No. 666,432. Patented Jan. 22, 1901.

F. H. C. MEY.

MALTING OR DRYING APPARATUS.

(Application filed Mar. 22, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

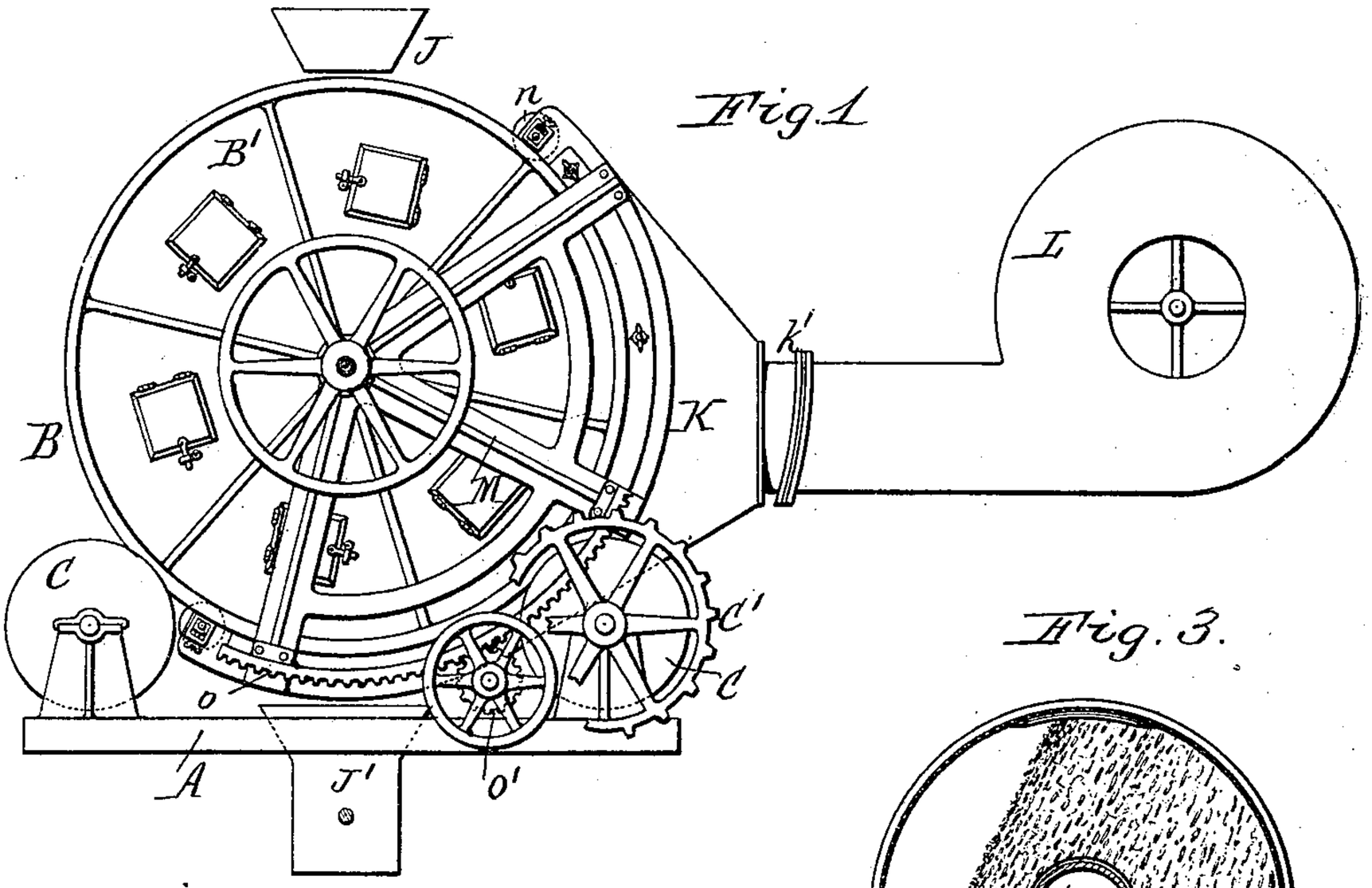


Fig. 3.

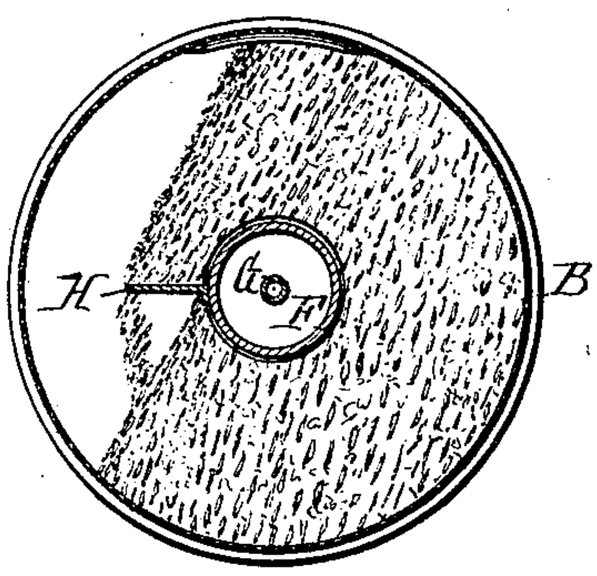
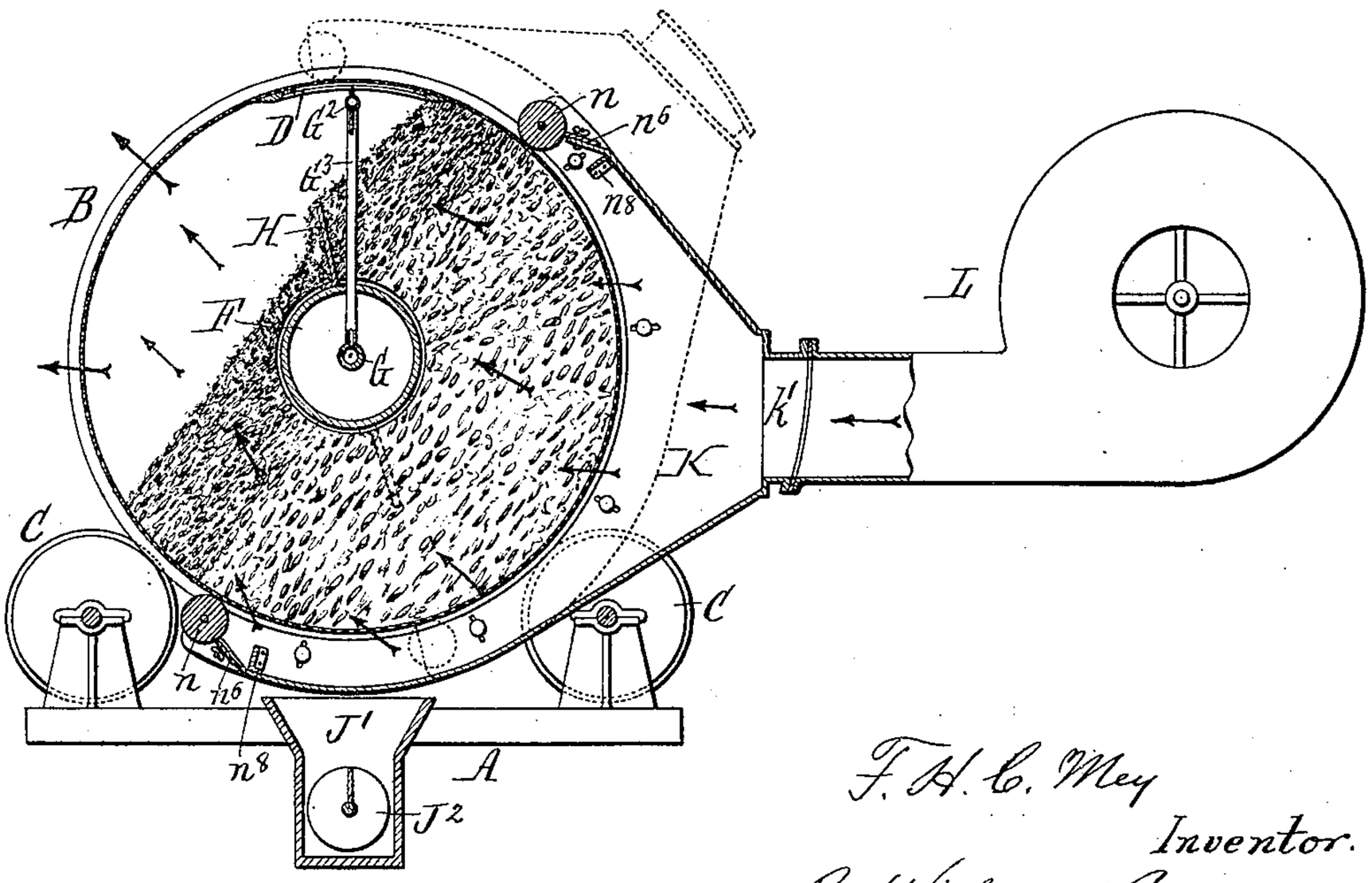


