W. E. ELLIS.

BLEACHING GRAIN.

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Patented Feb. 6, 1917.

1,214,526.

Fig. 1.

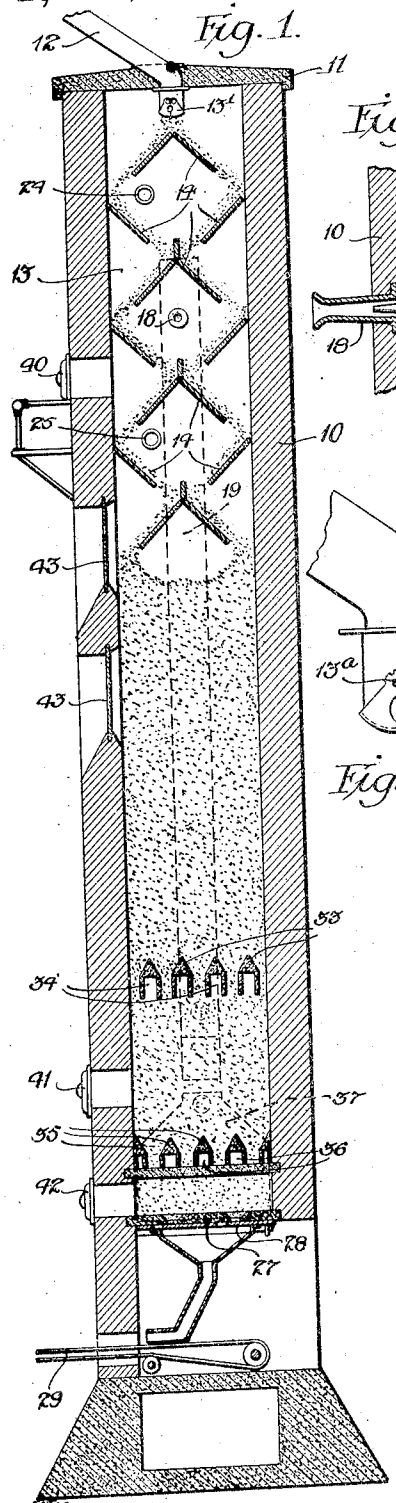
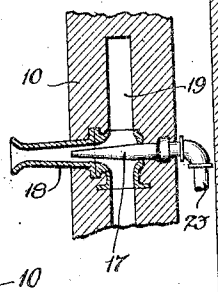


Fig. 3.



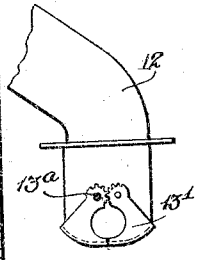
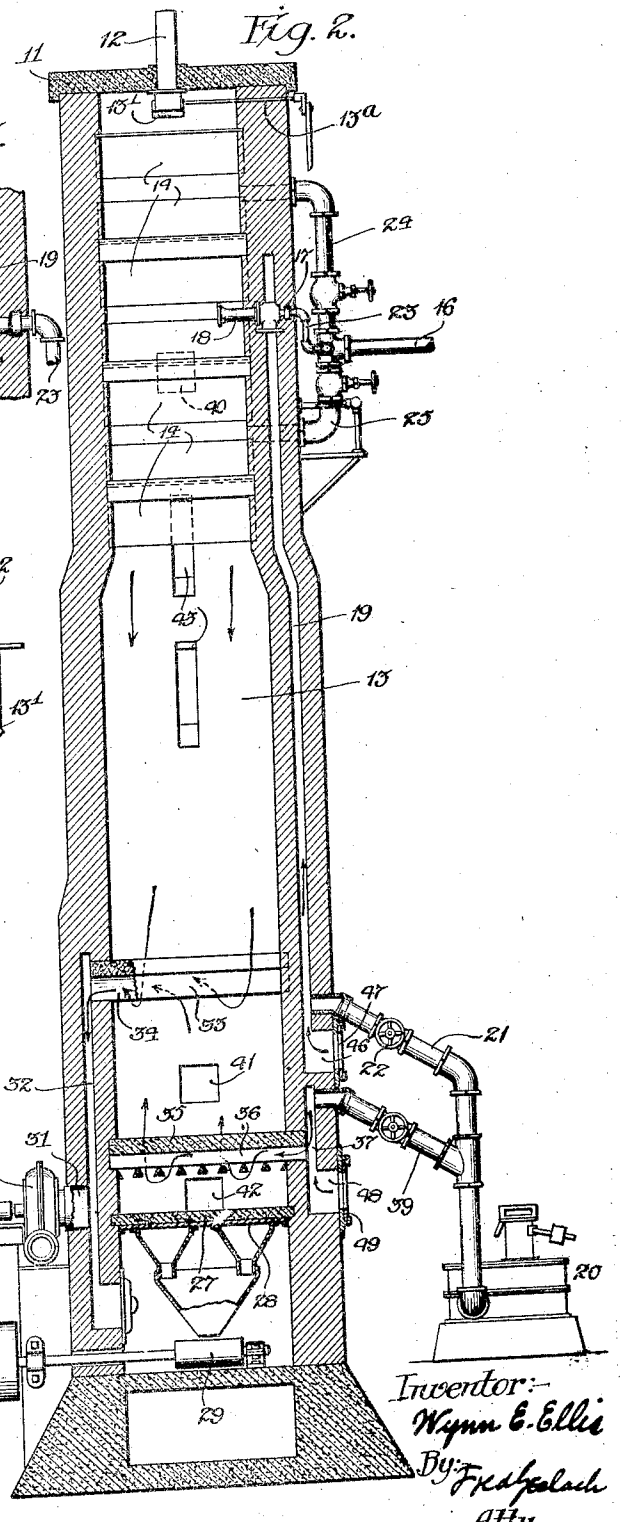


