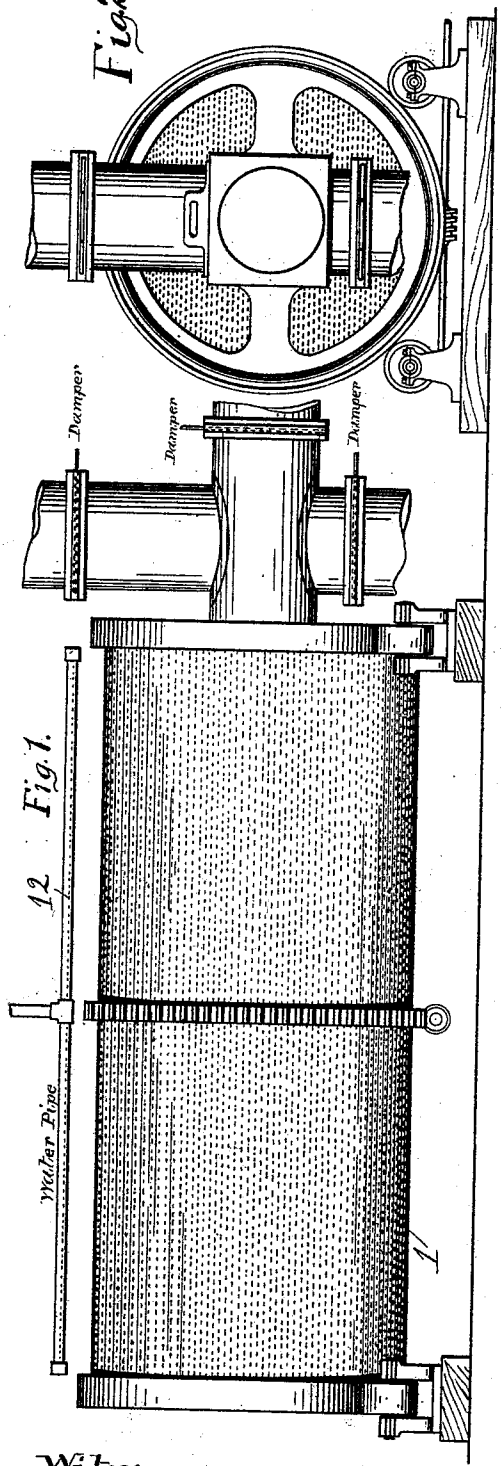
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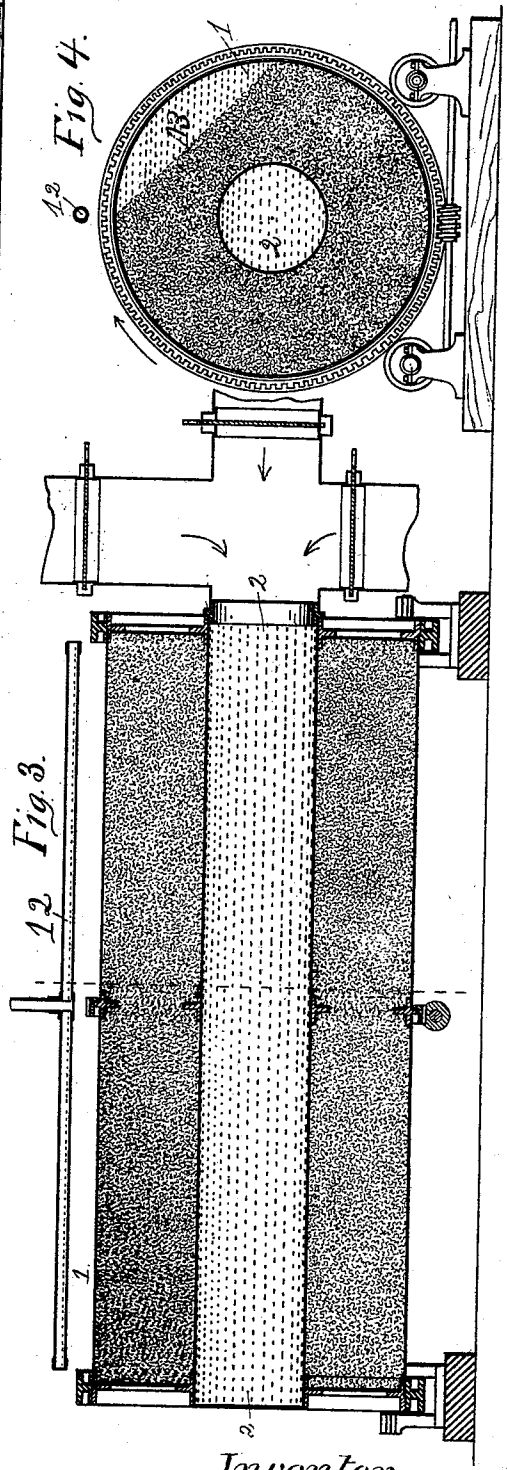
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J. A. TILDEN.

