No. 672,843. Patented Apr. 23, 1901.

P. RENNER.

GRAVITY PNEUMATIC MALTING SYSTEM.

(Application filed Feb. 5, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig 1

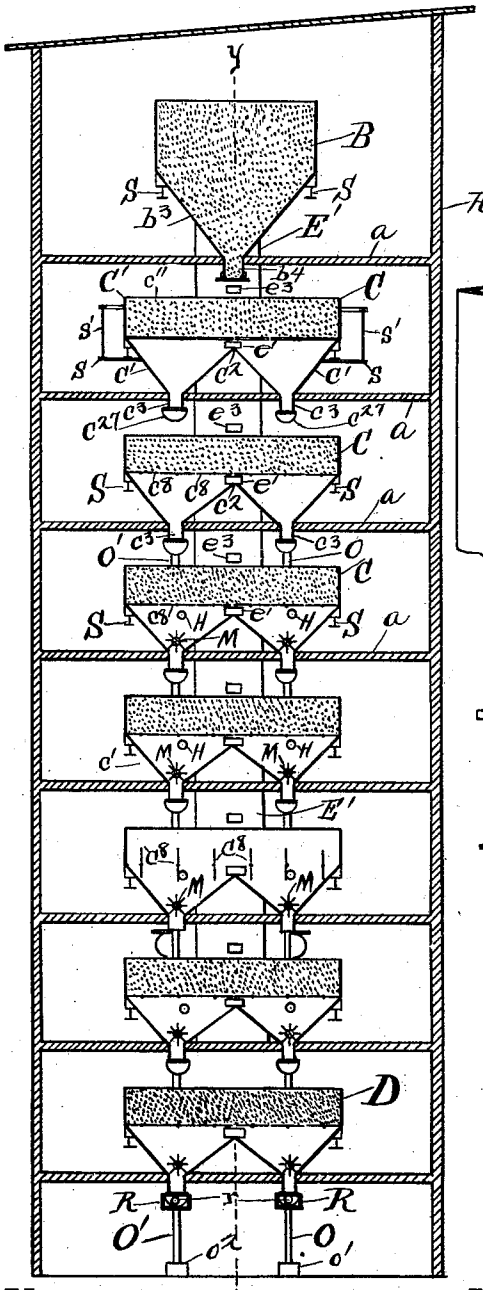


Fig 2

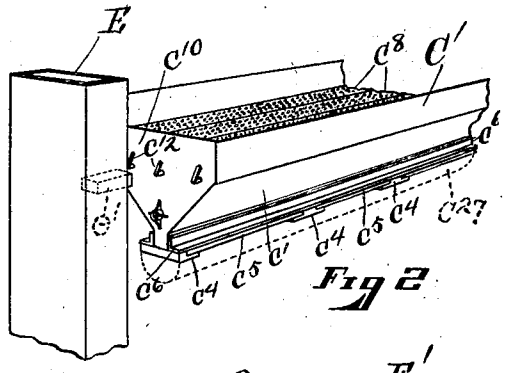
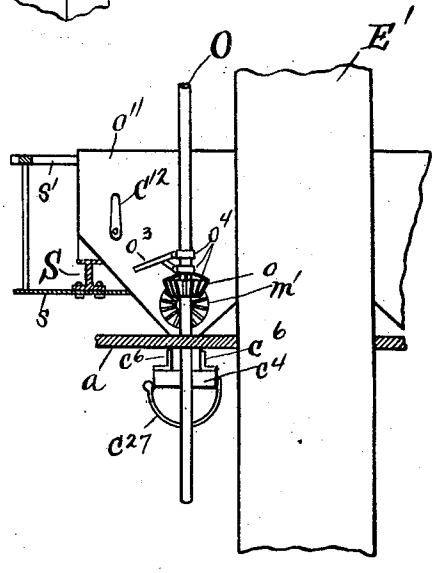


