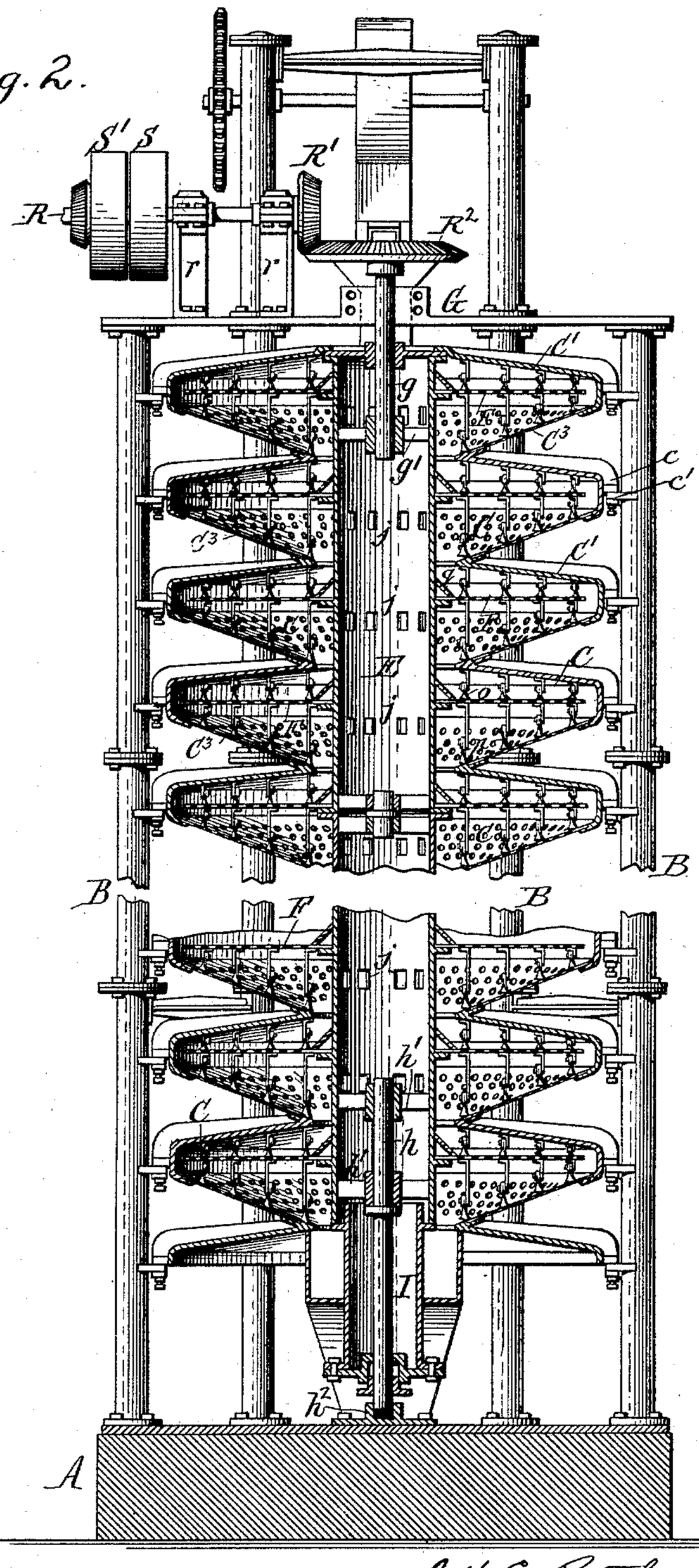

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Fig. 3.