PROCESS OF MALTING.

No. 500,305. Patented June 27, 1893.





Witnesses:
Wm. J. Smith
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Inventor:
James A. Tilden
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Henry D. Minton

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Fig. 5.

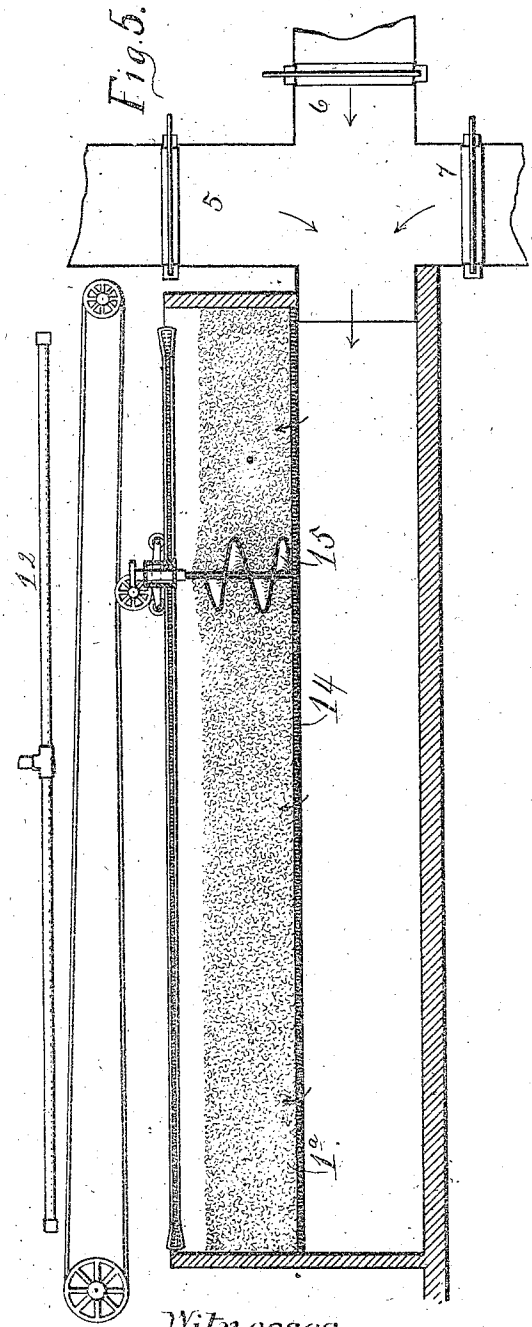
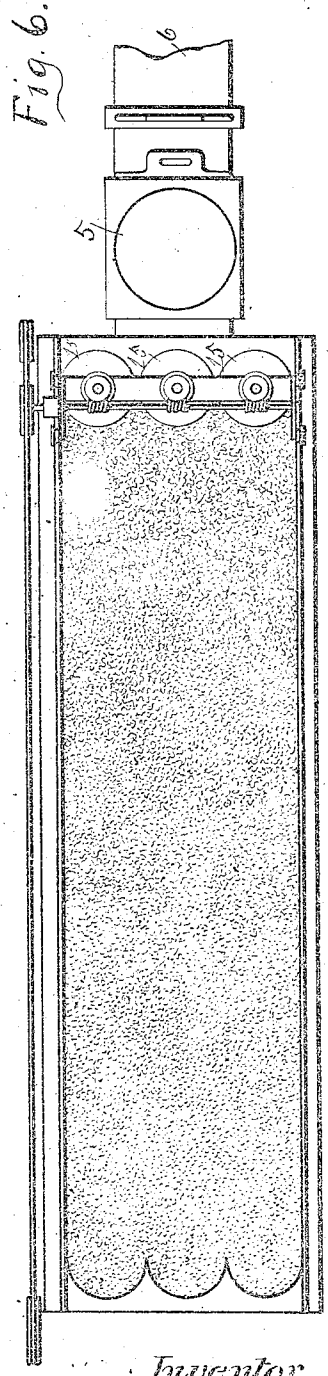


Fig. 6.