Fig 3



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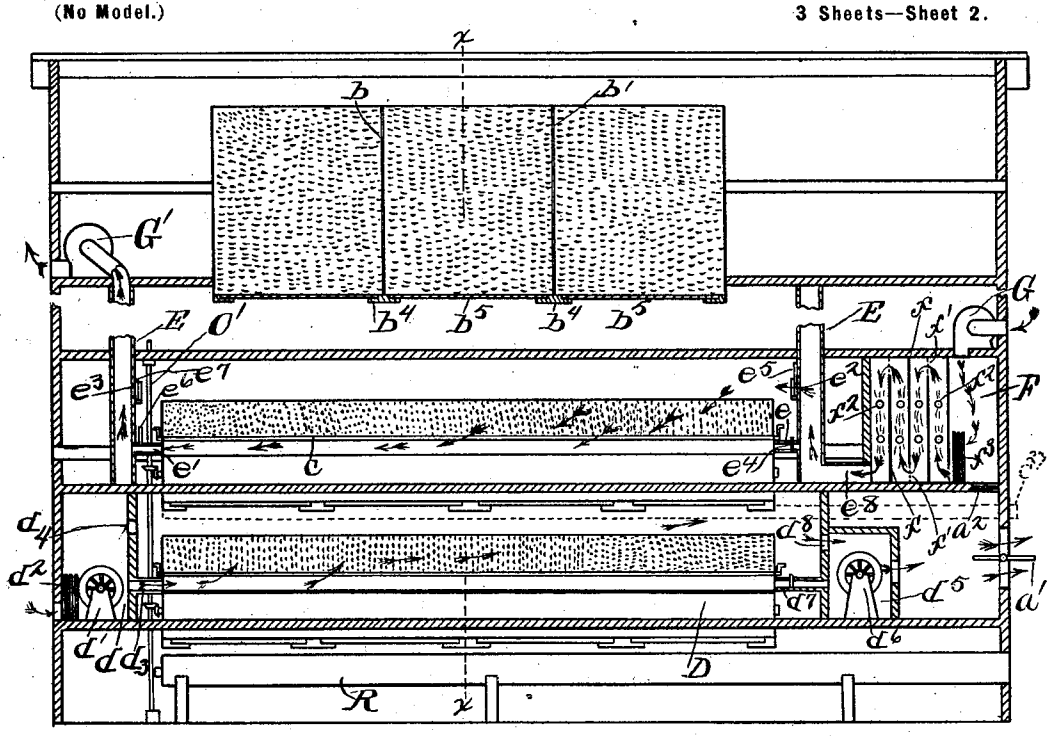


Fig 4.

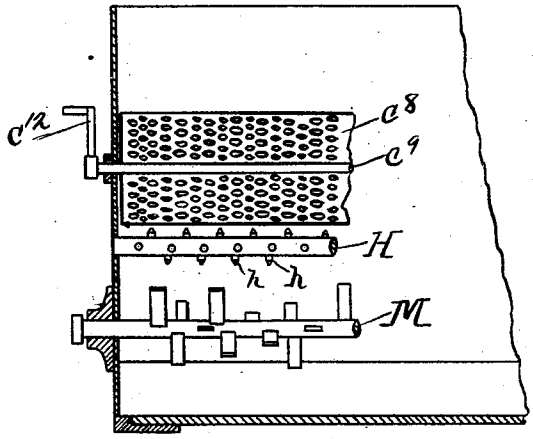


Fig 5.

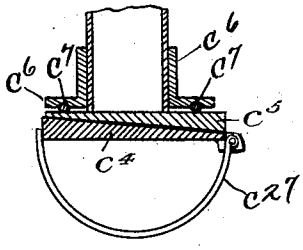


Fig 6.

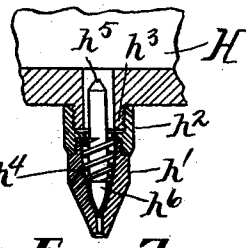


Fig 7.

