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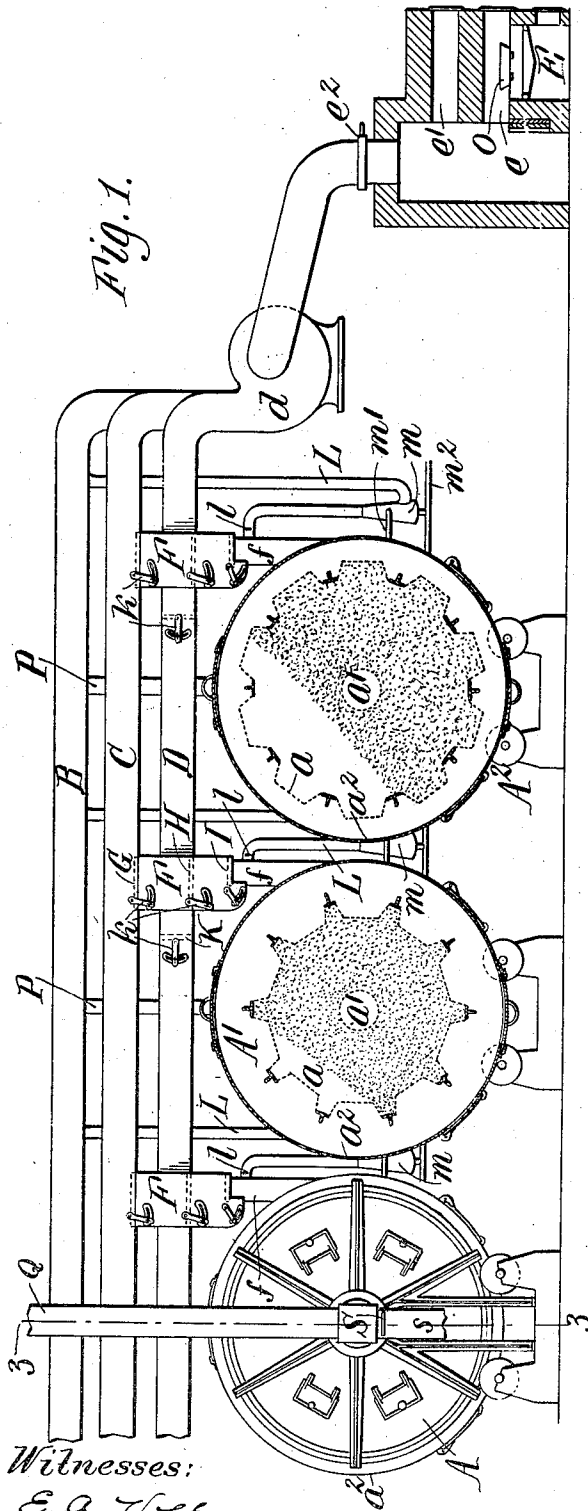
PATENTED JUNE 25, 1907.

F. H. C. MEY.

PNEUMATIC MALTING AND PNEUMATIC DRYING APPARATUS.

APPLICATION FILED SEPT. 14, 1906.