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UNITED STATES PATENT OFFICE.

JAMES A. TILDEN, OF HYDE PARK, MASSACHUSETTS, ASSIGNOR TO THE HERSEY MANUFACTURING COMPANY, OF PORTLAND, MAINE, AND BOSTON, MASSACHUSETTS.

PROCESS OF MALTING.

SPECIFICATION forming part of Letters Patent No. 500,305, dated June 27, 1893.

Application filed November 26, 1892. Serial No. 453,193. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES A. TILDEN, a citizen of the United States, residing at Hyde Park, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Processes of Malting, of which the following is a specification.

My invention relates to a process of malting whereby grain commonly barley is converted into malt without hand manipulation and without transferring the grain from one place to another during the entire process of conversion.

In converting grain to malt as now commonly practiced there are five distinct stages, namely, steeping, which consists in soaking the grain in water to impart to it sufficient moisture to insure perfect germination; second, couching or removing the excess of water and subjecting the steeped grain to its own heating action while lying in a quiescent mass until the growing point of the rootlet begins to show; third, germinating or subjecting the grain to the influence of very moist air, and intermittingly agitating the same, under which conditions the grain sprouts or grows until the acrospire and rootlets have reached the desired development; fourth, withering or stopping the germination by removing the excess of moisture, thus causing the rootlets to wither or shrivel up; and finally, kiln drying or driving off all the moisture so as to dry thoroughly and cure the grain. Incident to this stage the rootlets become detached and the grain is bleached, making the same white and salable.

This process as now commonly practiced requires for its different stages separate treatment and handling, and the removal of the grain from one place to another, and although apparatus has been devised for performing a portion of the series of operations without separate handling or removal of the grain, and such apparatus with some modifications and additions can be used in carrying out the process forming the subject of this invention, the present process is not limited to the use of any special apparatus.

Suggestions have been made pointing toward the production of malt from grain by a continuous process in a single apparatus but the method of treatment suggested is not capable of producing the desired result, and so far as I am aware a continuous process of malting has never been successfully practiced.

In carrying out the process of malting in accordance with this invention, the grain is introduced into a receptacle in which it may be properly agitated and subjected to the various atmospheric conditions necessary for carrying out the process, apparatus comprising such a receptacle and the means for producing the required atmospheric and agitating conditions being indicated in the drawings accompanying this specification and which form part of the specification in explaining the process.

Figure 1 represents a view in elevation of a perforated malting drum arranged to be rotated upon trucks or carriages, and having ducts or passages provided with dampers for admitting the required currents of air to the interior of the drum to be distributed through the mass of grain. Fig. 2 represents an end view of the same. Fig. 3 represents a vertical sectional view of the same. Fig. 4 represents a cross section through the same. Fig. 5 represents a sectional view of a malting apparatus of different construction, comprising a vat having a traveling agitator composed of a series of revolving screws which are moved back and forth upon carriages through the mass of grain, ducts or passages being arranged to conduct the required currents of air to an open space underneath the vat and through a perforated bottom, thereby distributing it through the mass of grain. Fig. 6 is a plan view of the same.

A suitable receptacle for containing and operating upon the grain in carrying out this invention may be composed of a horizontal perforated drum 1 five to seven feet in diameter and an inner concentric drum 2 also perforated, of about one third that diameter, the annular space between the drums being closed at the ends by perforated plates so that an annular cylindrical space is wholly inclosed

by perforated or foraminous walls, in which space the grain to be treated is introduced.