Fig. 4.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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BLEACHING GRAIN.

1,214,526. Specification of Letters Patent. Patented Feb. 6, 1917.

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To all whom it may concern:

Be it known that I, WYNN E. ELLIS, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Bleaching Grain, of which the following is a full, clear, and exact description.

The invention relates to the art of bleaching grain.

In bleaching oats, it is now common practice to subject the grain to the action of a suitable bleaching agent, such as sulfur-dioxid, by delivering the re-agent and steam into a chamber containing grain and to permit the re-agent to escape after it has passed through the grain.

The invention designs to provide an improved apparatus for bleaching grain in which the bleaching agent is fully and effectively utilized in treating grain, so that the grain will be more effectively and uniformly treated and of a better quality.

Another feature of the invention consists in causing a current of air and sulfur fumes to pass through the grain column to produce a current through the grain-column which causes the agent to act more effectively and quickly on the grain. In practice, it has been found that such treatment measurably cools the grain and that the sulfur more effectively bleaches the grain when it is cool. Therefore, by providing an apparatus by which a current of air is caused to pass through the grain-column with the bleaching agent, the bleached grain becomes better in quality. Furthermore, by producing a current through the grain-column, any unabsorbed sulfur will be carried away from the grain, so that when the grain is discharged from the apparatus, it will not be impregnated with free sulfur, which is important because free sulfur is destructive to the walls of the building in which it is stored, and objectionable in handling the grain.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure 1 is a central vertical section of an apparatus embodying the invention. Fig. 2 is a section taken on a vertical plane extending through the center of Fig. 1. Fig. 3 is a detail view of the steam jet and nozzle for delivering the bleaching agent into the grain chamber. Fig. 4 is a detail of the valve mechanism for controlling the supply of grain to the grain chamber.

In treating grain a comparatively open or divided stream of grain is first dampened with steam and then subjected to the action of a bleaching re-agent, usually sulfur dioxid, which is forced into the grain chamber by a jet of steam which draws the sulfur fumes from a sulfur-furnace and delivers them to the grain-chamber, air being admitted with the fumes. The sulfur after treating the divided stream of grain, is not permitted to escape but is confined in the grain chamber and drawn through a mass or column of accumulated grain, which is held in the chamber for a sufficient period for effective treatment. Resultantly, the current passing through the grain-column makes it possible to subject a large quantity of grain to the action of sulfur for the period necessary to effect a more complete bleaching action and to fully utilize the bleaching properties of the bleaching agent and thereby the method is rendered economical, in that a large mass or quantity of grain may be simultaneously treated. The bleaching agent, after it is supplied to the divided stream of grain, is drawn downwardly through a mass or column of grain by a current of sufficient force to cause the bleaching agent to permeate through the grain-column and the unabsorbed portion of the bleaching agent, if any, is removed from the grain-column. As a result of producing a current impregnated with the sulfur fumes through the grain-column and then drawing off the unabsorbed sulfur, the grain will be cooled in a degree, and will be more uniformly treated in transit through the grain-chamber and the unabsorbed sulfur will be removed from the grain, thus resulting in a more evenly bleached and cleaner product. Finally, the grain is again subjected to a fresh supply of bleaching agent and air to treat any portion of the grain, which may not have been effectively bleached by the previous treatment, and the current passing through the grain-column causes the sulfur to permeate the grain in the column, and carries off any unabsorbed portion of the bleaching agent and also reduces the temperature of the grain, so that the grain as it is discharged, will be free from sulfur, and in condition to be conveniently handled or shipped. The method may be advanta-

geously utilized in a structure having a vertically extending grain chamber through which the grain passes for successive treatments and by which it can be economically handled and when the grain is discharged at the bottom of the structure, the grain will be completely bleached and devoid of free sulfur. Resultantly, when the grain leaves the bleaching apparatus, it is in such condition that it can be conveniently handled or shipped without further treatment.