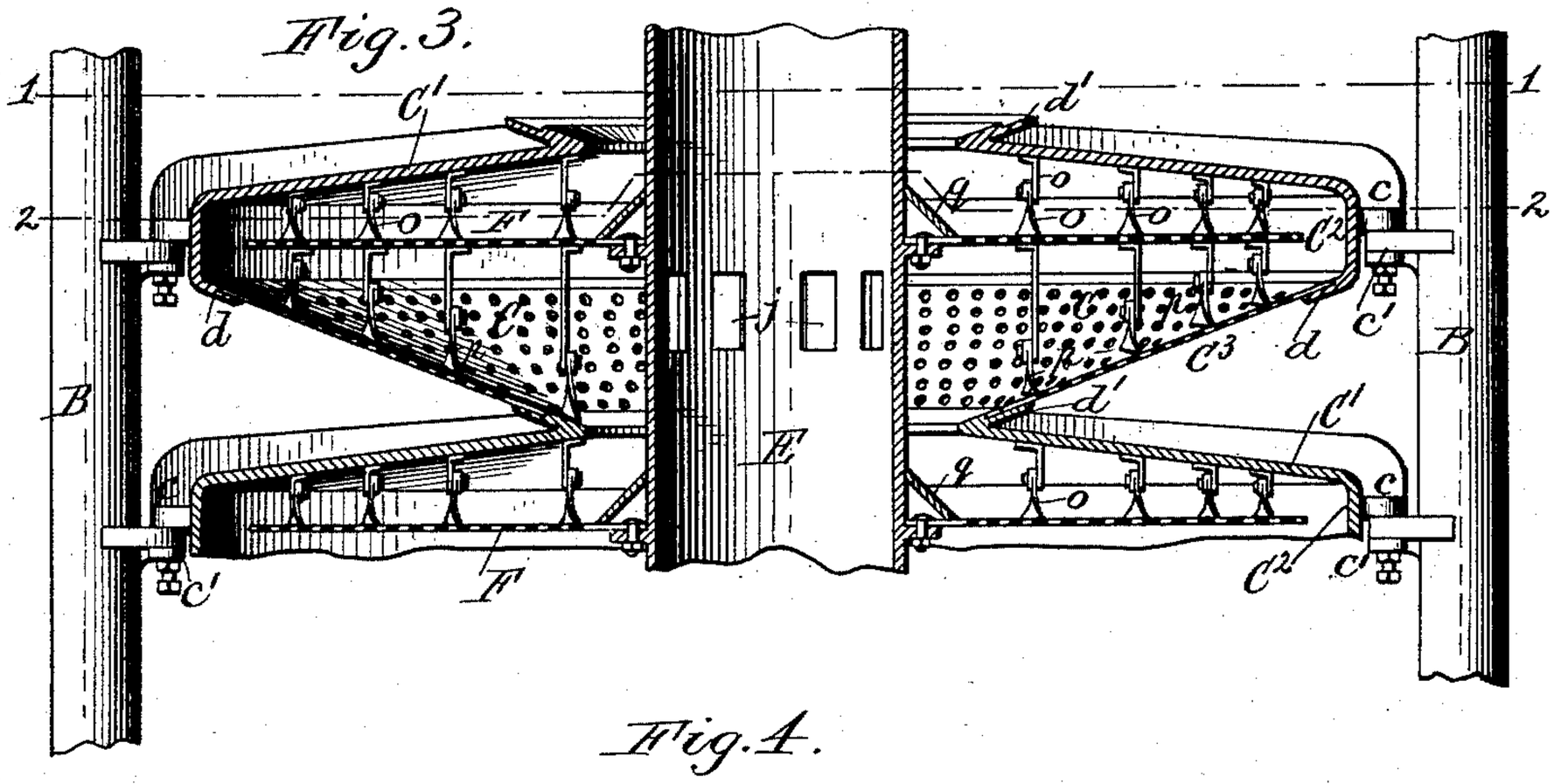
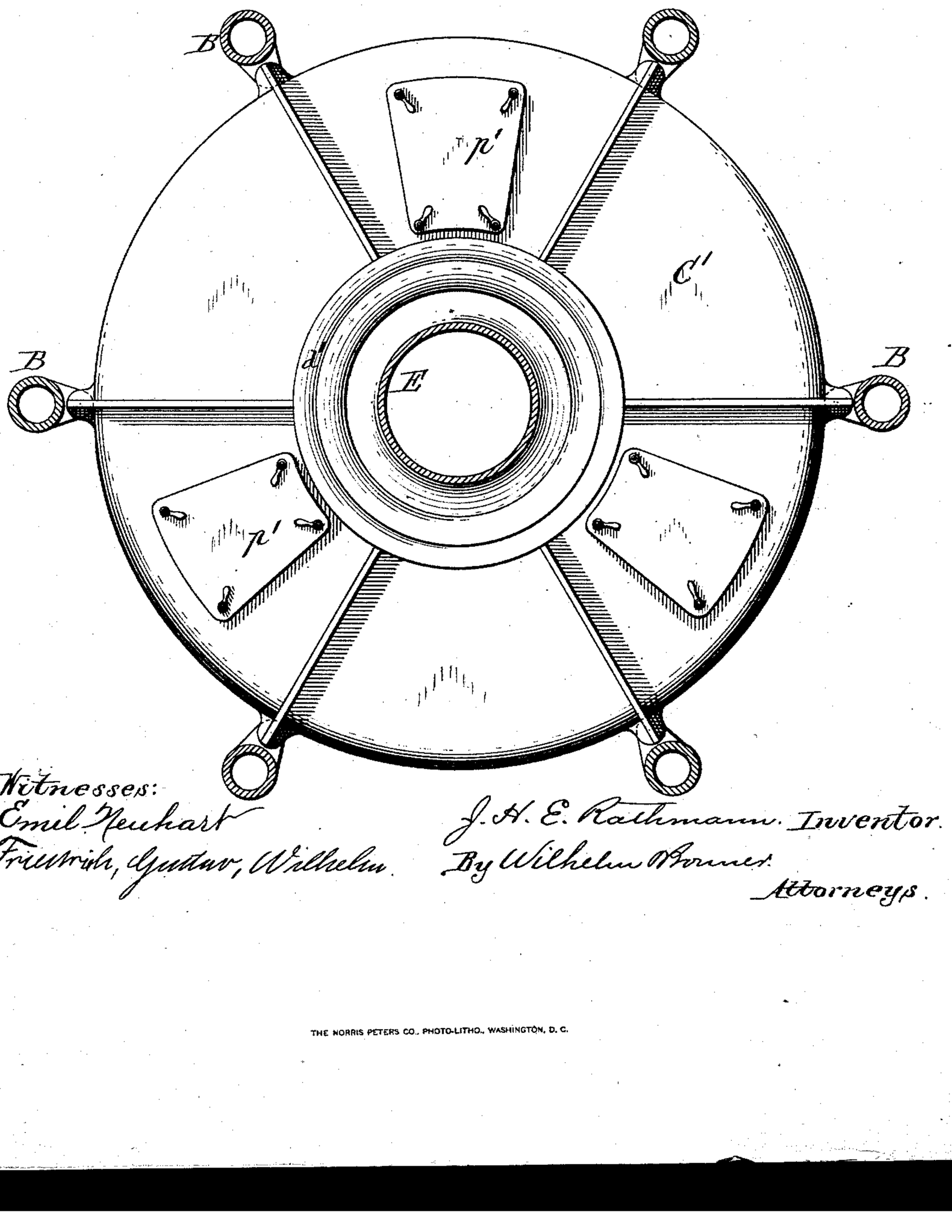


Fig. 4.