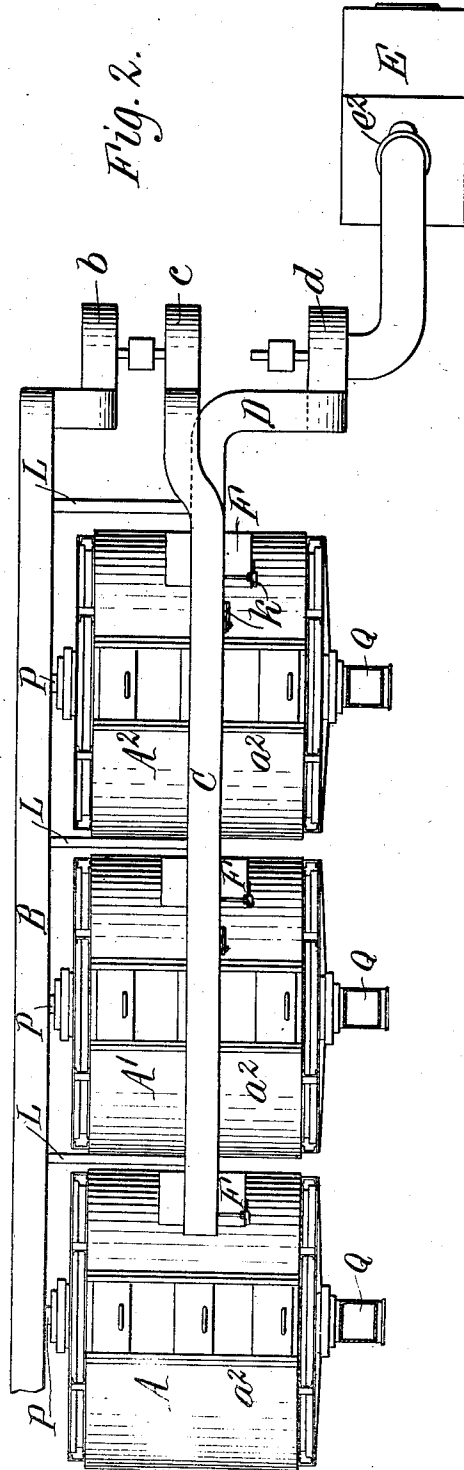
3 SHEETS—SHEET 1.



Witnesses:

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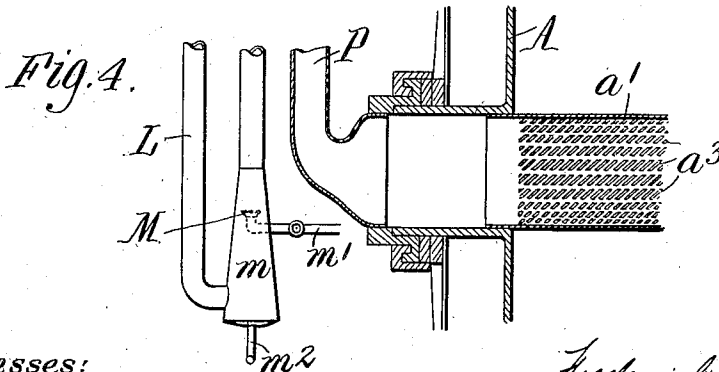
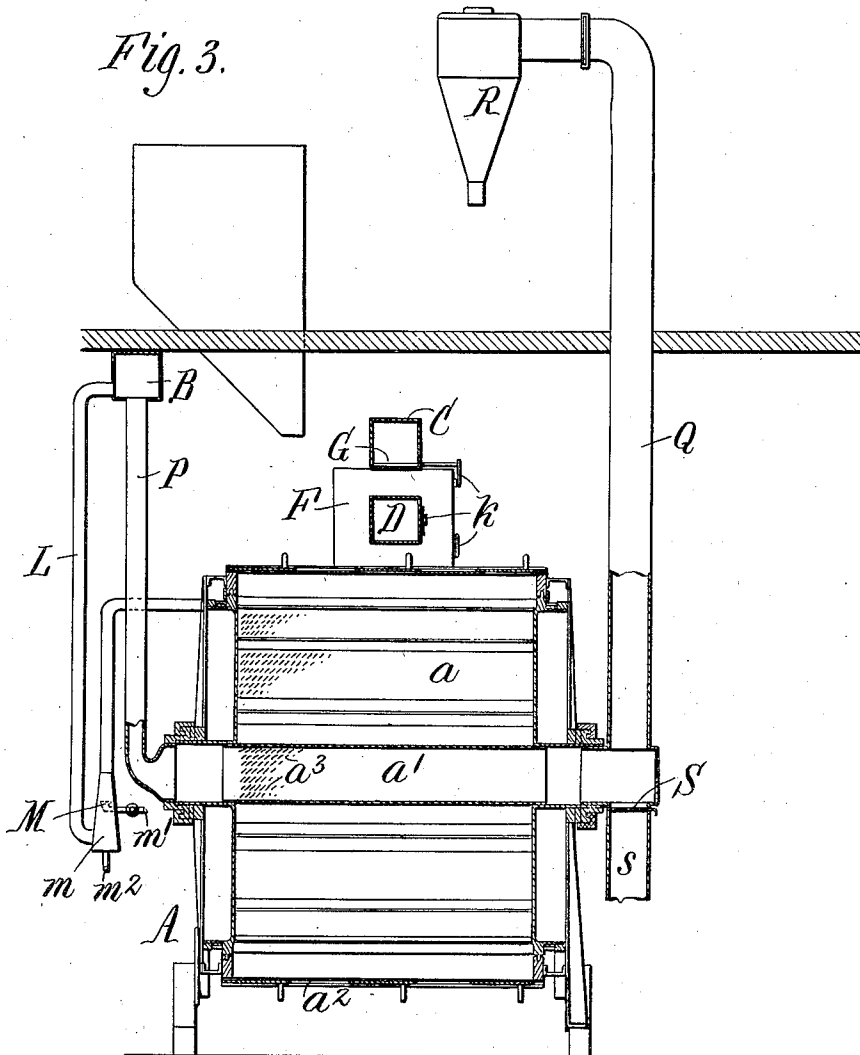
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 5.