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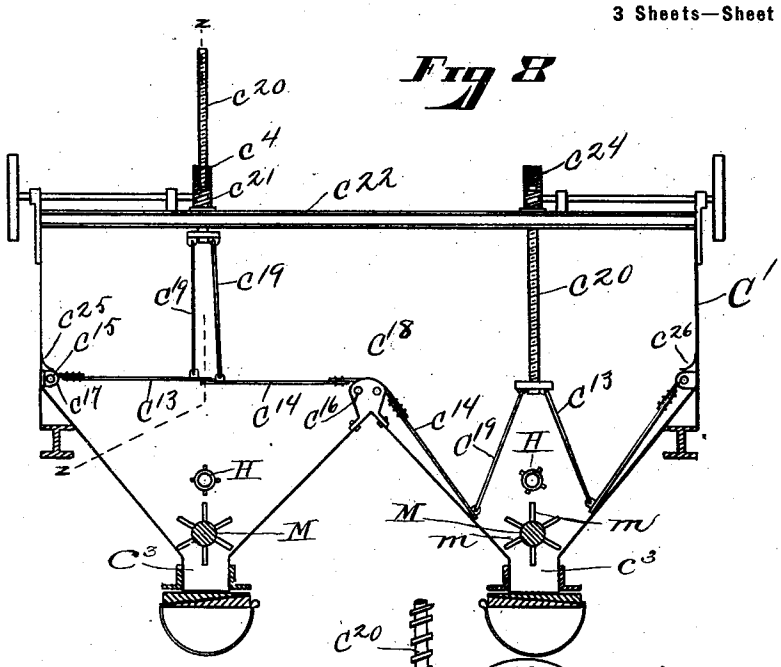
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(No Model.) 3 Sheets—Sheet 3.

Fig 8



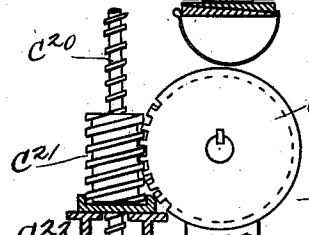
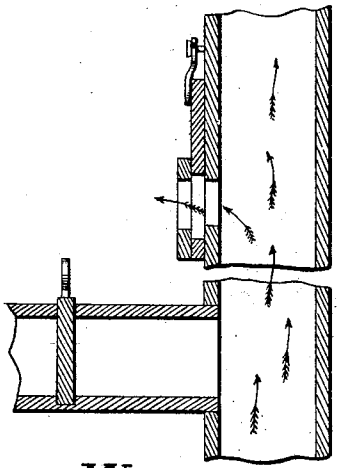
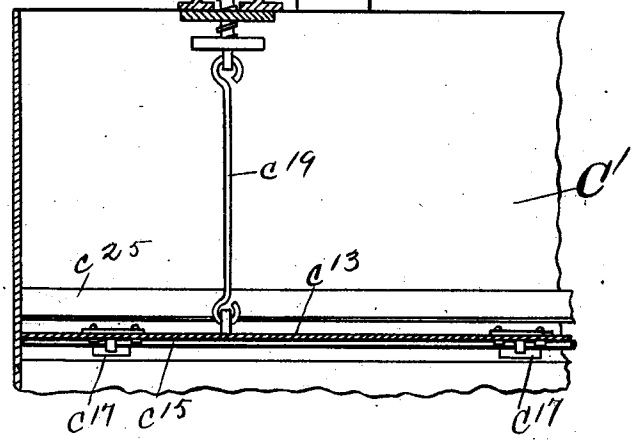


Fig. 9.

Fig. 10.





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UNITED STATES PATENT OFFICE.

PETER RENNER, OF CINCINNATI, OHIO.

GRAVITY PNEUMATIC MALTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 672,843, dated April 23, 1901.

Application filed February 5, 1900. Serial No. 3,920. (No model.)

To all whom it may concern:

Be it known that I, PETER RENNER, a citizen of the United States, and a resident of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Gravity Pneumatic Malting Systems, of which the following is a specification.

My invention relates to a new system of malting, which I shall call a "gravity pneumatic malting system." Its object is a system in which the manual labor necessary to carry on the process of malting is greatly decreased, with no corresponding increase of machinery to take the place of the hands, and is accomplished by means of a series of germinating-compartments arranged vertically below each other, from one to the other of which the grain is dropped during germination by gravity; of air-shafts with fans for drawing air first through an attemperating-room, where it is brought to the desired degree of temperature and moisture, and then through the grain while it lies in the successive compartments; of horizontal revolving shafts and sprayers in the compartments, the former for separating the grain matted together from its sprouting and the latter for moistening it in the course of its descent from one compartment to the next, and, lastly, of a withering-compartment below the lowest germinating-compartment, in which the grain is brought in contact with hot dry air for withering it before it is conveyed to the drying-kiln, as illustrated in the accompanying drawings, in which—