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

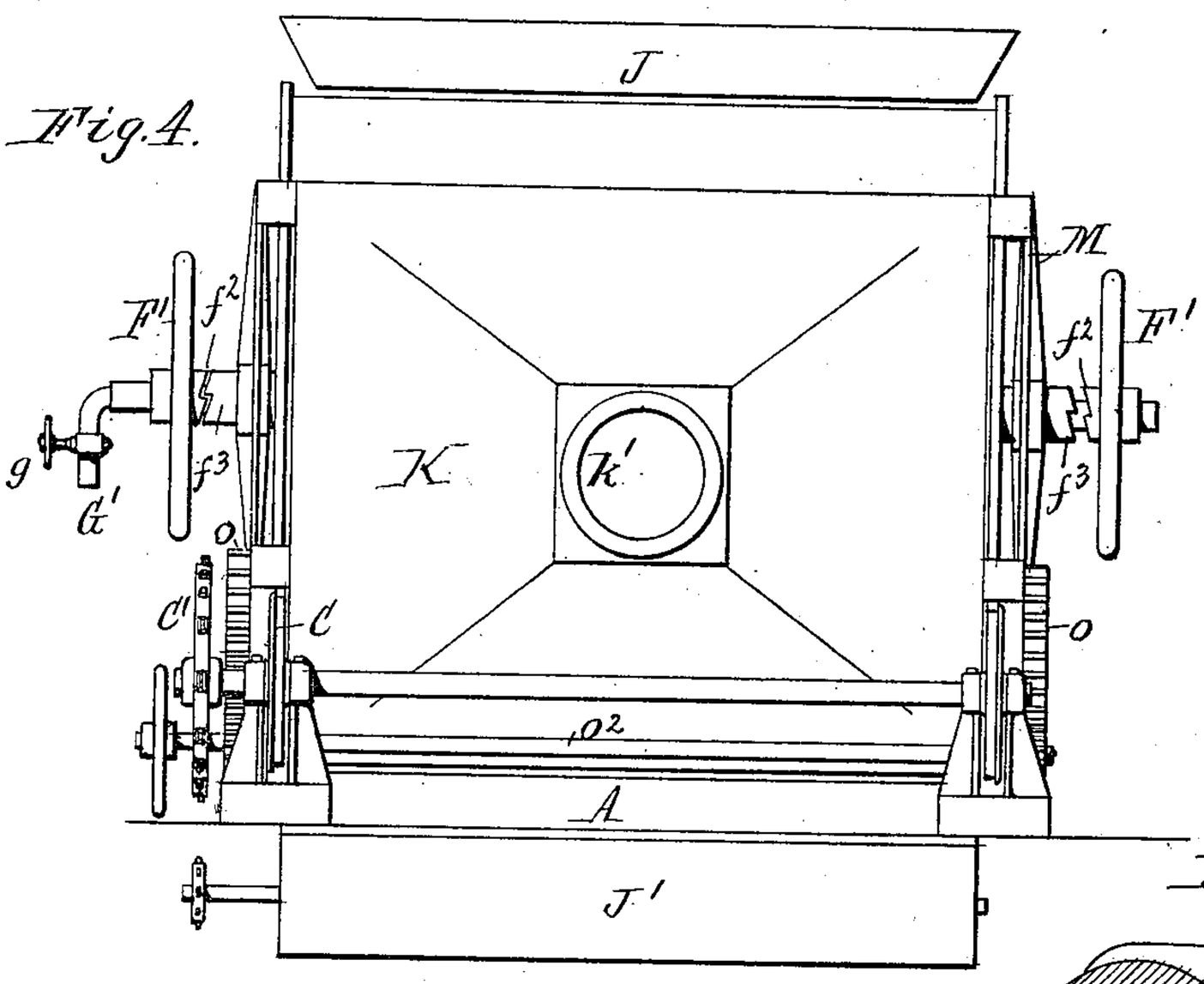


Fig. 6.