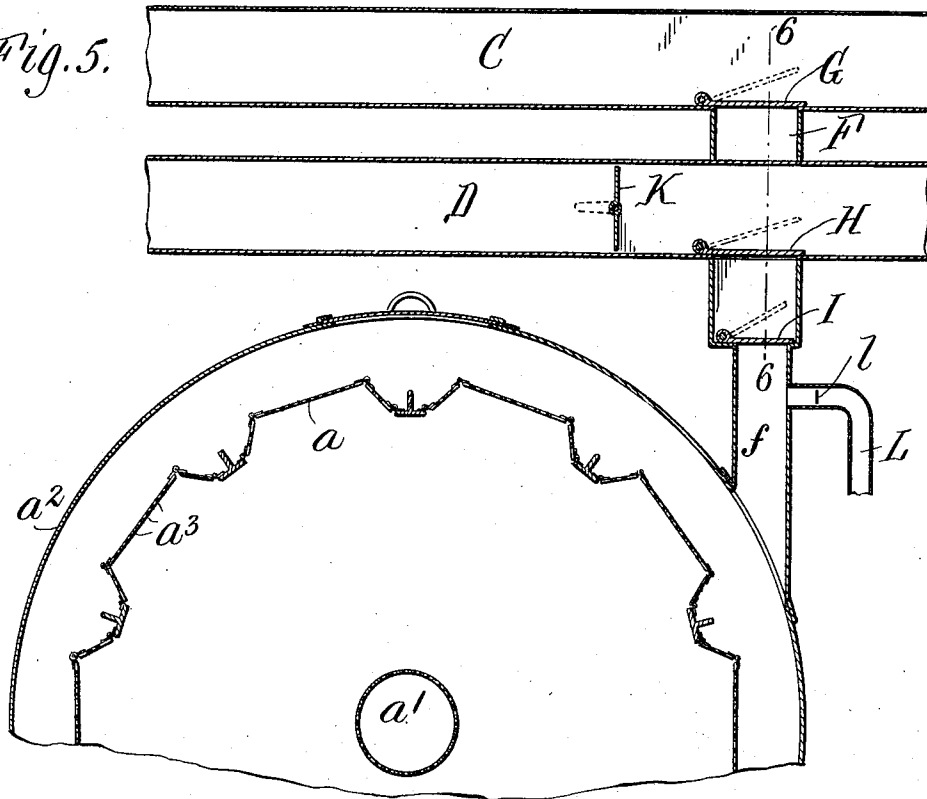
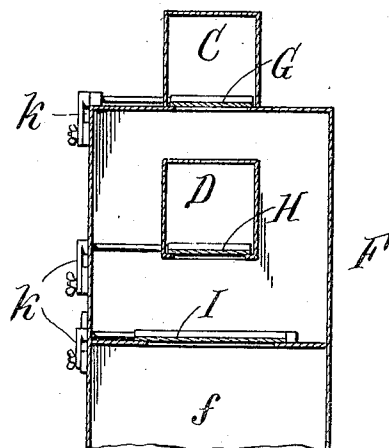


Fig. 6.