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APPARATUS FOR DRYING AND GERMINATING MALT.

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Fig. 5.

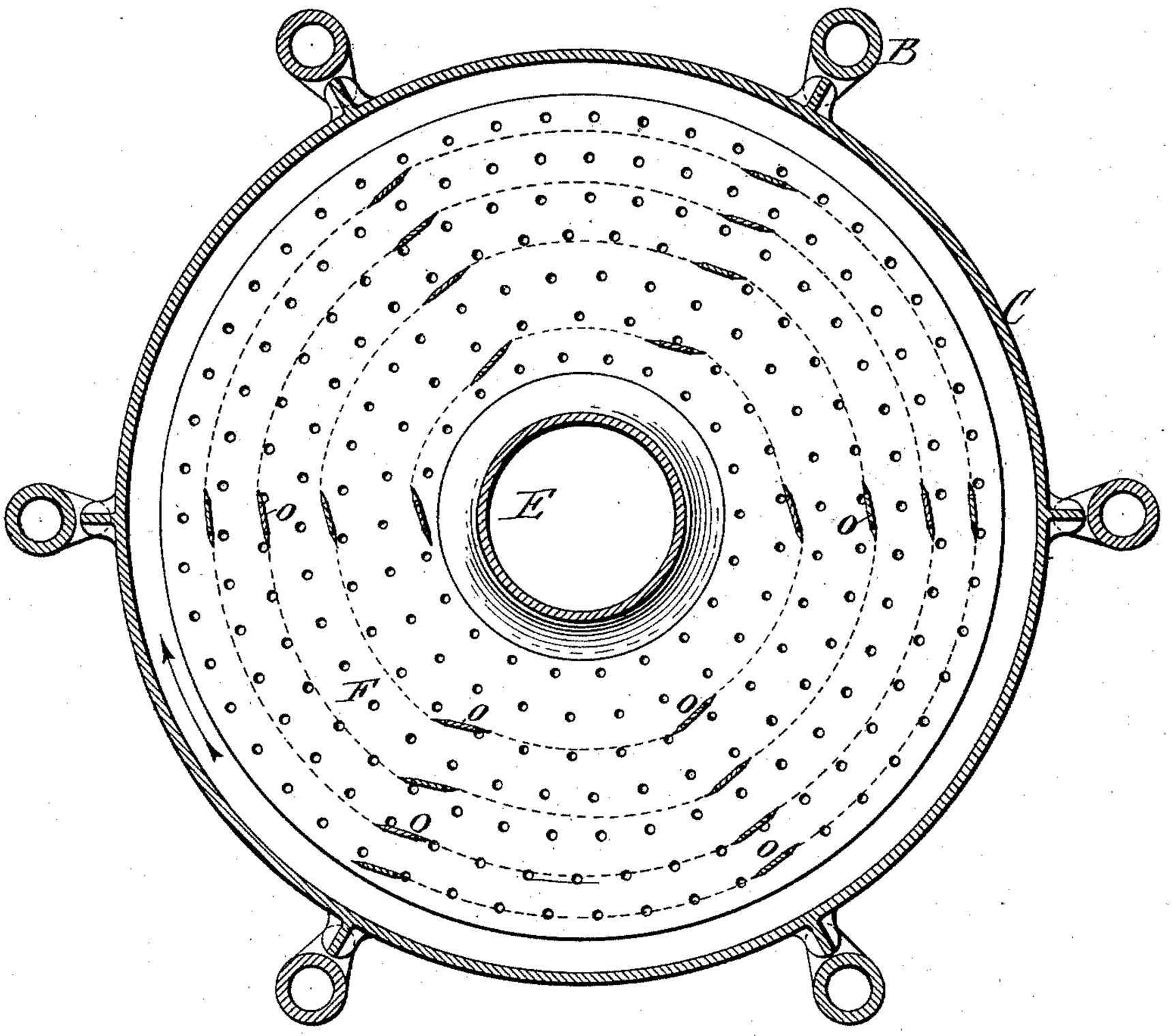

Fig. 6.

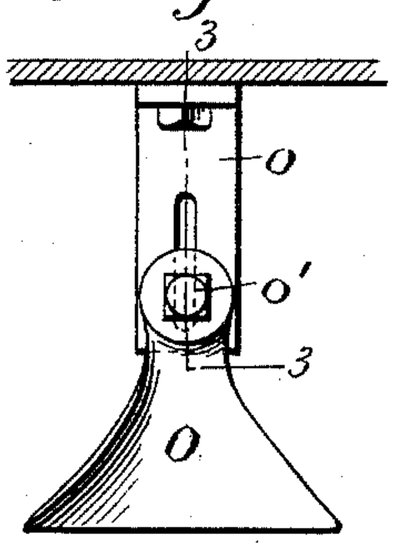

Fig. 7.