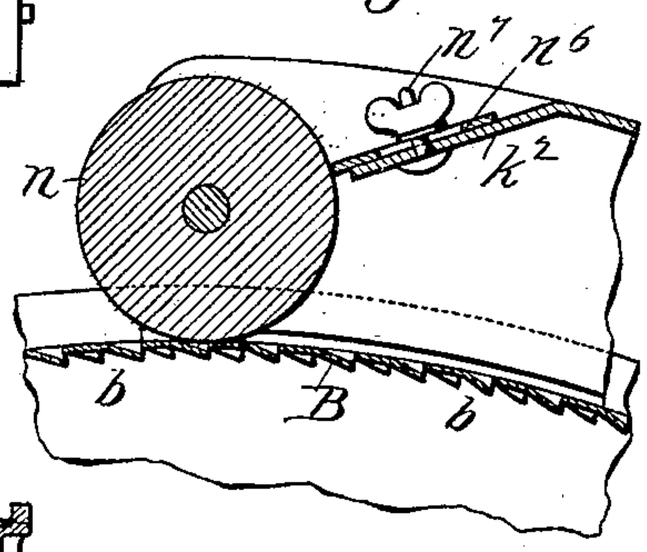


Fig. 5.

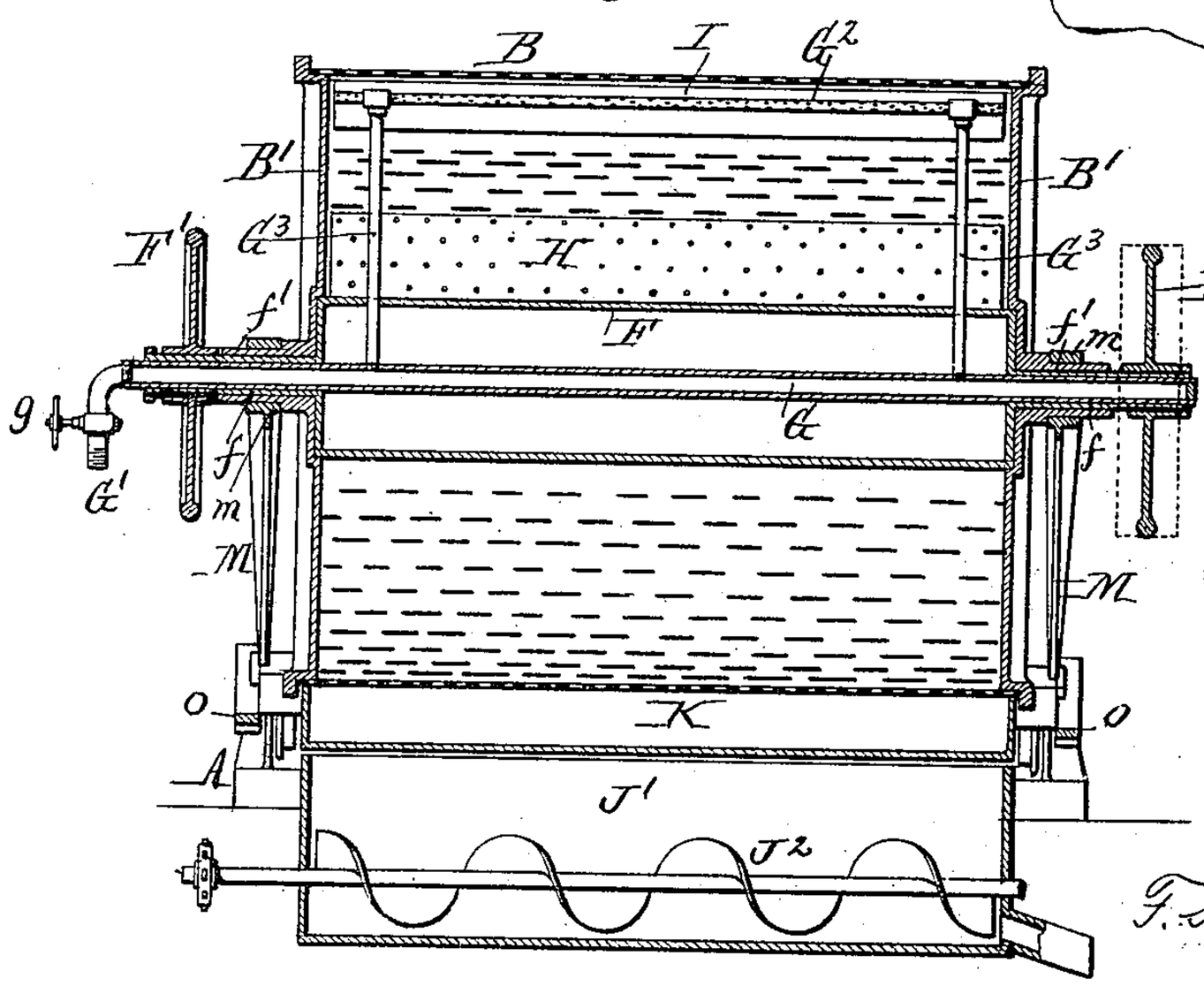
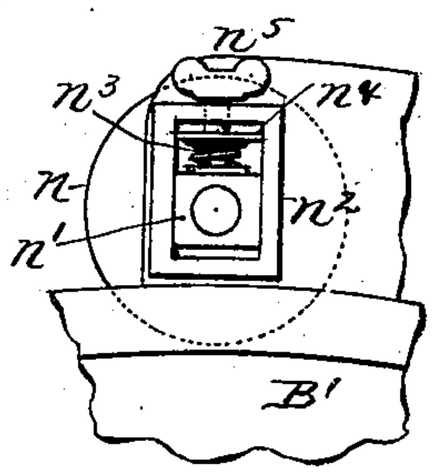


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 8.