The improved bleaching apparatus comprises a structure consisting of a suitable shell 10 usually built of concrete and having a top wall 11 through which extends a supply-duct or pipe 12 for delivering oats or grain to be bleached into the upper portion of the chamber 13 within the shell 10. A suitable rocker-valve 13′ comprising oppositely swinging members disposed at the lower end of the grain-supply pipe 12 controls the delivery of grain into the bleaching chamber. Suitable operating mechanism, such as a shaft 13ª and mechanism for rocking said shaft intermittently is provided to feed the grain in regulated quantities into the apparatus.

The grain delivered into the bleaching-chamber passes over a vertical series of zig-zag walls or vanes 14 so that the grain will be divided into thin or open streams for initial treatment by the bleaching re-agent. The bleaching re-agent, (usually sulfur dioxid) is supplied to the upper portion of chamber 13 through which the open or divided stream of grain passes, by a steam-jet 17, which is disposed in a suitable nozzle 18 opening into said chamber. The sulfur-fumes are conducted to nozzle 18 through a duct 19 formed in one of the walls of shell 10, which is connected to a sulfur-furnace 20 by a pipe 21 provided with a valve 22, for controlling the quantity of sulfur supplied to the nozzle.

Steam is supplied to the jet 17 by a pipe 23 which is connected to a steam-supply pipe 16 and branch steam-pipes 24 and 25 supply steam to the upper portion of the chamber 13 to dampen the grain so it will absorb the bleaching agent. Resultantly, a blast of sulfur fumes is forced into the upper portion of the closed grain-chamber, through which the grain passes in an open or divided stream and thereby the grain will be moistened and subjected to the action of the sulfur-fumes, while the grain is separated.

The grain-chamber 13 is provided with a bottom 27 for holding the grain after it has passed over the series of oppositely inclined or zig-zag walls and has been subjected to the initial action of the steam and sulfur. A sufficient quantity of grain is accumulated to form a solid mass or column in the chamber, so that this column or body may be further treated. The bottom 27 is provided with suitable openings and valve-mechanism 28 for said openings which controls the discharge of the grain from the grain-chamber. In practice, suitable operating mechanism (not shown) is provided to operate these valves, so that the discharge will be controlled to correspond to the feed and to retain the grain-column in chamber 13. In transit through the grain-chamber, the grain remains therein for a sufficient period to complete the bleaching operation as hereinafter set forth. As the grain is discharged from chamber 13 under control of valves 28, it is deposited on a suitable conveyer 29 whereby it will be conducted to any suitable point as may be desired.

The bleaching agent which is forced into the upper part of the grain-chamber, is drawn downwardly from the upper portion of the chamber 13 and through a portion of the grain-column, by a suction-fan 30, the intake 31 of which is connected to a duct 32 formed in one of the walls of the shell 10 and said duct communicates with that portion of the grain-chamber which contains the grain-column and below the top of the grain-column and the nozzle 18 which delivers the sulfur into the grain. In order that the exhaust will be taken from and to cause the current to pass through different portions of the grain-column, a series of arched cross-strips or walls 33 extend across the chamber 13 and channels 34 in said strips, communicate respectively with an exhaust-duct 32. Air is supplied to the grain-chamber with the sulfur-fumes by an inlet-duct 46, which communicates with supply-duct 19 and is provided with a suitable valve 47 for regulating the supply of said air through said inlet. When the suction-fan 30 is operated, the current produced thereby will cause the bleaching agent supplied to bleaching chamber 13 above the grain-column to pass downwardly through the column of grain and effect a thorough bleaching of the grain.

Before being discharged, the grain is preferably subjected to a fresh supply of sulfur and for this purpose a series of arch-walls 35 extend across the chamber adjacent the bottom 27 and channels 36 in said walls communicate with a duct 37 formed in one of the walls of the shell and this duct is connected to the sulfur-furnace by a pipe 39. Resultantly, a fresh supply of the bleaching agent and air will be drawn upwardly through the lower portion of the grain-column before the grain is finally discharged from the apparatus, by the suction-fan 30, which will cause a current to pass through pipe 39, duct 37, channels 36 and that portion of the grain-column disposed between the walls 35 and 33 and thence through channels 34 and through duct 32.

An air-inlet 48 controlled by a valve 49 is provided at the bottom of duct 37, to supply air in desired quantity with the sulfur-furnace to the lower portion of chamber 13. Resultantly, the grain will be subjected to a final treatment by a current of air and sulfur fumes which permeats the lower portion of the grain-column, cools the grain, subjects any unbleached portion of the grain to sulfur, and then draws the unabsorbed sulfur from the grain, discharging it from the fan-outlet.