Means are provided for rotating the drum at variable speeds about its axis which should be substantially horizontal and which consists of a gear 3 secured to the drum, which is driven by the worm 4, ducts or passages 5, 6 and 7 having dampers for admitting currents of air of the requisite variety of conditions as to temperature and humidity to pass through the annular body of grain, said currents being commonly introduced into the interior of the inner drum and passing out through the body of the grain and escaping through the foraminous wall of the outer drum. In a slow rotation of the drum the separate grains or kernels of the mass of grain will not change their relative position during the greater part of the rotation but as the mass of grain introduced is not sufficient to wholly fill the annular space, the upper surface of the mass of grain will stand at an inclination as shown at 13, Fig. 4 and the grains will successively fall and turn over and change their relative position as they arrive at the highest position in the drum so that in the continuous rotation of the drum the grain will be intermittingly agitated, the agitation going on continuously at certain positions in the mass of the grain and the different parts of the mass coming successively to such position once during each rotation of the drum.

To carry out the process the grain is introduced into the annular space in the drum and a shower of water from the pipe 12 is allowed to fall on the drum, which passes through the perforations and percolates the mass of grain. This shower of water is supplied at a temperature of from 50° to 60° Fahrenheit for a period of two or three days, causing the grain to absorb sufficient moisture to produce germination. In order that the grain may be evenly and uniformly saturated it may be submitted to a slight intermittent agitation. This stage of the process corresponds to that now known as steeping, and when completed the grain should be allowed to drain and stand, or couch as it is called in ordinary processes, in a quiescent state, to develop spontaneous heat and prepare itself for the subsequent germination. This couching or quiescent state should continue from half a day to a day and a half, that is, to the time when the temperature of the grain has been raised to the temperature selected for the next stage by a natural heating process. The next step is that of germination, or sprouting, and consists in subjecting the mass of grain to an atmosphere moistened practically to saturation and at a temperature of about 62° Fahrenheit, the limits as to temperature which are allowable being from 55° to 70°. During the passage of this moist atmosphere through the grain it is intermittently agitated at intervals of from twenty to forty minutes, preferably about once in thirty minutes, which may be done by rotating the drum at the proper speed, say, from one and a half to three turns an hour. This operation of intermittingly agitating the grain and passing the current of saturated air through it is continued from three to five days, or until the acrospire and rootlets have attained their proper growth. It is then necessary to stop the sprouting or germination, which result is accomplished as follows, this step being that of withering or shriveling above described. To effect this withering the supply of saturated air is discontinued and a current of non-saturated air is caused to pass through the mass of grain for from three to six hours, the temperature of said atmosphere being preferably raised slightly above that used in germination. Subsequent to the germinating stage the rate of intermittent agitation should be increased to periods of from five to fifteen minutes, preferably to about ten minute periods, which may be done by increasing the speed of rotation of the drum to from four to twelve turns an hour. In the withering stage the rootlets become shriveled and the grain loses its vitality, and at this step in the process, or before the moisture is wholly expelled, the grain should be whitened by introducing a suitable bleaching agent, such for example as sulphurous acid gas or chlorine, into the current of air passing through the same. These gases also exercise a beneficial antiseptic effect in that they destroy any mold spores or other harmful germs which may have been present in the malt or apparatus. The quantity of bleaching gas used should be limited to that sufficient to produce a desired whitening and antiseptic effect; an excess is known to be deleterious to the finished malt. Two or three pounds of sulphur and a few ounces of salt burned in the current of air passing through the apparatus would be sufficient for two hundred and fifty bushels of ordinary barley. The final stage is the drying, and to accomplish this a current of dry hot air is passed through the grain and to secure the best results its temperature and dryness should be gradually raised from the temperature and humidity at which the withering process took place, to a practically dry air preferably from 180° to 220° Fahrenheit. This process commonly requires from twenty to thirty hours and the rate of intermittent agitation must be greater than in the germinating stage. Unless the grain is agitated more rapidly in the stage of drying than in that of germination it will be imperfectly dried owing to its subjection alternately to the drying effect of the hot air when near the distributing passages and the moistening influence of subsequent contact with wet grains. By a more rapid agitation the drying of the mass is carried through evenly, all grains practically being subjected to like conditions. The increase in speed may be made at the beginning of the withering process, or during withering, or at the beginning of the drying process. This completes

the entire process, the grain having been converted into dry finished malt in one apparatus without removal.