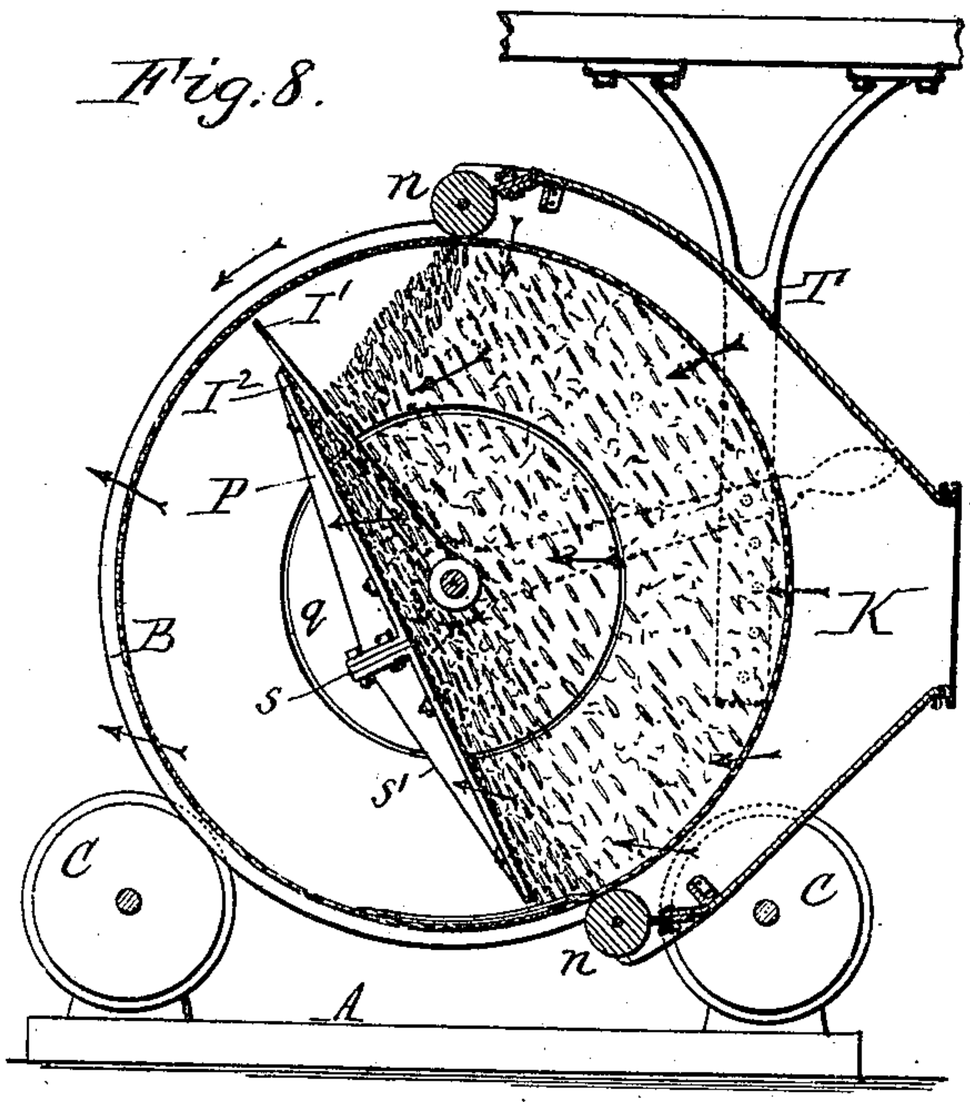


Fig. 9.

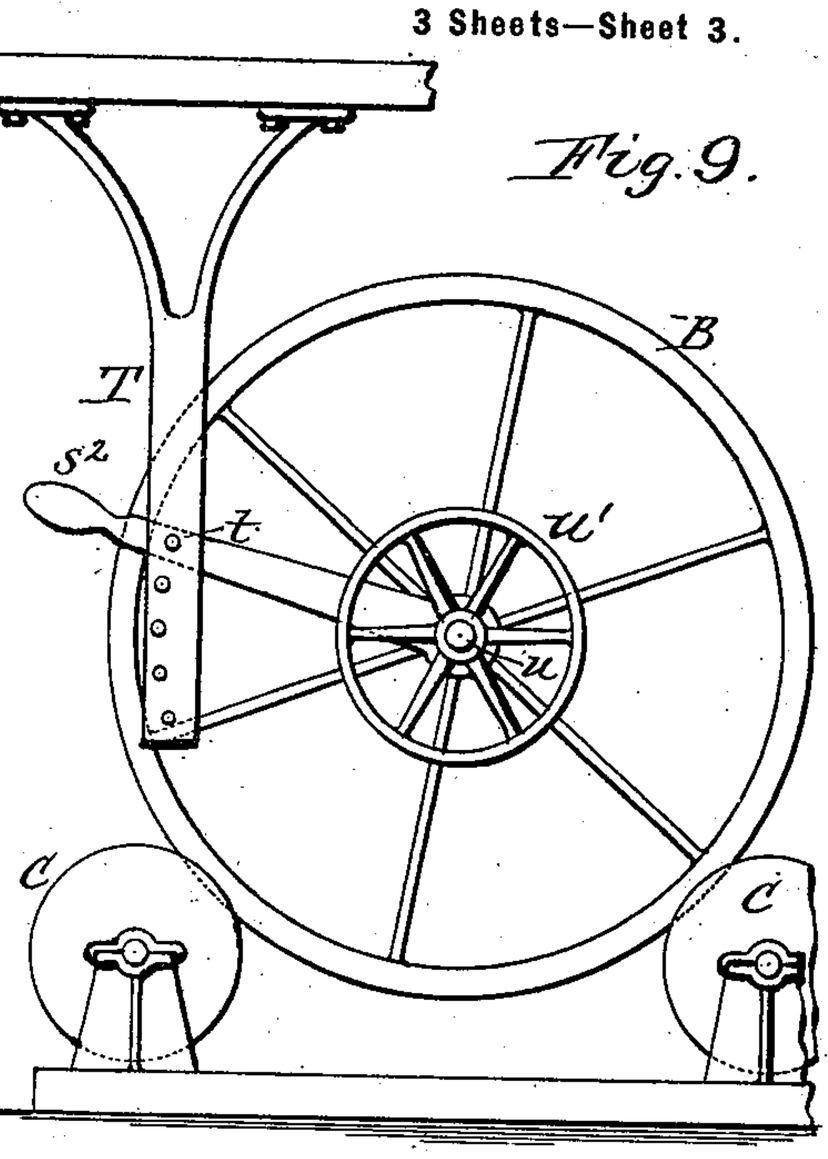


Fig. 11.

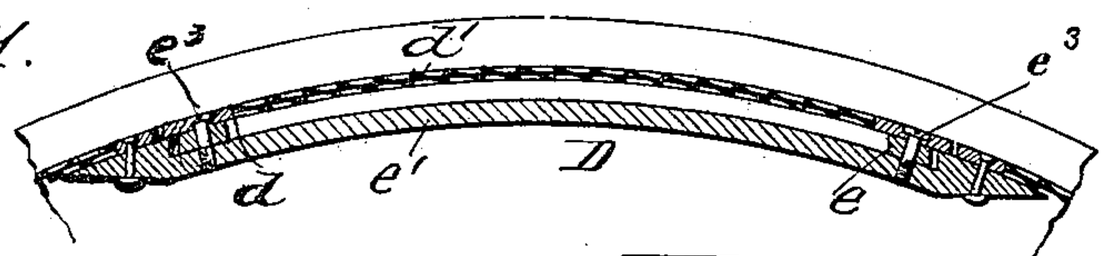


Fig. 10.