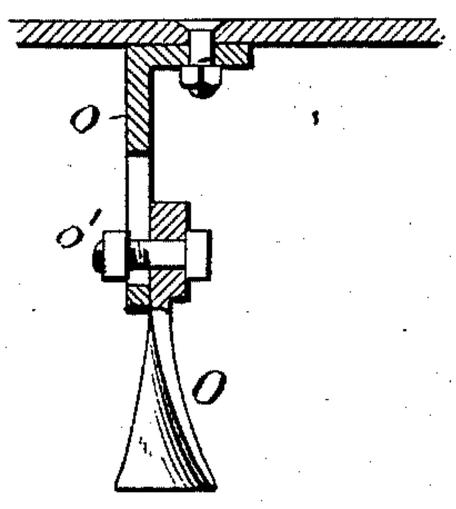

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Fig. 8.

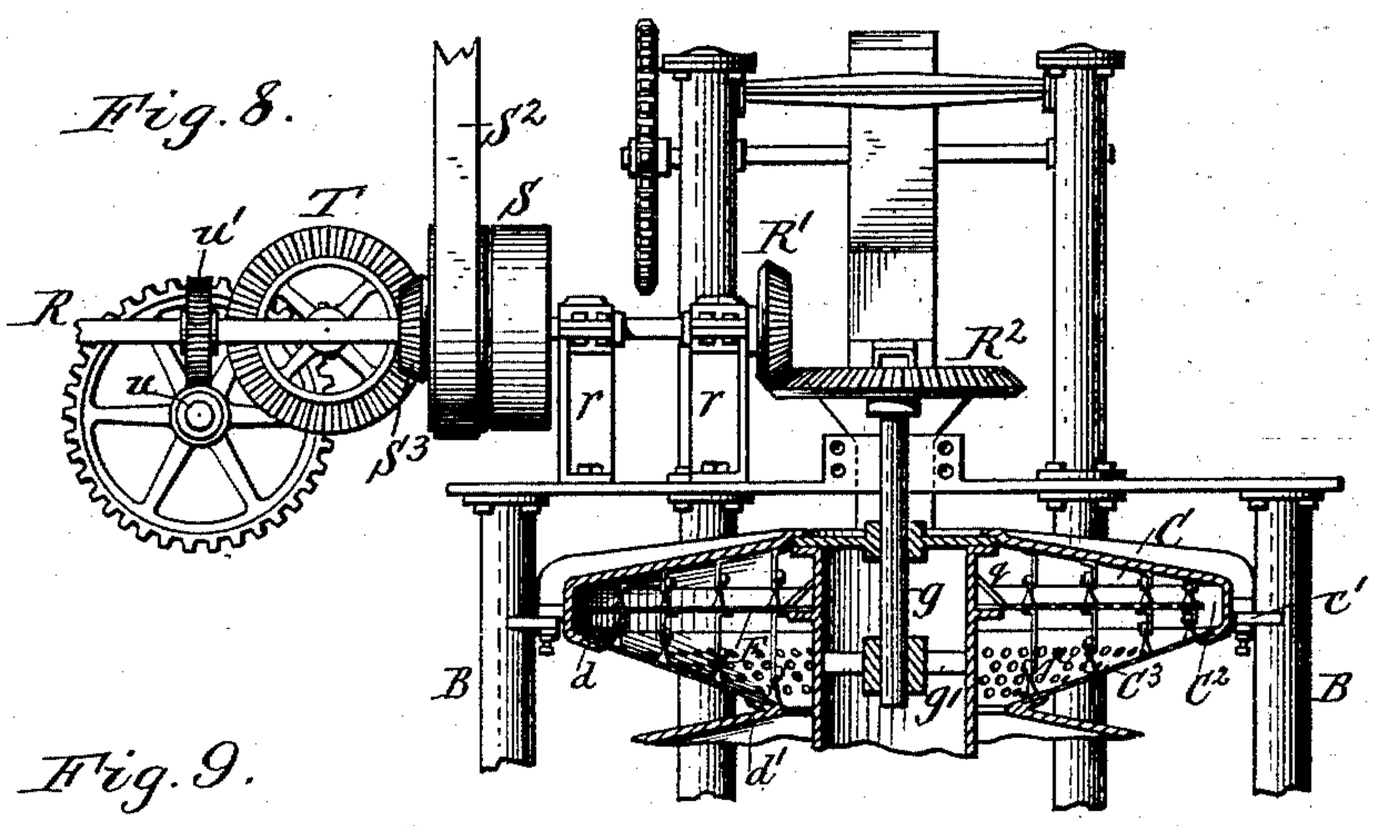


Fig. 9.