Having thus described how by proper manipulation of atmospheric and mechanical agencies in a receptacle adapted thereto, grain may undergo the several stages of conversion above described, without the ordinary transference from place to place, I wish to state that my invention is not confined to the carrying out of the complete process. Certain combinations of the stages of this process are valuable in conjunction with portions of the old processes. For instance, if desired, the grain may be steeped previous to its introduction into the drum. In such case it can be placed in a steep-tub and subjected to that stage as commonly practiced in the present method of malting, and it can then be introduced into the drum and undergo the other stages in the process in accordance with the description already given. It may be subjected to the stage of couching also in the steep-tub, or on a floor, before it is introduced into the drum, these two stages of the process being manipulated in this manner in existing methods of malting. Having passed these two stages the grain can be introduced into the drum and undergo the essential features in the herein described process.

While I have shown and described the process as practiced in a receptacle which agitates its contents by rotation at different speeds, and having means for producing said speeds and for supplying the required variable atmospheric conditions, the same process may be carried out although not so effectively in apparatus of other kinds, as for example, a stationary receptacle in the form of a vat, the same having a perforated bottom, such as shown in Figs. 5 and 6. The grain being placed in this stationary vat 1^a is subjected to the various atmospheric conditions previously described, the air passing through one of the pipes 5, 6, 7, as may be required to the open space and through the perforated bottom of the vat 14, and the variable intermittent agitation performed by means of a traveling agitator composed of a series of screws 15 which travel back and forth through the mass of grain, each screw lifting the grain from the bottom of the vat and conveying it to the top, causing an entire change or overturning of the grain.

I am aware that apparatus has been used in the process of malting comprising a rotating drum for the grain and means to introduce air and moisture thereto, also stationary receptacles with perforated bottoms provided with agitators, by which the sprouting of the grain has been accomplished successfully, and it has also been suggested that the malt may be subsequently dried by passing blasts of hot dry air through the grain while in said receptacles, but said apparatus has not been provided with the necessary air ducts by which in the same machine the intervening step of withering the grain by non saturated air may be accomplished, and whereby the grain may be bleached by a proper agent, and whereby a gradual increase in temperature and dryness of the atmosphere may be obtained, and no mechanical means have been provided whereby the variable intermittent agitation may be had at proper times. Consequently the grain has not been properly cured and made marketable as to color and general appearance, and the processes referred to have been failures, and so far as I am aware the essential steps for a continuous process have not been discovered nor suggested prior to my invention thereof.

Having thus fully described my invention, what I desire to claim and secure by Letters Patent is—

1. That improvement in the art of malting which consists of withering the previously steeped, couched and germinated grain by passing a current of non-saturated air through it and whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it in the same apparatus, substantially as set forth and described.

2. That improvement in the art of malting which consists of whitening the previously steeped, couched and germinated grain by passing a current of air mixed with a limited amount of bleaching agent through the same, and curing the grain by passing a dry hot air through it under increasing dryness and temperature to practically dry air preferably at a temperature of 180° to 220° Fahrenheit in the same apparatus, substantially as set forth and described.

3. That improvement in the art of malting which consists of withering the previously steeped, couched and germinated grain by passing a current of non-saturated air through it, whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the grain by passing a dry hot air through the same under increasing dryness and temperature to practically dry air preferably at a temperature of 180° to 220° Fahrenheit producing thereby a withering, bleaching and curing of the grain in a single apparatus, substantially as set forth and described.

4. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 50° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, and whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it, producing thereby a continuous germination, withering and whitening of the grain by variable conditions in a single apparatus, substantially as set forth and described.

5. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 50° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, and curing the same by passing a dry hot air through it while under increased intermittent agitation, producing thereby a continuous germination, withering and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

6. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, and curing the grain by passing a dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit and under increased intermittent agitation, producing thereby a continuous germination, withering and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

7. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the grain by passing dry hot air through it while under increased intermittent agitation, producing thereby continuous germination, withering, whitening and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

8. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the grain by passing a dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit, producing thereby a continuous germination, withering, bleaching and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

9. That improvement in the art of malting which consists, in the stage of germination, of subjecting the previously steeped and couched grain while intermittingly agitating the same, to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the grain by passing a current of non-saturated air through it, whitening the same by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the grain by passing a dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit while under increased intermittent agitation, producing thereby a continuous germination, withering, whitening and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

10. That improvement in the art of malting which consists of couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, and whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, producing thereby a continuous couching, germinating, withering and whitening of the grain by variable conditions in a single apparatus, substantially as set forth and described.