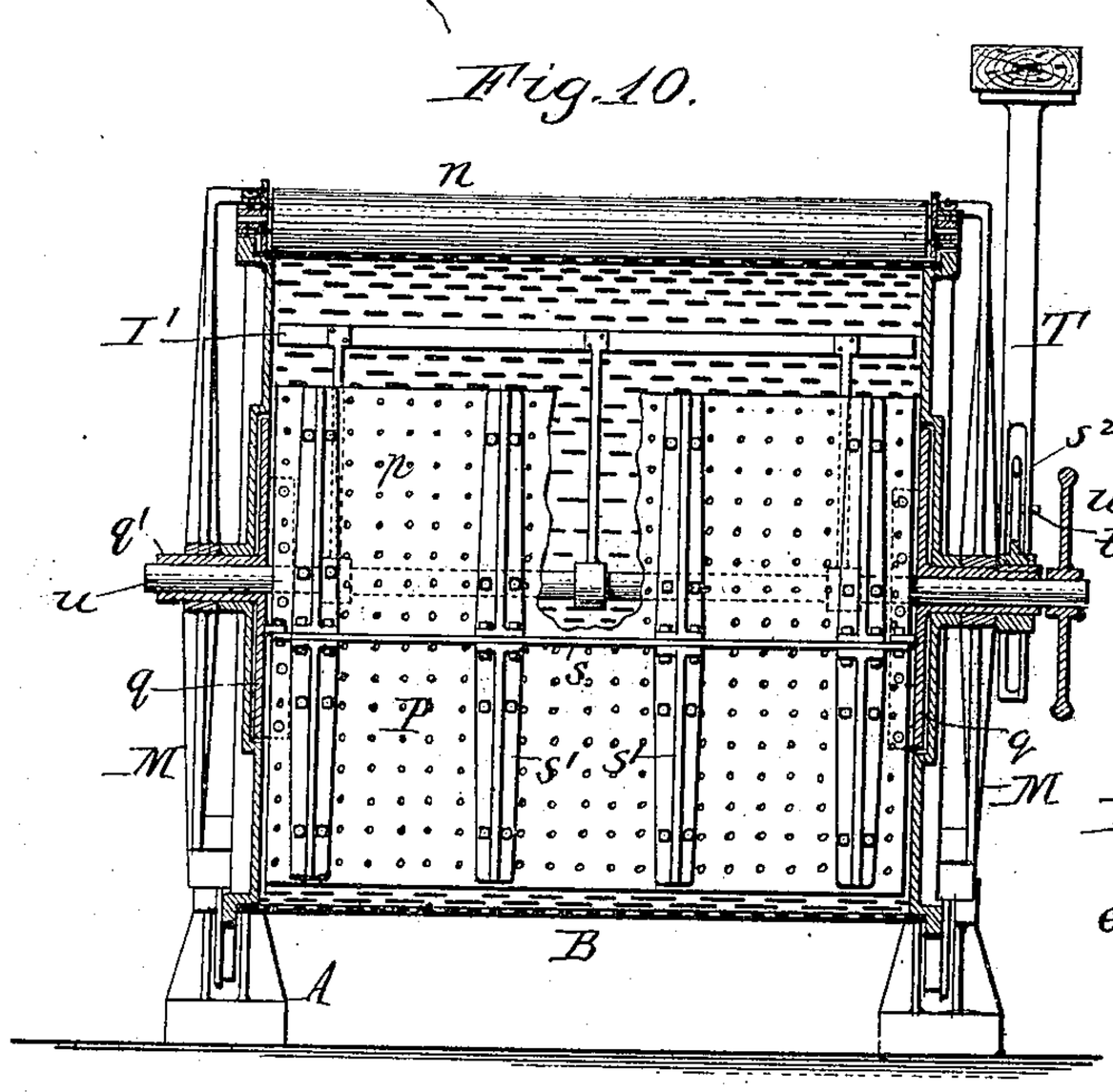
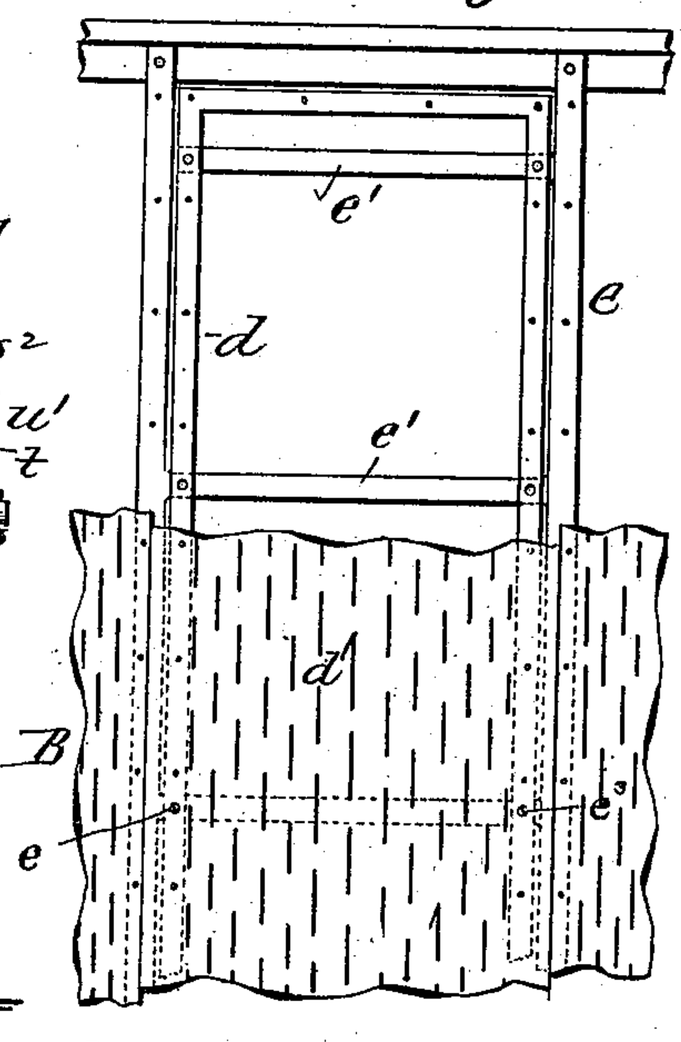


Fig. 12.



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Henry L. Decke. } Witnesses.

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UNITED STATES PATENT OFFICE.

FREDERICK H. C. MEY, OF BUFFALO, NEW YORK.

MALTING OR DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 666,432, dated January 22, 1901.