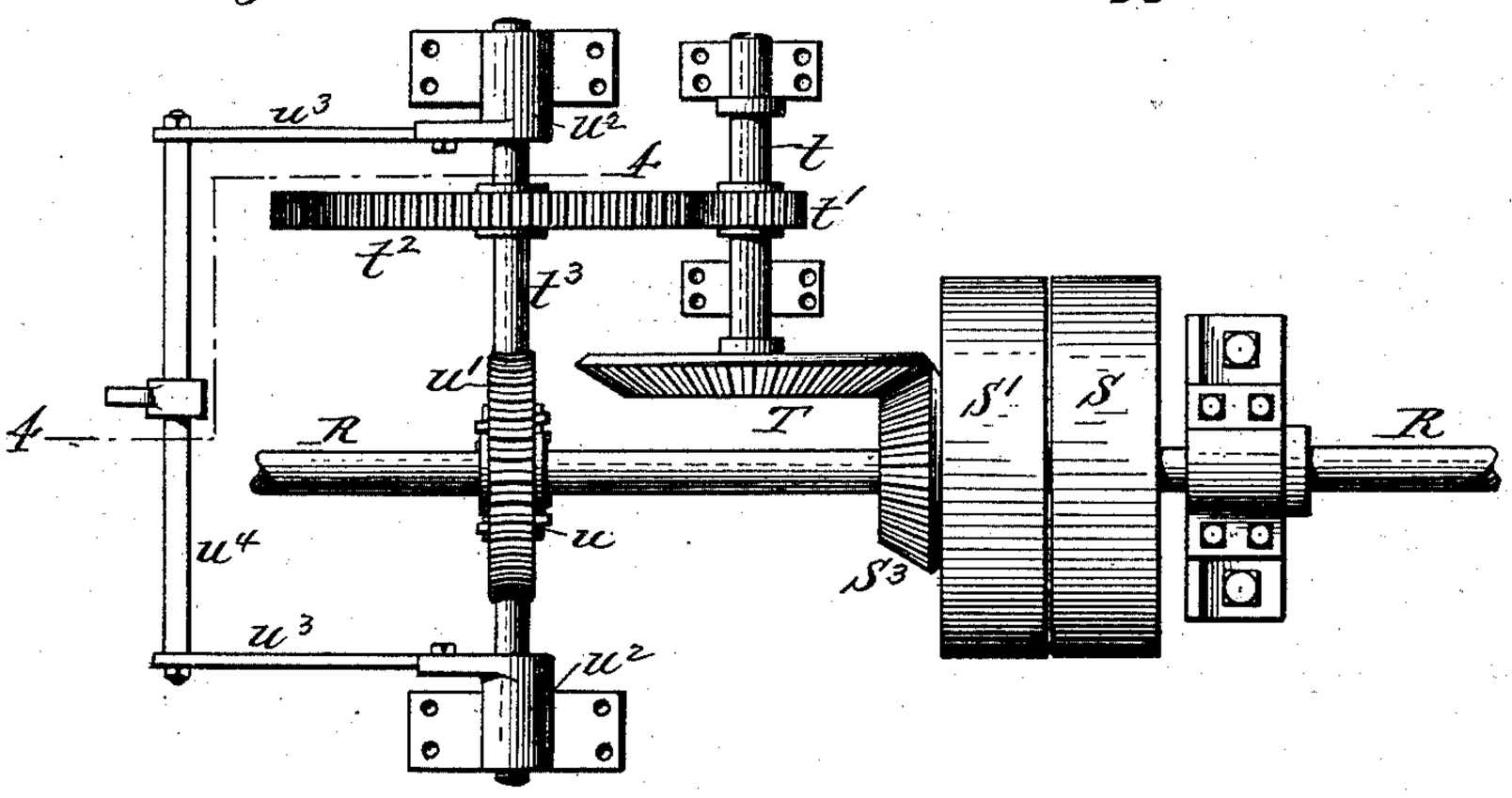


Fig. 10.

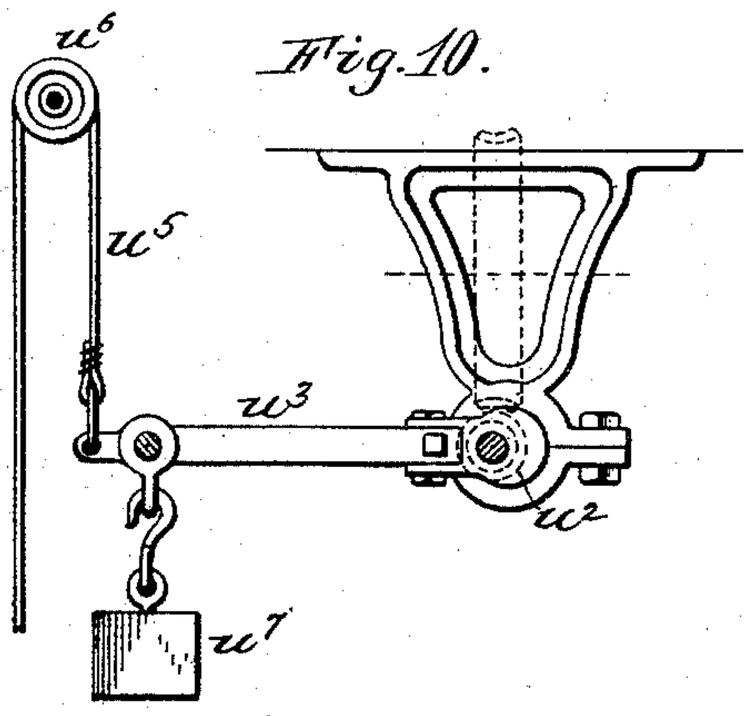
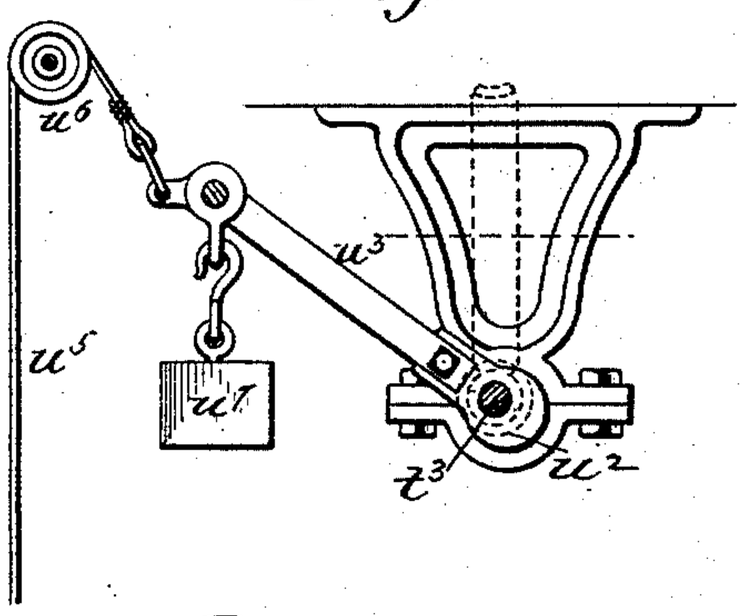


Fig. 11.