11. That improvement in the art of malting which consists in couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 50° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, and curing the grain by passing a dry hot air through it while under intermittent agitation, producing thereby a continuous couching, germinating, withering and curing of the grain by variable atmospheric conditions in a single apparatus, substantially as set forth and described.

12. That improvement in the art of malting which consists in couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 50° to 70° Fahrenheit, withering the same by passing a current of non-

saturated air through it, and curing the same by passing a dry hot air through the grain under increasing temperature and dryness of air from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit while under increased intermittent agitation, producing thereby a continuous couching, germinating, withering and curing of the grain by variable atmospheric and agitating conditions in a single apparatus, substantially as set forth and described.

13. That improvement in the art of malting which consists in couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it and curing the same by passing a dry hot air through it while under increased intermittent agitation, producing thereby a continuous couching, withering, whitening and curing of the grain by variable atmospheric and agitating conditions in a single apparatus, substantially as set forth and described.

14. That improvement in the art of malting which consists in couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the grain by passing dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit, producing thereby a continuous couching, germinating, withering, whitening and curing of the grain by variable conditions in a single apparatus, substantially as set forth and described.

15. That improvement in the art of malting which consists in couching the previously steeped grain by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the same by passing a dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit while under increased intermittent agitation, producing thereby a continuous couching, germinating, withering, whitening and curing of the grain by variable atmospheric and agitating conditions in a single apparatus, substantially as set forth and described.

16. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, draining the same, and then couching it by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, and whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, producing thereby a continuous steeping, couching, germinating, withering and whitening of the grain by variable atmospheric conditions in a single apparatus, substantially as set forth and described.

17. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, draining the same, and then couching it by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, and curing the grain by passing dry hot air through it while under increased intermittent agitation, producing thereby a continuous steeping, couching, germinating, withering and curing of the grain under variable atmospheric conditions in a single apparatus, substantially as set forth and described.

18. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, draining the same, and then couching it by holding it in bulk in a quiescent state to develop spontaneous heat, then germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, and curing the grain by passing dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering up to a practically dry air prefer-

ably at a temperature of from 180° to 220° Fahrenheit while under increased intermittent agitation, producing thereby a continuous steeping, couching, withering and curing of the grain by variable atmospheric conditions in a single apparatus, substantially as set forth and described.

19. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, draining the same, and then couching it by holding it in bulk in a quiescent state to develop spontaneous heat, then germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the same by passing dry hot air through it while under increased intermittent agitation, producing thereby a continuous steeping, couching, germinating, withering, whitening and drying of the grain by variable humid atmospheric and agitating conditions in a single apparatus, substantially as set forth and described.

20. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, couching it by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the same by passing dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering to a practically dry air preferably at a temperature of from 180° to 220° Fahrenheit, producing thereby a continuous steeping, couching, germinating, withering, bleaching and curing of the grain under variable humid and atmospheric conditions in a single apparatus, substantially as set forth and described.

21. That improvement in the art of malting which consists in steeping the grain by subjecting it to saturation with water at a temperature of from 50° to 60° Fahrenheit to cause the grain to absorb moisture, couching it by holding it in bulk in a quiescent state to develop spontaneous heat, germinating the same by intermittingly agitating the grain while subjecting it to the influence of air saturated with moisture at a temperature of from 55° to 70° Fahrenheit, withering the same by passing a current of non-saturated air through it, whitening the grain by passing a current of air mixed with a limited amount of bleaching agent through it, and curing the same by passing dry hot air through it under increasing temperature and dryness from and above the temperature and humidity used in withering up to practically dry air preferably at a temperature of from 180° to 220° Fahrenheit and while under increased intermittent agitation, producing thereby a continuous steeping, couching, germinating, withering, whitening and curing of the grain under variable humid atmospheric and agitating conditions in a single apparatus, substantially as set forth and described.

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Witnesses:
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