Application filed March 22, 1898. Serial No. 674,737. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK H. C. MEY, a citizen of the United States, residing at Buffalo, in the county of Erie, in the State of New York, have invented a new and useful Improvement in Malting or Drying Apparatus, of which the following is a specification.

This invention relates more especially to a malting apparatus in which the operations of germinating and drying are performed in a horizontal drum which has suitable means for rotating it slowly and which is connected with an air-propelling device, whereby an air-current is maintained through the drum; but the apparatus, while desirable for malting, may be used for drying various substances.

One of the objects of my invention is to so construct the machine that the air-current is permitted to pass through all portions of the body of material in the drum, so as to more effectually remove the carbonic-acid gas evolved during the germinating operation when the apparatus is used for malting and to dry the grain more rapidly and uniformly.

The invention has the further objects to provide the machine with simple means for supplying water to the drum and for removing any adhering grain from its inner surface and to provide the drum with efficient means for preventing fine or mealy material, such as brewers' grains, from falling through the perforations of the drum in drying the same.

In the accompanying drawings, consisting of three sheets, Figure 1 is an end elevation of my improved apparatus. Fig. 2 is a transverse vertical section thereof. Fig. 3 is a similar section of the drum, showing a different position of the rotary dam. Fig. 4 is a side elevation of the machine viewed from the side on which the segmental air-chamber is located. Fig. 5 is a longitudinal section of the machine. Fig. 6 is a fragmentary transverse section of the air-chamber and the drum on an enlarged scale. Fig. 7 is an enlarged view of one of the roller-bearings. Fig. 8 is a transverse section of an apparatus embodying my invention and designed more particularly for drying fine or granular substances. Fig. 9 is an end view thereof. Fig. 10 is a longitudinal section of the same. Fig. 11 is an enlarged fragmentary view of the side of the drum containing the feed and discharge door. Fig. 12 is an enlarged transverse section of the same portion of the drum.

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

A is the base or foundation of the machine.

B is the rotary drum, which is supported horizontally on friction-rollers C, journaled in standards rising from the base. One of these friction-rollers is provided with a sprocket or driving wheel C′, around which runs a suitable driving-belt. (Not shown in the drawings.) The body or cylindrical portion of the drum is slitted or perforated over its entire surface, while its heads B′ are solid or imperforate. The slits or perforations of the drum are small enough to retain ordinary-sized grain therein and are preferably provided with inclined hoods *b*, Fig. 6, which open rearwardly or in the opposite direction to that in which the drum turns and are closed at their front ends, these hoods being formed by striking up the metal immediately behind the perforations. The drum is provided in one side with a feed and discharge opening, which is closed by a door D. This door extends from end to end of the drum and consists of an open rectangular frame *d* and a plate of perforated sheet metal *d′*, Fig. 12, secured to the outer side of said frame and curved concentrically with the surface of the drum. Owing to the length of the door-opening the metal along its edges is liable to buckle, and in order to prevent this the edge of the opening is stiffened or reinforced by longitudinal bars *e*, secured at their ends to the drum-heads and connected by cross-bars *e′*, arranged at suitable intervals, as shown in Figs. 11 and 12. The stiffening-bars are arranged on the inner side of the drum and extend inwardly beyond the edge of the door-opening to form a rabbet, as shown in Fig. 11, and the perforated plate *d′* of the door extends beyond the edge of its frame *d* and fits into this rabbet, rendering the door flush with the surface of the drum. The door is removably secured to the frame of the drum-opening by bolts e^3 or other suitable means.

F is an auxiliary imperforate drum arranged within the main or outer perforated drum and occupying the central space thereof. Comparatively little or no movement of the

material takes place in the central portion of the drum, and in order to keep the material outside of this dead zone or portion and bring the inner portion thereof sufficiently near to the periphery of the drum to insure its displacement by the rotation of the drum said space is occupied by the auxiliary drum. As shown in Fig. 5, the inner drum is provided at its ends with hollow journals *f*, which are supported in sleeves or bearings *f'*, arranged at the ends of the main drum. The inner drum is capable of turning independently of the outer drum, but is normally connected therewith by coupling devices or clutches of any suitable construction. The clutches shown in the drawings consist of hand-wheels or clutch-collars F', arranged to slide lengthwise on the hollow journals of the inner drum and held against turning thereon by keys or splines. The hubs of these hand-wheels are provided at their inner ends with teeth f^2, which are adapted to interlock with corresponding teeth f^3 on the outer ends of the sleeves of the main drum, so as to cause the inner drum to turn with the outer drum, while allowing the inner drum to be turned independently of the outer drum by means of the hand-wheels upon shifting the latter out of engagement with the toothed sleeve of the main drum. If desired, these clutch-wheels may be normally held in engagement with the hubs of the main drum by suitably-arranged springs.

G is a hollow shaft or water-pipe arranged axially in the inner drum and passing through the hollow journals thereof, as shown in Fig. 5. This pipe is closed at one end and connected at its other end with a supply-pipe G', having a hand-valve *g* for regulating or entirely shutting off the passage of the water into the pipe. This supply-pipe is connected with the axial pipe by a suitable union or joint which permits the shaft to rotate independently of the supply-pipe.

G^2 is a longitudinal spray or sprinkler pipe arranged within the drum in close proximity to its peripheral wall and connected with the axial pipe G by hollow radial arms or pipes G^3, which extend through openings in the inner drum and through which the water passes from the radial pipe to the spray-pipe. The latter extends from end to end of the drum, so as to deliver a spray or sheet of water upon the material throughout the length of the drum. The sprinkler-pipe may be moved in the arc of a circle for bringing the same over any desired portion of the material in the drum by disengaging the clutch-wheels F' from the main drum and then turning the wheels, so as to rotate the inner drum, with which the sprinkler-pipe is connected.

H is a rotary blade or dam which projects radially from the inner drum F and extends from end to end thereof. This blade turns with the inner drum and has no effect upon the material as long as it is buried in the same, as indicated by dotted lines in Fig. 2; but when it protrudes beyond the inclined surface of the material, as shown in Figs. 2 and 3, it acts as a dam, which checks the descent of the material until the dam by its downward movement slopes toward the descending side of the drum and beyond the angle of repose of the material, whereupon the latter falls over the outer edge of the dam upon the material below, as shown in Fig. 3. This action of the dam takes place once during every turn of the drum. The material is by this means turned or displaced more effectually than when it simply rolls down the inclined surface of the mass. If desired, the dam may also be used as a stirrer by turning the inner drum faster than the outer drum. If used in this manner, one of the hand-wheels F' may consist of a driving-pulley, as shown by dotted lines in Fig. 5, so that the stirrer may be driven by power at suitable intervals. The dam is perforated, so as to prevent the water from accumulating thereon.