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UNITED STATES PATENT OFFICE.

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PNEUMATIC MALTING AND PNEUMATIC DRYING APPARATUS.

No. 857,954.

Specification of Letters Patent.

Patented June 25, 1907.

Application filed September 14, 1906. Serial No. 334,668.

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 and State of New York, have invented a new and useful Improvement in Pneumatic Malting and Pneumatic Drying Apparatus, of which the following is a specification.

In the manufacture of malt by the so-called "pneumatic" process the soaked or steeped barley or grain is allowed to stand in a suitable drum or receptacle and germinate, and cool air forced through the grain to prevent its temperature from rising above 60° to 70° F. After the germination has progressed somewhat the grain is maintained under the influence of moistened air for a further period of time, the temperature of the air being regulated to maintain the grain at the temperature stated, until the rootlets have attained the proper growth, after which the moist air is shut off. During or after this period the grain is ordinarily bleached by subjecting it to the action of sulfur fumes or other suitable bleaching agent, and thereafter the malt is dried and its manufacture completed by the action of dry hot air.

This invention relates more particularly to malting apparatus comprising a battery of malting drums or receptacles with means for supplying the same individually with moisture and air under the proper conditions of temperature, whereby the process can be carried on continuously, that is, in such manner that the different stages of germinating, bleaching and drying can be effected at the same time in different drums or receptacles, thus enabling the process to be started in one or more drums and completed in another drum or drums at regular intervals of time.

The primary object of the invention is to produce an efficient malting apparatus of desirable and practical construction in which the different atmospheric conditions necessary for conducting different stages of the process at the same time in the different drums or receptacles can be effected readily and with certainty.

Other objects of the invention are to provide simple and novel means for collecting and saving the rootlets which become detached from the malt in drying; and to improve malting apparatus in the respects hereinafter described and set forth in the claims.

In the accompanying drawings, consisting of three sheets: Figure 1 is a sectional eleva-

tion of a portion of a malting apparatus embodying the invention. Fig. 2 is a plan view thereof. Fig. 3 is a transverse sectional elevation thereof, on an enlarged scale, in line 3—3, Fig. 1. Fig. 4 is a fragmentary sectional elevation, on an enlarged scale, of one end of one of the malting drums and associated parts. Fig. 5 is a fragmentary section, on an enlarged scale, of one of the drums and air connections therefor. Fig. 6 is a transverse section of one of the air mixing boxes, in line 6—6, Fig. 5.

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

A A' A² represent the malting drums or receptacles in which the grain is subjected to the several operations of the malting process. Only three drums are shown in the drawings, but any suitable number of drums can be used, and in practice it is preferable to employ enough drums for the malting process to be started on a quantity of grain in one drum and a quantity of malt to be completed in another drum each day. The drums or receptacles are preferably of the character disclosed in U. S. Letters Patent No. 745,366, granted to me Dec. 1, 1903, and comprise each a rotary drum or receptacle *a* in which the grain is placed and which has a perforated outer wall and a perforated central pipe or cylinder *a'*, and which is surrounded by a stationary casing *a²* that forms an annular air space around the rotary drum. The perforated wall *a* of the drum, as fully described in said patent, is made up of stationary sections between which are hinged sections adapted to be secured in the outer position shown in the right-hand drum in Fig. 1 and in Fig. 5, or to be moved inwardly between the stationary sections, as indicated in the middle drum in Fig. 1, to contract or decrease the capacity of the drum. Air is forced into the casing and enters the rotary drum from all sides of the perforated wall, passing through the mass of grain and escaping through the central perforated pipe. As explained in my said patent, the perforated wall of the drum can be contracted as the bulk of the malt decreases in the drying operation so that the grain will always nearly fill the drum and surround the central pipe, thereby insuring an equal distribution of the air throughout the entire mass. In Fig. 1 the drum at the right is shown expanded or enlarged to its full capacity, which is the case during the germinating process, while the