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UNITED STATES PATENT OFFICE.

JOHANN H. E. RATHMANN, OF BUFFALO, NEW YORK.

APPARATUS FOR DRYING AND GERMINATING MALT.

SPECIFICATION forming part of Letters Patent No. 485,355, dated November 1, 1892.

Application filed June 20, 1892. Serial No. 437,327. (No model.)

To all whom it may concern:

Be it known that I, JOHANN H. E. RATHMANN, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Apparatus for Drying and Germinating Malt, &c., of which the following is a specification.

This invention relates to an apparatus which is designed for germinating grain in the production of malt, but which may also be used for drying grain, &c.

The invention has more particular reference to apparatus of this class which consists of a number of connecting compartments or chambers arranged one above the other, each containing a rotary table or disk upon which the grain is deposited and each being connected with an air-supply tube or conduit which delivers an air-current to the compartments.

The object of my invention is to convey the material over the several tables and through the several compartments of the apparatus in bodies or layers of uniform thickness, so as to expose all portions of the grain uniformly to the action of the air and thereby produce a uniform product.

The invention has the further objects to improve the construction of the apparatus in various details and to provide the apparatus with driving mechanism, whereby the same may be operated at a very slow speed when used as a germinator or at a higher speed in charging the apparatus and when using it as a drier.

In the accompanying drawings, consisting of five sheets, Figure 1 is a side elevation of my improved apparatus. Fig. 2 is a sectional elevation thereof, the plane of section being at right angles to Fig. 1. Fig. 3 is a fragmentary sectional elevation of the apparatus on an enlarged scale. Fig. 4 is a horizontal section in line 1 1, Fig. 3. Fig. 5 is a similar section in line 2 2, Fig. 3. Fig. 6 is a side elevation, on an enlarged scale, of one of the conveyers and its supporting-bracket. Fig. 7 is a vertical cross-section thereof in line 3 3, Fig. 6. Fig. 8 is a side elevation of the driving mechanism of the apparatus. Fig. 9 is a top plan view thereof on an enlarged scale. Fig. 10 is a vertical section of the same in line 4 4, Fig. 9, showing the means for throwing the worm of the driving mechanism into and out of gear with the worm-wheel, the worm being shown out of gear. Fig. 11 is a similar view showing the position of the parts when the worm is in gear.

Like letters of reference refer to like parts in the several figures.

A represents a suitable base or foundation for the apparatus, and B represents a number of upright columns or posts upon said base equidistant from the center and forming the stationary frame of the apparatus. These columns are firmly connected together at intervals by horizontal braces.

C represents a number of circular chambers or compartments arranged between the columns B, one above the other, and supported by horizontal lugs or ears *c*, formed at the circumference of the compartments and resting upon brackets *c'*, formed on the inner sides of the columns B, as most clearly shown in Fig. 3. Each of these compartments is provided with an imperforate top plate C', an imperforate annular side wall C^2, and a perforated bottom plate C^3, which is preferably conical. The side wall of each compartment is formed at its lower edge with an inwardly-projecting rim *d*, to which is secured the upper edge of its perforated bottom, while the compartment next below is provided centrally in its top with an upwardly-projecting flaring rim or flange *d'*, to which the lower edge of said perforated bottom is secured. Each compartment is formed in its perforated bottom with a central opening, which coincides with a similar opening formed in the imperforate top of the compartment next below, thereby placing the several compartments in communication with each other.

E represents a hollow upright shaft or air-tube extending centrally through the several compartments, and F are perforated horizontal disks or tables arranged in the compartments and secured to the air-tube E, so as to rotate therewith. Each of these tables extends from the air-tube outwardly nearly to the surrounding side wall of the compartment, so as to leave an annular space between the peripheral edge of the table and the side wall, through which the material falling over the edge of the table drops upon the perforated

bottom of the compartment. The air-tube E is connected at its upper end to a vertical shaft g, which is attached to a spider g', secured within the tube. This shaft turns in a bearing supported upon a horizontal frame G, which is secured to the upper ends of the columns B. The air-tube is supported at its lower end upon a vertical shaft h, which is secured with its upper portion to radial arms or spiders h', secured within the tube, and which turns with its lower end in a step-bearing h^2.

I is a stationary air-tube which projects with its upper end into the lower end of the air-tube E and from which the air is delivered into the rotary air-tube. Air is supplied to this stationary tube by means of a pipe i, which is connected with a blower or other air-propelling device. (Not shown in the drawings.)

j represents tiers of air-exit openings formed in the air-tube E, and through which the air passes from the central tube into the several compartments. Each tier of openings is arranged below the perforated table, so that the air issuing therefrom passes upward through the table as well as laterally through the perforated bottom of the compartment.