The outlets 34 through which the exhaust from the grain-column passes, are disposed somewhat closer to the inlets 36 than to the top of the grain-column, so that the downward flow, aided by gravity and the upward currents will balance one another and a constant even current will be maintained through the upper and lower portions of the grain-column. The shell is provided with openings which are closed by doors 40, 41 and 42 to provide access to the different portions of the chamber in the shell when desired. Windows 43 are also provided in one of the walls of the shell for the inspection of the grain in the bleaching chamber.

In operation, assuming the chamber 13 to contain a column of grain as illustrated, and the valve-mechanism for controlling the feed of the grain in the top of the chamber and the valve-mechanism for controlling the discharge through the bottom of said chamber to be operated to control the flow of grain through the chamber, so that the grain-column therein will be maintained, the grain will pass downwardly over the oppositely inclined walls 14 to the top of the grain-column. In thus passing through the upper portion of the grain chamber, the grain will be dampened by the steam in said chamber and will absorb the sulfur fumes discharged into the chamber through nozzle 18. As the feed and discharge of the grain continues, the grain will be gradually lowered into the grain-column and while settling from the top of the column to the level of the exhaust-channels 34, the current produced by fan 30 will draw the sulfur fumes and air supplied to the upper portion of the chamber with the fumes, through that portion of the grain-column above channels 34 and cause the grain to continue to be subjected to the action of the sulfur, the air passing through the column serving to lower the temperature of the grain, to carry the fumes rapidly through the grain-column and cause the grain to better absorb the sulfur. The sulfur admitted to the top of the chamber 13 and settling with the grain, will be absorbed by the grain in the upper portion of the column and the current produced by fan 30 will cause the fumes to rapidly permeate the grain. As the grain settles below exhaust-channels 34, it will be subjected to an upwardly flowing current of sulfur, which will further treat the grain and bleached portions thereof, which may not have been previously bleached. This current will also reduce the temperature of the grain and will also remove any unabsorbed or free sulfur from the grain before the grain reaches the discharge at the bottom of the grain-chamber. When it reaches the bottom, the grain will have become thoroughly bleached, will be cool and clean and in fit condition to be handled or shipped. By regulating the valves which control the supply of air and sulfur to the grain-chamber, the currents may be modified to supply the necessary proportions of such fluids to effect proper treatment of the grain. The apparatus may be continuously operated, the grain-column being maintained in the grain-chamber by regulating the discharge of grain to correspond with the supply at the top. A large quantity of grain may be thus treated as it passes through the apparatus, so that it will be economical in operation.

The invention is not to be understood as restricted to the details shown and described, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In apparatus for bleaching grain, the combination of a structure having a chamber therein for retaining a grain-column, means for supplying a bleaching agent and moisture to said grain chamber above the grain-column, means for producing a current downwardly through the column, and means for effecting a simultaneous withdrawal of the bleaching agent and moisture from across the body of said grain-column.

2. In apparatus for bleaching grain, the combination of a structure having a chamber therein for retaining a grain-column, means for supplying a bleaching agent and moisture to said chamber, a series of outlets leading from the grain chamber and disposed below the inlet for the bleaching agent and across said chamber, and means for producing a downward current through the column and out of said outlets.

3. In apparatus for bleaching grain, the combination of a structure having a chamber therein for retaining a grain-column, means for supplying a bleaching agent and moisture to said chamber, a series of arched cross strips disposed horizontally across said chamber and below the inlet for the bleaching agent and communicating with the exterior of the structure, and means for exerting a suction through said cross strips upon the interior of the chamber to produce a downward current through the column.

4. In apparatus for bleaching grain, the

combination of a structure having therein a chamber for a column of grain, means for supplying a bleaching agent and steam to one portion of the grain-column, means for supplying a bleaching agent and air to another portion of the column, and means for causing a current to pass in opposite directions through the grain-column.

5. In apparatus for bleaching grain, the combination of a structure having a vertically extending chamber therein, and a closed top, means for supplying grain to the top of said chamber, a valved discharge at the bottom of said chamber for maintaining a grain-column in said chamber, means for supplying a bleaching agent and steam to the upper portion of said chamber, means for producing a current downwardly through the grain-column from the upper portion of the grain-chamber, and means for causing the bleaching agent to pass upwardly through the column, and an outlet for the unabsorbed agent from the grain.

6. In apparatus for bleaching grain, the combination of a structure having a vertically extending chamber therein, and a closed top, means for supplying grain to the top of said chamber, a valved discharge at the bottom of said chamber for maintaining a grain-column in said chamber, means for supplying a bleaching agent and steam to the upper portion of said chamber, an outlet for the unabsorbed bleaching agent which has passed downwardly through the grain column from the upper portion of the grain-chamber, means for supplying a bleaching agent to the lower portion of the grain-column and means for producing a downward current through the upper portion of the grain-column and an upward current through the lower portion of the grain column and an outlet for any unabsorbed bleaching agent.

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