I is a scraper, preferably mounted on the spray-pipe G' and adapted to bear against the inner surface of the drum for detaching any adhering material therefrom. This scraper may consist of a strip of rubber or other flexible material, which projects outwardly from the spray-pipe and extends from end to end thereof, as shown in Figs. 2 and 4. The scraper is swept over the surface of the drum when necessary by simply disconnecting the clutch-wheels from the main drum and turning the wheels.

J is a removable feed trough or hopper arranged above the drum, and J' a discharge-trough arranged below the same and having a conveyer J^2.

K is a segmental air-chamber or case which is arranged on one side of the drum, preferably on its ascending side, and which extends from end to end of its perforated body. This air-chamber extends around the top, bottom, and the ascending side of the drum, so as to inclose all portions of its circumference except its descending side, the latter remaining uncovered and exposed to the atmosphere. The curved front side of the air-chamber is open, so that the adjacent side of the drum communicates through its perforations with the chamber, while the rear wall and the sides of the chamber are tightly closed, so that the air delivered into the chamber can escape only into the drum and from the latter into the atmosphere through the uncovered portion of the drum. The front edges of the side walls of the air-chamber are curved concentrically with the periphery of the drum, so as to fit closely against the same.

L is an air-propelling device, preferably a blast-fan, having its spout arranged to register with the contracted outer portion or nozzle *k'* of the air-chamber, so as to deliver a blast of air into and through said chamber and transversely through the drum and its contents for driving off the gases generated during the germinating operation and for dry-

ing the material. For drying purposes the eye of this fan is connected with a furnace or other heater. (Not shown in the drawings.)

As the segmental air-chamber K covers the lower portion of the drum, it extends across the top of the discharge-trough J′ in the normal operation of the apparatus. In order to permit the chamber to be moved out of the way for exposing the lower side of the drum when it is desired to discharge its contents, the chamber is arranged to turn upwardly circumferentially of the drum, as indicated by dotted lines in Fig. 2, thus uncovering the portion of the drum above the conveyer-trough. In the construction shown in the drawings the chamber is carried by radial arms or frames M, secured at their outer ends to the side walls of the frame and connected at their inner ends by hubs *m*, which are journaled on the projecting bearings or sleeves *f′* of the drum-heads B′. In the construction illustrated in the drawings each of these carrying-frames consists of three radial arms, as shown in Fig. 1. In order to form a tight joint between the curved end portions of the segmental air-chamber and the surface of the drum, a longitudinal roller *n* is journaled in each of said end portions, which rollers extend from end to end of the chamber and run in contact with the drum, as shown in Figs. 2 and 6. These rollers are preferably made yielding, so as to bear at all times against the drum, and for this purpose their bearings *n′* are arranged to slide in boxes n^2, secured to the side walls of the air-chamber, and are constantly pressed toward the drum by springs n^3, as shown in Fig. 7. Each of these springs is interposed between the bearing-box and a follower n^4, having an adjusting-screw n^5, whereby the tension of the spring may be regulated. The horizontal front edges k^2 of the air-chamber may bear directly against the rear sides of the rollers *n;* but they are preferably provided with bearing strips or bars n^6, which extend from end to end of the rollers and are adjustably secured to the longitudinal walls of the chamber by bolts n^7, passing through transverse slots formed in the strips, or by other suitable means, so that the strips can be adjusted to bear snugly against the rollers. The air-chamber is fitted between the raised end flanges of the drum, and a suitable packing is arranged between the sides of the chamber and these flanges. Packing rings or segments are also secured to the side walls of the air-chamber, and these rings bear against the surface of the drum, so as to form a tight joint between these walls and the drum. The longitudinal walls of the chamber are stiffened near their front edges by reinforcing-bars n^8, secured to the inner sides thereof.

In order to permit the air-chamber to be readily shifted from one position to the other, the nozzle *k′* of the chamber is not secured to the spout of the fan; but the contiguous faces of the nozzle and the spout simply bear against each other and are curved concentrically with the axis or pivot on which the carrying-arms M of the chamber swing, as shown in Figs. 1 and 2, thus permitting the chamber to be turned from its normal to its inoperative position, or vice versa, without manipulating the joint. The air-chamber may be rotated by any suitable means; but it is preferably shifted by curved gear-racks *o*, secured to the sides of the chamber, and pinions *o′*, meshing with said racks and secured to a longitudinal shaft o^2. This shaft is arranged below the drum and provided at one end with a hand-wheel for turning it.

When my improved machine is used for malting, the germinating operation is conducted in a manner common to this class of machines, the drum being rotated from time to time during the germinating period to turn the grain. The air current or blast produced by the fan enters the air-chamber K and passes from the latter through the portions of the drum covered by the chamber, whence it passes transversely through the body of grain in the drum and escapes, finally, through the opposite descending side of the drum into the atmosphere, carrying with it the carbonic-acid gas evolved by the growing grain. As the air-chamber extends around all portions of the drum against which the body of grain rests, the air-current permeates all portions of the body of material, thus effectually ventilating the material and producing a better and more uniform product. The proper quantity of water is supplied to the material from time to time by opening the hand-valve *g* of the supply-pipe G′, and the spray-pipe G^2 is brought over different portions of the material by the hand-wheels F′, as hereinbefore described. During the germinating operation the fan is allowed to draw its air-supply from the atmosphere, or if the temperature of the atmosphere is too high or too low the fan may be connected with a compartment in which the air is properly heated or cooled, and which is not shown in the drawings. When the germinating operation is completed, the grain is dried by supplying a current of hot air to the air-chamber, the current passing through all portions of the body of grain from the periphery toward the axis of the drum, as above described. By thus directing a hot-air current through the entire body of material the same is dried thoroughly and quickly and in a uniform manner. After drying a batch of material the feed-trough J is moved aside, the air-chamber K is turned upward to uncover the bottom of the drum, as shown by dotted lines in Fig. 2, the drum is rotated to bring its discharge-opening over the discharge-trough J′, and the door is then removed, allowing the finished malt to flow into the trough. After emptying the drum the same is turned to bring its opening under the feed-trough J, and after recharging the drum the door is replaced and the air-chamber returned to its operative position.