K represents the feed-hopper, having its spout connected with the uppermost compartment of the series, so as to deposit the grain upon the table of said compartment. L is a discharge-hopper arranged below the lowermost compartment and receiving the material from the discharge-opening in the bottom of said compartment. The spout l of this hopper leads to a receiver M, in which is arranged the boot of an elevator M', whereby the material after having traversed the apparatus may be elevated and stored or returned into the feed-hopper and again passed through the apparatus, as may be desired. For this purpose the elevator-head is provided with a movable or swiveling spout of any well-known construction, so that the spout may be brought over the feed-hopper or turned to one side thereof.

The spouts of the feed-hopper K and discharge-hopper L are provided with automatic valves n n', which permit the material to pass by the same, but prevent the escape of air through the spouts, thereby compelling the air to pass through the grain and the perforations of the compartments.

O represents stationary oblique blades or deflectors arranged in each compartment above its rotary table and attached to brackets o, secured to the under side of the top plate of the compartment. The lower ends of these deflectors are arranged in close proximity to the upper side of the perforated table and are inclined in the proper direction to move the grain on the table outwardly toward the peripheral edge thereof, so as to discharge the same upon the outer portion of the perforated bottom of the compartment.

As shown in Fig. 5, the blades O are arranged in a scroll or spiral line winding outward from the central portion of the perforated table to the periphery thereof, and the front end of each deflector is arranged at about the same distance from the center of the table as the rear end of the deflector preceding it, as indicated by the dotted lines in Fig. 5. By these deflectors the grain is moved on the table outward toward the periphery thereof as it comes in contact with the stationary deflectors and is finally discharged over the edge of the table by the deflector arranged nearest its periphery.

The grain lying on the central portion of the rotary table has a slower peripheral speed than that lying farther toward the periphery, and in order to maintain a uniform thickness of the layer of grain upon all parts of the table the grain must be conveyed outwardly over the central portion of the table at a greater speed than over the peripheral portion. To effect this movement of the grain with a speed which gradually decreases from the center outwardly, the blades or deflectors are set at a gradually-diminishing angle from the center toward the periphery of the table, as shown in Fig. 5.

p represents rotary oblique conveyers or blades depending from the under side of each rotary table and running in close proximity to the perforated bottom arranged below the table. These movable conveyers are also arranged at a gradually-diminishing angle from the center to the periphery; but as the conveyers rotate with the table and the material upon the perforated bottom of the compartment is as rest they move the layer of grain inwardly on the bottom toward the central discharge-opening of the bottom and finally cause it to drop through said opening upon the central portion of the perforated table of the compartment next below. The material upon the rotary tables is thus gradually moved outwardly by contact with the depending stationary blades O and finally discharged over the edge of the table upon the stationary bottom of the compartment, while the material discharged upon said bottom is gradually moved inwardly on the bottom and discharged through the central discharge-opening of the compartment by the traveling blades p, and the speed of the grain is so regulated by the different angles of the blades that a uniform thickness of the layers of grain is maintained, thereby insuring a uniform action of the air-current upon the grain.

Each deflector O is preferably made vertically adjustable on its bracket by a horizontal bolt o', passing through an upright slot in the bracket, as shown in Figs. 6 and 7, so that it can be adjusted with reference to the surface of the perforated table, and the rotary blades p are made likewise adjustable with reference to the bottom of the compartment. Each compartment is provided in its top with several manholes p', as shown in Fig. 4, through which access may be had to the interior of the compartment.

q represents a conical or downwardly-flaring shield or deflector arranged upon the central portion of each table around the central air-tube and serving to deflect the material outwardly, which drops down around the central tube, so as to bring it within reach of the inner stationary deflector or deflectors.

When the apparatus is used as a germinator, the grain-carrying tables are rotated at a slow speed, so as to carry the grain through the apparatus very slowly, while in charging the apparatus and when using it as a drier the tables may be rotated at a higher speed.

Any suitable mechanism may be used for driving the hollow shaft or air-tube at a higher or lower speed; but the driving mechanism shown in the drawings is preferably employed for this purpose. This mechanism is constructed as follows:

R represents a horizontal driving-shaft provided at its inner end with a bevel-pinion R′, which meshes with a horizontal bevel-wheel R^2, secured to the upper end of the upright shaft g of the hollow shaft E. The driving-shaft R turns in bearings arranged in standards r, secured to the horizontal top frame of the apparatus.

S S′ are respectively tight and loose pulleys mounted on the driving-shaft R, and S^2 is the driving-belt.

S^3 is a bevel-pinion formed on or secured to the loose pulley S′, so as to turn therewith and which meshes with a bevel-wheel T, mounted upon a horizontal counter-shaft t, arranged at right angles to the driving-shaft.

t' is a spur-pinion secured to the counter-shaft t and engaging with a spur-wheel t^2, secured to a worm-shaft t^3, arranged parallel with the counter-shaft t.

u is a worm fixed to the shaft t^3 and adapted to engage with a worm-wheel u', secured to the driving-shaft R. The shaft of the worm u is made vertically adjustable toward and from the worm-wheel, so that the worm can be thrown into or out of gear with the worm-wheel. For this purpose the worm-shaft is journaled in eccentric-boxes u^2, having shifting-arms u^3, which are connected by a cross-bar u^4, so that by raising or lowering said bar the eccentric-boxes are simultaneously turned in their bearings and the worm-shaft is raised or lowered for throwing the worm into or out of gear with the worm-wheel. The worm is preferably held in gear with the worm-wheel by a cord u^5, attached to the connecting-bar u^4, running upwardly over a guide-pulley u^6 and fastened with its lower end to a suitable support, while the worm is thrown out of gear when said cord is released by a weight u^7, suspended from said connecting-bar.