Figure 1 is a vertical transverse central sectional view of a malt-house with my improved malting apparatus in position, taken through line x x of Fig. 4, looking toward the left. Fig. 2 is a detail perspective view, upon a slightly-enlarged scale, of the front end of one of the compartments in which the grain is germinated and a part of the front or fresh-air shaft, the conduit leading from the air-shaft to a point beneath the perforated dumping-floor of the compartment and the gutter for conveying the water to the sewer after it has cleansed the emptied compartment being shown in dotted lines. Fig. 3 is a detail rear elevation, upon an enlarged scale, of a compartment, a part of the foul-air shaft, showing the vertical shaft for revolving the horizontal shaft for separating the matted grain, and the sliding clutch mechanism for coupling and uncoupling the two shafts, as desired. Fig. 4 is a vertical longitudinal sectional view taken upon line y y of Fig. 1, showing the top floor containing the steeping-tank and the lowermost germinating-compartment, with the attemperating-room adjacent to it and the withering-compartment below it, the floors intervening between said germinating-compartment and the top floor being broken out. Fig. 5 is a longitudinal sectional view, upon an enlarged scale, of the front ends of a compartment, taken through the center of one of its hoppers, showing the dumping-floor in its open position and below it the pipe with sprayers and the revolving shaft with its tines for moistening and separating the matted grain in its descent. Fig. 6 is a detail transverse sectional view of the lower extension of a hopper, showing the sliding plate for closing it, the rubber strips for insuring an air-tight fit, the ways in which the plate slides, and the gutter for carrying off the water used in cleansing the compartment when emptied of grain. Fig. 7 is a central sectional view, upon a greatly-enlarged scale, of one of the sprayers or atomizers shown on the pipe in Fig. 5. Fig. 8 is a transverse sectional view, upon an enlarged scale, showing a modified form of floor. Fig. 9 is a detail sectional view, upon a much-enlarged scale, of an end of the compartment, taken upon line z z of Fig. 8, looking toward the left. Fig. 10 is a central longitudinal detail view, upon an enlarged scale, of the fresh-air shaft and one of the pipes for connecting it with one of the hoppers, showing the slide in the pipe for controlling the admission of air into the hopper closed and the slide for closing the opening in the air-shaft above the hopper open.

Referring to the parts, the malt-house A shown in the drawings has eight floors a, upon the uppermost of which is steeping-tank B, vertically below which, upon the consecutive six floors, are germinating-compartments C, and upon the lowermost or first floor of which is the withering-compartment D.

Steeping-tank B is divided into three compartments by vertical partitions b b', Fig. 4, and its bottom is in the shape of a hopper b^3, with a longitudinal channel b^4 extending

down through the floor to convey the grain after being steeped down upon the germinating-compartment beneath it.

Each germinating-compartment C consists of a rectangular box C′, which has a perforated floor *c*, vertically beneath which and secured to or formed integral with the box are two V-shaped hoppers *c′*, with their inner edges c^2 meeting each other. Each hopper has a longitudinal channel c^3 passing through the floor *a*. Secured at intervals across channel c^3 are I-beams c^4, Fig. 2, between whose flanges and the lower edge of the channel slide horizontal plates c^5. The plates and the flanges of the I-beams are beveled, and to the sides of the channel are secured angle-irons c^6, carrying longitudinal strips c^7, Fig. 1, of rubber, against which the plates bear when pushed in to form air-tight joints. Steeping-tank B has a similar construction in I-beams b^4 and sliding plates b^5.

The floor *c* (shown in Figs. 1, 3, 4, and 5) consists of perforated slats c^8, which rotate upon rods c^9, which are journaled in the front and rear ends c^{10} and c^{11}, respectively, of box C′ and are brought to their opened or closed position by turning cranks c^{12}, which are secured upon the outer ends of rods c^9. The floor shown in Figs. 8 and 9 consists of perforated plates c^{13} and c^{14}, Fig. 8, which are secured to rods c^{15} and c^{16}, the former of which is journaled in lugs c^{17}, secured at intervals to the side of box C′, and the latter in lugs c^{18}, secured at intervals along meeting edges c^2 of the hoppers. These plates are coupled by rods c^{19} to a screw c^{20}, which fits into an internally-screw-threaded collar c^{21}, which is seated upon I-beams c^{22} and c^{23}, which rest upon the upper edges of compartment C. Collar C^{21}, Fig. 9, has an external worm to mesh with pinion c^{24}, the rotating of which reciprocates screw c^{20} to bring plates c^{13} and c^{14} to their open or closed position. To the sides of the box, above the inner edge of the perforated plates, are secured strips c^{25} and c^{26} to keep the grain from being caught between the walls of the box and the plates.