When the machine is to be used for drying brewers' grains or other material which is finely reduced and liable to drop through the perforations of the drum, an inclined stationary dam, shield, or deflecting-plate P is arranged in the drum, as shown in Figs. 8 and 10. This shield extends from end to end of the drum and from the bottom to or nearly to the top of the same. It is preferably arranged between the axis of the drum and its descending side and slopes toward the ascending side of the drum. The material does not come in contact with the descending side of the drum, but is banked against the inclined shield, which confines the material between itself and the ascending side of the drum. As the drum rotates the material resting against the shield gradually descends, and the shield causes the material to flow toward the ascending side of the drum, thus directing the material in a direction unfavorable to its escape through the hooded perforations of the drum and checking the discharge of the material through the perforations. The shield is provided with hooded perforations *p* for the passage of the air-current. It is desirable to change the angle of the shield more or less, according to the character of the material to be dried, and in order to permit of this adjustment the shield is supported at its ends by a pair of rotary disks *q*, having hubs or sleeves *q'*, which turn in bearings in the heads of the drum, as shown in Fig. 10. *s* is a longitudinal connecting-bar secured at its ends to the disks *q* and arranged on the same side of the shaft as the shield, and *s'* represents inclined supporting arms or bars which are secured to said longitudinal bar and to the front sides of which the shield is fastened by bolts or otherwise. s^2 is a hand-lever secured to the hub of one of the rotary disks *q* for turning the same and changing the angle of the shield. This hand-lever is locked in position after adjusting the shield by a pin *t*, which is passed through a hole in the lever and one of a series of holes formed in a bracket T, depending from the ceiling or other suitable support. In this form of the machine the scraper I' is connected by arms I^2 with a rotary shaft *u*, which passes through the sleeves of the disks *q* and is provided at one end with a hand-wheel *u'* for turning it. In this case the radial arms M, which carry the air-chamber K, are journaled on the sleeves of the disks *q*, as shown in Fig. 10. In this form of the machine the air-chamber need not extend along the under side of the drum, and it is therefore unnecessary to shift the chamber for discharging the contents of the drum.

When the shield P is employed, the inner drum G and the dam H of the first-described construction are omitted.

I claim as my invention—

1. The combination with a perforated rotary drum, of an external air-chamber communicating with the interior of the drum and extending around all portions thereof against which the material is banked, while the remaining portion of the drum not occupied by the grain is exposed to the atmosphere, and an air-propelling device for producing an air-current through said chamber and the drum, substantially as set forth.

2. The combination with a perforated drum having a feed and discharge opening in its periphery, of an air-chamber extending around the outer side of the drum, communicating at its inner side therewith, and movable circumferentially of the drum, said chamber being constructed to normally clear the upper side of the drum and extend across the lower side thereof, and to clear the lower side of the drum when shifted out of its normal position, and an air-propelling device connected with said air-chamber, substantially as set forth.

3. The combination with a perforated drum having a feed and discharge opening, of an external segmental air-chamber arranged on the ascending side of the drum, communicating with the interior thereof and inclosing all portions of the circumference of the drum except its descending side, said chamber being movable circumferentially of the drum for uncovering the opening of the drum in discharging its contents, and an air-propelling device arranged to communicate with said air-chamber when the latter is in its operative position, substantially as set forth.

4. The combination with a perforated rotary drum, of a segmental air-chamber arranged on one side of the drum and movable circumferentially thereof, a curved gear-rack arranged on said air-chamber, and an operating-shaft having a gear-pinion meshing with said rack, substantially as set forth.

5. The combination with a perforated rotary drum, of an external air-chamber arranged on one side of the drum, communicating with the interior thereof and movable circumferentially of the drum, and a fan or air-propelling device arranged to communicate with said air-chamber when the latter is in its normal position, said air-chamber and the casing of said fan having registering nozzles or spouts the meeting ends of which are curved concentric with the axis of the drum, substantially as set forth.

6. The combination with a perforated rotary drum, of a movable segmental air-chamber arranged on one side of the drum and communicating therewith, rollers closing the curved end portions of said chamber and running in contact with the periphery of the drum, and an air-propelling device arranged to connect with said air-chamber, substantially as set forth.

7. The combination with a perforated rotary drum, of a movable segmental air-chamber arranged on one side of the drum and communicating therewith, rollers closing the curved end portions of said chamber and mounted in bearings which are movable toward and from the drum, springs operating to press said rollers against the drum, and

means for regulating the tension of said springs, substantially as set forth.

8. The combination with a perforated rotary drum, of a movable segmental air-chamber arranged on one side of the drum and communicating therewith, rollers closing the curved end portions of said chamber and running in contact with the periphery of the drum, adjustable strips forming the front edges of the longitudinal top and bottom walls of said air-chamber and bearing against said rollers, and an air-propelling device arranged to connect with said air-chamber, substantially as set forth.

9. The combination with a main rotary drum, of an auxiliary drum occupying the central portion of the main drum and capable of turning independently thereof, a movable longitudinal sprinkler-pipe arranged within the main drum and connected with said auxiliary drum, a water-pipe arranged in the drum and connected with said sprinkler-pipe, and a clutch or coupling device for connecting said auxiliary drum with the main drum, substantially as set forth.

10. The combination with a main rotary drum, provided at its ends with sleeves or bearings, of an auxiliary drum arranged centrally in the main drum and provided with hollow journals turning in said sleeves, a clutch for connecting the auxiliary drum with the main drum, a sprinkler-pipe arranged in the main drum, a water-supply pipe arranged axially in the auxiliary drum and passing through one of the hollow journals thereof, and a radial pipe or pipes connecting said sprinkler-pipe with said supply-pipe and passing through the auxiliary drum, whereby the sprinkler-pipe is compelled to turn with the auxiliary drum, substantially as set forth.

11. The combination with a rotary drum having perforations provided with hoods opening in the opposite direction to that in which the drum rotates, of an external air-chamber arranged on one side of the drum and communicating therewith, an air-propelling device connected with said chamber, and an inclined dam or shield arranged within the drum at a distance from its descending side and sloping toward its ascending side, substantially as set forth.

12. The combination with a rotary drum, having perforations provided with hoods opening in the opposite direction to that in which the drum turns, of an inclined dam or shield arranged within the drum, extending upwardly from the bottom thereof, and sloping toward the ascending side of the drum, substantially as set forth.

13. The combination with a rotary drum having perforations provided with hoods opening in the opposite direction to that in which the drum rotates, of an external air-chamber arranged on the ascending side of the drum and communicating therewith, an air-propelling device connected with said chamber, an adjustable inclined dam or shield arranged within the drum and sloping toward the ascending side thereof, and retaining means for holding the shield in position, substantially as set forth.

14. The combination with the rotary drum having hooded perforations, of rotary disks journaled at the ends of the drum, a longitudinal bar connecting said disks, and carrying inclined arms, and a perforated plate or shield secured to said arms and extending upwardly from the bottom of the drum, substantially as set forth.

Witness my hand this 16th day of March, 1898.

FREDERICK H. C. MEY.

Witnesses:
CARL F. GEYER,
KATHRYN ELMORE.