middle drum is shown contracted as it is when the drying is nearly completed. The perforations of the central pipe of the drum are preferably in the form of narrow elongated slots a^3 arranged obliquely in rows, as shown in Fig. 4. The slots are too narrow for the grains to fall through them or stick in and clog the slots, but they are long enough to allow the free passage therethrough of the rootlets which become detached from the grain in drying and which are collected and saved as hereinafter explained. The contractible and expansible wall of the drum is also preferably perforated by similar slots. Otherwise the drums are constructed substantially as described in my said patent, but drums or receptacles of other construction could be employed in the apparatus as will be apparent from the following description. The drums are rotated by any suitable means as required to agitate the grain therein and insure a uniform treatment thereof.

B, C and D represent main air pipes or trunks each connected with the several malting drums or receptacles and leading from blowers, or air compressors b c and d of any suitable kind for delivering air under pressure to the malting drums. The blowers b and c take the air from the external atmosphere or room in which the apparatus is installed at the temperature there prevailing and deliver it to the malting drums, but the air from the blower b and pipe B is moistened before it enters the drums, as will be explained, so that the former pipe supplies moist air and the pipe C dry cool air, or ordinary atmospheric air to the drums. The other pipe D is for supplying hot dry air and for this purpose the intake of the blower d is connected with a suitable furnace E. The air for drying the malt is preferably heated by passage through the fire pot e in direct contact with the fire, and the hot air can be properly tempered without altering its volume by regulating the volume of air through the fire pot and supplementing the same with a proper proportion of air taken through a cold air flue e' of the furnace. A damper e^2 in the intake pipe for the hot air blower also enables the regulation of the volume of hot air to suit the necessities of the apparatus. The air can be heated to the degree required for drying the malt in a heater of this sort with a small coal fire which can be maintained economically and a very high grade of malt is produced.

The main air pipes or trunks B, C, D are connected with the casing of each malting drum preferably as follows: An air mixing box or chamber F, Figs. 1, 5 and 6, connects with the drum casing by an inlet pipe f , and the atmospheric air pipe C connects with the top of each mixing box by an opening controlled by a suitable valve or damper G. The

hot air pipe D passes through the several mixing boxes and communicates with each by an opening in its bottom, also controlled by a valve or damper H. By closing one of these dampers and opening the other either atmospheric air alone or hot air alone can be delivered to the drums and by proper adjustments of the two valves the temperature of the air to the drums can be regulated as required during the different stages of the malting process. As the hot air trunk passes through the air mixing boxes, the cold air must pass around the same on its way to the drum and its temperature can be raised somewhat by radiation from the hot air pipe or to a greater degree by opening the hot air damper H to allow hot air to enter the mixing box and commingle with the cold air. This arrangement of the pipes and dampers makes it possible to easily and accurately regulate the temperature of the air. Dampers I are provided between the drums and the mixing boxes whereby any one or more of the drums can be cut off from both the cold and hot air pipes while the remaining drum or drums can be supplied with air at any required temperature. And dampers K are also provided in the hot air pipe D between the connections of the same with the several drums for cutting off one or more of the drums. The dampers G, H, I and K may be of any suitable character, but pivoted dampers are shown in the drawings having operating handles k , Fig. 1, and means for holding them in adjusted positions.

The moist air pipe or trunk B connects with the inlet pipes of the several drums by branch pipes L each provided with a controlling valve or damper l , see Figs. 1 and 5. Separate air moistening means are provided for each of these branch pipes. The air moistener shown consists of a water spray head M, Figs. 3 and 4, arranged in a conical portion m of the branch pipe.

m^1 represents valve-controlled water supply pipes for the spray heads, and m^2 waste water pipes therefor.