Withering-compartment D is the same as the germinating-compartments in construction.

At the front and rear ends of the germinating-compartments and running from the second to the top floor are a fresh-air shaft E and a foul-air shaft E′. At each end of a germinating-compartment is a pipe or conduit *e* and *e′*, Fig. 4, respectively, forming communication between it and the fresh and foul air shafts in the space below the perforated floor. Each shaft has likewise an opening e^2 and e^3 above the top of the compartment. These passages may be opened or closed by slides e^4, e^5, e^6, and e^7, respectively. A horizontal shaft e^8 places fresh-air shaft E in communication with attemperating-room F, which is situated upon the second floor and has baffle-plates *f* secured alternately to the ceiling and the floor and extending to within a short distance of the floor and the ceiling, screens *f′* being placed in the intervening space. Between the baffle-plates are a series of pipes f^2, supplied with sprayers for spraying water to be intermixed with the air which is drawn into the attemperating-room through heating-coils f^3 and forced into the fresh-air shaft by a fan G. Upon the top floor, above foul-air shaft E′ and communicating with it, is a second fan G′ for exhausting foul-air shaft. Now by closing pipe *e* by dropping slide e^4 and opening e^2 by raising slide e^5 in the fresh-air shaft and opening pipe *e′* by raising slide e^6 and closing opening e^3 by dropping slide e^7 upon the foul-air shaft the attemperated air is drawn down through the grain and passes through the perforated floor and into the foul-air shaft, as shown in Fig. 4, or by opening pipe *e* and opening e^3 and closing pipe *e′* and opening e^2 the air could be drawn up through the perforated plates and the grain, passing out of the room through opening e^3.

Within each hopper of the lower four germinating-compartments is a pipe H, with sprayers *h*. Sprayer *h* consists of a tube *h′*, tapered at one end and screw-threaded at the other to fit into collar h^2, which couples it to nipple h^3 upon pipe H. Tube *h* has an internal cone-shaped bore h^4, within which is seated a stem h^5, with a triple-screw-threaded portion h^6, which is tapered similarly to the bore, so as to fit snugly against its walls. The cone shape of the screw-threaded portion h^6 enables it to be seated snugly against the walls of tube *h′* without driving and keeps it from passing so far into the tube as to obstruct the outlet. Collar h^2 has an internal annular flange of an internal diameter smaller than that of the screw-threaded portion h^6 to keep it from dropping out of the tube into the pipe H.

Shafts M, which are provided with a set of radially-projecting tines *m*, are journaled in the front and rear ends of the hoppers of the lower four germinating-compartments and the withering-compartment and have beveled gear-wheels *m′* upon their rear ends to mesh with beveled gear-wheels *o* upon vertical shafts O and O′, which extend from the first floor to the sixth, being journaled in suitable boxes *o′* and o^2 and which are kept in constant rotation by any suitable mechanism. (Not shown.) Gear-wheels *o* are provided with a lever o^3 and suitable clutch mechanism o^4, Fig. 3, upon shafts O and O′, so that when lever o^3 is thrown upward gear-wheels *o* turn loosely on shafts O O′ and that when said lever is thrown downward gear-wheels *o* are tightened on shafts O O′ to impart rotation to shafts M M. Clutch mechanism of the character described is not new, and is therefore not shown more in detail.