When it is desired to drive the rotary tables at a very slow speed, the driving-belt is shifted upon the loose pulley S′ and the worm is thrown into gear with the worm-wheel on the driving-shaft. The comparatively-fast speed of the loose pulley will now be transmitted to the driving-shaft R at a greatly-reduced speed through the medium of the bevel-wheels S^3 T, spur-wheels t' t^2, worm u, and worm-wheel u'. When it is desired to drive the rotary tables at a higher speed, the driving-belt is shifted upon the tight pulley S and the worm is thrown out of gear with the worm-wheel, when the motion of the tight pulley will be transmitted directly to the hollow shaft E by the bevel-wheels S^3 T, while the other gearing remains at rest. In order to stop the apparatus, the driving-belt is shifted upon the loose pulley S′ and the worm is thrown out of gear with the worm-wheel of the driving-shaft, in which case the train of gearing extending from the loose pulley to the worm-shaft simply runs loose without affecting the driving-shaft.

The grain fed into the hopper K is delivered upon the central portion of the rotary table of the uppermost compartment and gradually moved outward over the table in a layer of uniform thickness by contact with the stationary deflectors above the table until it reaches the periphery of the table, when it drops upon the peripheral portion of the perforated bottom of the compartment. From this point it is gradually moved inwardly on said bottom in a layer of uniform thickness by the rotary conveyers p and discharged through the central opening in the same and upon the central portion of the rotary table next below. The grain is caused to traverse this table and the bottom of its compartment in a similar manner, and so on throughout the entire series of compartments until it is finally discharged from the lowermost compartment into the receiving-hopper M, whence it may be again elevated and passed through the apparatus or diverted and stored. As the grain is carried through the apparatus it is exposed to the action of the air-currents, which enter the compartments from the air-tube E and pass upwardly through the layers of grain upon the perforated tables and laterally through the layers on the perforated bottoms of the compartments.

When the apparatus is used for drying purposes, hot air is supplied to the tube E, while when the apparatus is employed as a germinator cold air is usually supplied.

I claim as my invention—

1. The combination, with a chamber or compartment having an inlet in its top near its center and a similarly-located outlet in its bottom, of a rotary table arranged in said compartment, stationary blades arranged above said table and secured to the top of the compartment and inclined to move the material outwardly over said table, oblique rotary blades arranged above the bottom of the compartment and adapted to move the material inwardly over said bottom, and a central air-supply tube, substantially as set forth.

2. The combination, with a chamber or compartment having an inlet at its top near its

center and a similarly-located outlet in its bottom, of a rotary table arranged in said compartment, oblique stationary blades secured to the under side of the top of the compartment and adapted to move the material outwardly over said table, oblique rotary blades secured to the under side of the table and adapted to move the material inwardly over the bottom of the compartment, and a central air-tube carrying said table, substantially as set forth.

3. The combination, with a chamber or compartment having an inlet in its top near its center and a similarly-located outlet in its bottom, of a central air-tube, a rotary table arranged in said compartment and carried by said air-tube, oblique stationary blades secured to the under side of the top of the compartment and adapted to move the material outwardly over said table, oblique rotary blades secured to the under side of the table and adapted to move the material inwardly over the bottom of the compartment, and a downwardly-flaring shield arranged upon the table around the central air-tube and deflecting the incoming material outwardly within reach of the stationary blades, substantially as set forth.

4. The combination, with a horizontal chamber or compartment provided in its top near its center with an inlet and in its bottom with a similarly-located outlet, of a rotary horizontal table arranged in said compartment and receiving the material from the inlet of the compartment, and oblique stationary blades or deflectors arranged above said table and set at a gradually-diminishing angle from the central portion of the table toward its periphery, substantially as set forth.

5. The combination, with a horizontal chamber or compartment provided in its top near its center with an inlet and in its bottom with a similarly-located outlet, of a rotary horizontal table arranged in said compartment, oblique stationary blades or deflectors arranged above said table and set at a gradually-diminishing angle from the center toward the periphery of the table, whereby the material upon the table is moved outwardly with gradually-diminishing speed, and rotary oblique blades or conveyers arranged above the bottom of the compartment and set at a gradually-diminishing angle from the center toward the periphery of said bottom, whereby the material on said bottom is conveyed inwardly with gradually-increased speed, substantially as set forth.

6. The combination, with a horizontal chamber or compartment having an inlet in its top near its center and a similarly-located outlet in its bottom, of a rotary table arranged in said compartment, oblique stationary blades or deflectors arranged above said table, and oblique rotary blades arranged above the bottom of the compartment, both of said stationary and rotary sets of blades being arranged in spiral lines winding outward from the center of the compartment and placed at a gradually-diminishing angle from the center toward the periphery of the compartment, substantially as set forth.

7. The combination, with a horizontal compartment having an inlet in its top near its center, a perforated bottom, and an outlet in said bottom near its center, of an upright hollow shaft or air-tube extending through said compartment and communicating with the same, a perforated rotary table secured to said hollow shaft, stationary oblique blades depending from the top of the compartment, arranged in a spiral line and at a gradually-diminishing angle from the center toward the periphery of the table, and oblique conveyers or blades depending from the under side of the rotary table and arranged in a spiral line and at a gradually-diminishing angle from the center toward the periphery of the bottom of the compartment, substantially as set forth.

Witness my hand this 10th day or June, 1892.

JOHANN H. E. RATHMANN.

Witnesses:

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JNO. J. BONNER.