The water issues from the head in a fine spray and the air passing through the spray is moistened and the moistened air is forced to the drum for moistening the grain. By proper regulation of the water supply to the air moistener, water can be supplied to the drum in sufficient quantity for maintaining the necessary moisture of the air during the germination of the grain. The dampers l in the moist air branch pipes enable the moist air to be shut off from all of the drums except that one or more in which the germination is taking place. Other suitable means for moistening the air in the branch pipes L could be used in place of those shown.

The operation of the apparatus is as follows: A suitable quantity of grain which has been previously thoroughly soaked and

steeped is placed in the first drum A of the battery, and each succeeding day another drum is filled so that the malting operation will be completed in the several drums in succession on successive days. The soaked grain is left standing in the drum for about one day, during which time it heats spontaneously and commences to germinate. The dampers G and I are opened and cool air from the pipe C is forced into the stationary casing and through the grain to the central outlet pipe of the drum to keep the grain at a temperature of from 60° to 70° F. As the cool air completely surrounds the drum in the casing and passes through the grain from all sides of the perforated drum, this temperature can be readily maintained. After the grain has stood for about one day, as stated, moist air is admitted to the drum by opening the damper I of the moist air branch pipe L and the drum is slowly rotated to agitate the grain and insure a uniform moistening thereof. The damper G of the atmospheric air pipe C is adjusted as required to supply such air from this pipe as may be necessary from time to time in addition to the moist air from the pipe L to prevent overheating of the grain. This treatment is continued until the rootlets have attained the proper growth, three or four days being ordinarily required. While the grain is still moist it is bleached by placing a pan O of sulfur or other bleaching agent in the furnace, as shown in Fig. 1. At this time the damper K in the hot air pipe beyond the drum is closed to isolate the first drum from the others, and the damper H of the hot air pipe is opened to allow the sulfur fumes to enter the drum and permeate the malt. During the bleaching, sufficient cool air is admitted from the atmospheric air pipe C to keep the temperature within the drum at about 100° F. After the completion of the bleaching operation, which requires about one-half of an hour, the sulfur pan is removed from the furnace, and the drying is commenced. For drying, air is forced through the malt while the drum is kept in rotation at a temperature of from 100° to 120° F. for a period of about one day. This temperature of the air can be readily maintained by proper adjustments of the hot and cold air dampers H and G. The malt will be dry at the end of this time but it is aromatized and its quality greatly improved by subjecting it for about another day to hot air at a temperature ranging from 160° to 200° F. This completes the operation and the malt produced is equal in quality to the so-called "air" malt. The malting process, as above outlined, will be started on successive days in the other drums or receptacles, the same operations being performed in the order stated. The germination in the first drum will not be completed when the operation is

started in the second drum, and likewise the germinating or bleaching will be in progress in the other drums before the drying is finished in the first drum; but the described arrangement of the moist air pipes and dampers allow these different operations to be carried on simultaneously without interfering the one with the other. Thus by closing the moist air damper and adjusting the cold and hot air dampers G and H of the first one or more drums, and opening the moist air dampers for the other drum or drums, the grain in the latter can be germinating while the malt is being dried in the first one or other drums, from which the moist air is shut off. When bleaching the grain in the second or a succeeding drum, the damper or dampers I of the drum or drums in advance thereof and the damper K of the hot air pipe in rear thereof are closed to isolate all of the drums but the one in which the bleaching is being performed to prevent waste of the bleaching agent.

The apparatus described is very economical in operation and a very superior grade of malt can be produced therein in a period of about seven days. Thus with a battery of seven drums constructed and arranged as described, the process can be started on a quantity of grain in one drum and completed on a quantity in another drum each day.