At the rear end of withering-compartment D is a hot-air room *d*, within which is a fan *d′*, which draws in the outside air through heating-coils d^2. Room *d* communicates with compartment D by a pipe d^3 passing beneath

its perforated floor and an opening d^4 above the compartment. At the front end of the compartment is a second room d^5, within which is a fan d^6 and which communicates with the compartment below its perforated floor by a pipe d^7 and has an opening d^8 above the compartment. Pipes d^3 and d^7 and openings d^4 and d^8 may be opened or closed by slides of the character shown in Fig. 10, in the manner above described. If pipe d^3 and opening d^8 be opened and pipe d^7 and opening d^4 be closed, as shown in Fig. 4, the fans conduct the hot dry air from room d into the compartment beneath its perforated floor up through the grain and out into room d^5 through opening d^8, or by closing pipe d^3 and opening d^8 and opening pipe d^7 and opening d^4 the hot air may be made to pass down through the grain and out through opening d^4. After the air has passed through the withering-compartment it may be passed out of the building through swinging door a' in the wall, or in extremely cold weather door a' may be closed and swinging door a^2 in the floor of the attemperating-room opened, so that this heated air may be passed into air-shaft E instead of using the outside air brought in by fan G, as described.

Underneath channels c^3 and hinged to I-beams c^4 are longitudinal gutters c^{27}, which are swung down, as shown in the open germinating-compartment in Fig. 1, when the grain is passing from its compartment to another. After a compartment has been emptied of grain it may be flushed with water after gutter c^{27}, which is hinged to I-beams c^4 beneath channels c^3, so that it may be swung to a vertical position to allow the grain to drop to the compartment next below when plates c^5 are drawn out, has been swung back to its horizontal position, leaving slide-plate c^5 partially or entirely pulled out to allow the soiled water to run into the gutters, by which it is drained off to a sewer.

In operation barley or other grain is started steeping in one of the compartments of tank B. After a third of the time required for its steeping has passed—say twenty-four hours—grain is started steeping in a second compartment, and after a similar period has again elapsed grain is started steeping in the third compartment. The grain started first has now completed the process of steeping and is passed down upon the upper germinating-compartment by sliding back plate b^5. A fresh supply of grain is then started steeping in the compartment just emptied. After the grain has lain in upper germinating-compartment for twenty-four hours the perforated floor and channel c^3 is opened, passing the grain down upon the floor of the second germinating-compartment. The grain from the compartment of the tank second to be started steeping is now passed down upon the floor of the upper germinating-compartment. The grain lies in each successive germinating-compartment twenty-four hours. It is thus seen that the process once started is continuous—that is, that there is always grain at all stages of malting in the several compartments. The grain having reached the third germinating-compartment is thereafter sprayed in its descent through each successive hopper and the matted sprouts are separated by revolving the shafts M, which at the time the floor is dumped are thrown by the attendants switching the lever o into gear with shafts O O', which are themselves kept by any suitable mechanism in constant rotation. From the lowest germinating-compartment the grain is passed down upon the perforated floor of the withering-compartment. While the grain is lying in the successive germinating-compartments attemperated air is drawn up through it from beneath and then down through it from above, or vice versa, by operating slides e^4 e^5 e^6 and e^7, as aforedescribed, so as to insure a uniform treatment for the grain on top and on the bottom. In the withering-compartment the hot dry air is likewise drawn first down and then up through the grain, or vice versa, by operating the slides. From the withering-compartment the grain is dropped into troughs R, in which are spiral conveyers e, of ordinary construction, by which the malt is carried outside of my malting-house to elevators to be conveyed by them to drying-kilns. (Not shown in drawings.) The steeping-tank, the germinating-compartments, and the withering-compartments are shown supported by I-beams S, which are themselves supported in the end walls of the house. To this I-beam a walk s, with a railing s', is secured for the attendants to walk around to examine and attend to the grain during the process.

I have shown an apparatus the best known to me to carry on my system of malting; but it is obvious that many mere mechanical changes might be made therein without departing from the spirit or scope of my invention—as, for instance, instead of using an eight-story building two four-story buildings might be used, the grain being carried from the lowest floor of the first to the top floor of the second by an elevator, or that by increasing the distance between floors one hopper might be used in each compartment instead of two.

What I claim is—

1. In a malting apparatus a steeping-tank, successive germinating-compartments below the tank separated from one another, horizontal perforated dumping-floors within the compartments upon which the grain lies, passages in the bottom of the tank and of each compartment from which the grain falls by gravity from the tank to the upper compartment and from one compartment to each successive compartment and means for passing attemperated air through the grain in each compartment, substantially as shown and described.