The main moist air pipe or trunk B is connected by branch blast pipes P with the adjacent ends of the central perforated pipes of the several cylinders, and the opposite ends of said central pipes connect with pipes Q each leading to a dust collector R of ordinary construction located in a room above that where the drums are installed, or elsewhere in the malt house, for collecting the sprouts or rootlets which are detached from the malt in drying and fall into the perforated central pipes of the drums. The air entering the central pipes through the grain in the drums will not have sufficient velocity to carry the rootlets to the collectors, but by admitting blasts of air to the ends of the central pipes through the blast pipes P the rootlets will be blown to the collectors, which will separate them from the air so that they can be saved and utilized. The air currents through the perforated central pipes also assist in causing the moisture collecting in the pipes to flow to the ends thereof from which it can escape through the drain valves S and pipes s, see Fig. 3. These valves are closed when the rootlets commence to enter the perforated pipes to prevent the loss thereof.

I claim as my invention:

1. The combination of a plurality of malting drums or receptacles, an air mixing box connecting with each drum, an atmospheric or cool air pipe connecting with each mixing box, a hot air pipe also connecting with each mixing box, dampers controlling the com-

munications between said pipes and each mixing box, a damper in the connection between each mixing box and drum, a third air pipe connected by branches with the several drums, and separately controlled air moistening means for each of said branch pipes, whereby the temperature and humidity of the air supplied to the several drums can be independently regulated, substantially as set forth.

2. The combination of a plurality of malting drums or receptacles, an air mixing box connecting with each drum, an atmospheric or cool air pipe connecting with each mixing box, a hot air pipe passing through said mixing boxes and communicating with each mixing box by an opening within the box, said hot air pipe leaving a space around the same in the mixing box for the passage of the cold air, pipes for supplying moist air to said drums, and dampers for controlling the connections between each of said pipes and each drum, substantially as set forth.

3. The combination of a plurality of malting drums or receptacles, an air mixing box connecting with each drum, an atmospheric or cool air pipe connecting with each mixing box, a hot air pipe also connecting with each mixing box, dampers controlling the communications between said pipes and each mixing box, a damper in the connection between each mixing box and drum, dampers in said hot air pipe between the connections of the same with the several drums, pipes connected directly with the several drums independently of said air mixing boxes for supplying moist air to said drums, and dampers in said several moist air pipes, substantially as set forth.

4. The combination of a plurality of malting drums or receptacles, an air mixing box connecting with each drum, an atmospheric or cool air pipe connecting with each mixing box, a hot air pipe also connecting with each mixing box, dampers controlling the communications between said pipes and each mixing box, a damper in the connection between each mixing box and drum, dampers in said hot air pipe between the connections of the same with the several drums for cutting off one or more drums, and means for

producing a bleaching agent in said hot air pipe, substantially as set forth.

5. The combination of a plurality of malting drums or receptacles, an air mixing box connecting with each drum, an atmospheric or cool air pipe connecting with each mixing box, a hot air pipe also connecting with each mixing box, dampers controlling said pipes, a third air pipe, branches connecting said third air pipe to the several drums and provided with means for regulating the moisture of the air therein, exhaust pipes for said drums, and branch pipes connecting said third air pipe with said exhaust pipes, substantially as set forth.

6. The combination of a malting drum or receptacle having a perforated outlet pipe for the air, means for forcing air through the grain in the drum to said outlet pipe, a spout and air separator connected to said perforated pipe, and a blast pipe connected to said perforated pipe to blow the sprouts collecting therein to said separator, substantially as set forth.

7. The combination of a malting drum or receptacle having a perforated outlet pipe for the air, means for forcing air through the grain in the drum to said outlet pipe, the perforations in said pipe being long and narrower than the grains, a spout and air separator connected to said perforated pipe, and a blast pipe connected to said perforated pipe to blow the sprouts collecting therein to said separator, substantially as set forth.

8. The combination of a rotary malting drum having perforated walls and a perforated outlet pipe for the air extending there-through, a casing surrounding said drum, means for forcing air into said casing and through the drum and grain therein to said outlet pipe, a spout and air separator connected to said perforated pipe, and a blast pipe connected to said perforated pipe to blow the sprouts collecting therein to said separator, substantially as set forth.

Witness my hand, this 10th day of September, 1906.

FREDERICK H. C. MEY.

Witnesses:

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A. L. MCGEE.