2. In a malting apparatus the combination

of a steeping-tank, successive separated germinating-compartments below the steeping-tank, horizontal dumping-floors within the compartments upon which rests the grain, a withering-compartment below and separated from the last germinating-compartment, passages leading from the bottom of the tank and of each compartment from which the grain falls by gravity to the successive compartments, means for passing attemperated air through the grain in each germinating-compartment and means for passing hot air through the grain in the withering-compartment, substantially as shown and described.

3. In a malting apparatus the steeping-tank, separated germinating-compartments below it, horizontal perforated dumping-floors within the compartments, hoppers beneath the floors each extending to a point vertically above the floor next below it so that the grain is carried from it by gravity upon said floor, and means for passing attemperated air through the grain upon each of the floors, substantially as shown and described.

4. In a malting apparatus separated germinating-compartments arranged vertically below each other, a horizontal perforated dumping-floor within each compartment, hoppers beneath each floor to convey the grain by gravity upon the floor beneath it, means for passing attemperated air through the grain upon each of the floors, and means for dumping the floors, substantially as shown and described.

5. In a malting apparatus germinating-compartments arranged one below and separated from the other having horizontal perforated dumping-floors therein, hoppers in the compartments beneath the floors and extending to a point vertically above the floor beneath to convey the grain by gravity successively from an upper to a lower compartment, a fresh-air shaft at one end and a foul-air shaft at the other end of the compartments communicating with each of them above and below the perforated floors, an attemperating-room communicating with the fresh-air shaft and a fan for forcing air through the attemperating-room into said shaft through the grain in each of the compartments and out of it into the foul-air shaft, substantially as shown and described.

6. In a malting apparatus the combination of separated germinating-compartments with horizontal perforated dumping-floors arranged one below the other, means for conveying the grain from one floor to the other by gravity, means for passing attemperated air through the grain in each of said compartments, a withering-compartment below the last germinating-compartment with a perforated floor, a hot-air room at one end of the withering-compartment communicating with it, a fan for forcing the hot air from said room to the grain in the withering-compartment and an exhaust at the end of the compartment for carrying off the air after it has passed through the grain, substantially as shown and described.

7. In a malting apparatus the combination of germinating-compartments with perforated dumping-floors arranged one below the other, hoppers beneath the floors for conveying the grain by gravity from one compartment to the next, shafts with radially-projecting tines journaled in the hoppers for separating the grain after it has matted from sprouting, means for revolving the shafts, and means for passing attemperated air through the grain in the compartments, substantially as shown and described.

8. In a malting apparatus the combination of germinating-compartments with perforated dumping-floors arranged vertically below one another, hoppers beneath the floors for conveying the grain by gravity from one compartment to the other, longitudinal shafts for separating the matted grain in its descent through the hoppers journaled in the hoppers beneath the perforated floors, a vertical shaft or shafts at the end of the hoppers, gear-wheels upon said shafts and a sliding clutch mechanism upon the vertical shaft opposite each longitudinal shaft for throwing it into gear with the vertical shaft when its floor is dumped, substantially as shown and described.

9. In a malting apparatus the combination of germinating-compartments with perforated dumping-floors one below the other, hoppers beneath the floors for conveying the grain by gravity upon the floor beneath, means for passing attemperated air through the grain upon the floors, and within the hoppers pipes with sprayers for spraying the grain in its descent through them, substantially as shown and described.

10. In a malting apparatus the combination of a germinating-compartment, a room adjacent thereto for attemperating the air to be passed into said compartment, a withering-compartment beneath the germinating-compartment, a hot-air room at one end and an exhaust at the other end of the withering-compartment beneath the attemperating-room, and a swinging door between the attemperating-room and said exhaust for admitting the hot air therefrom to the attemperating-room, substantially as shown and described.

11. In a malting apparatus a series of germinating-compartments arranged one below the other, means for conveying grain from one to the other by gravity, and a steeping-tank above the top compartment divided into a number of compartments by partitions and in each compartment a slide for controlling the exit of the grain from the compartment down upon the top germinating-compartment, substantially as shown and described.

PETER RENNER.

Witnesses:
WALTER F. MURRAY,
GEO. J. MURRAY.