

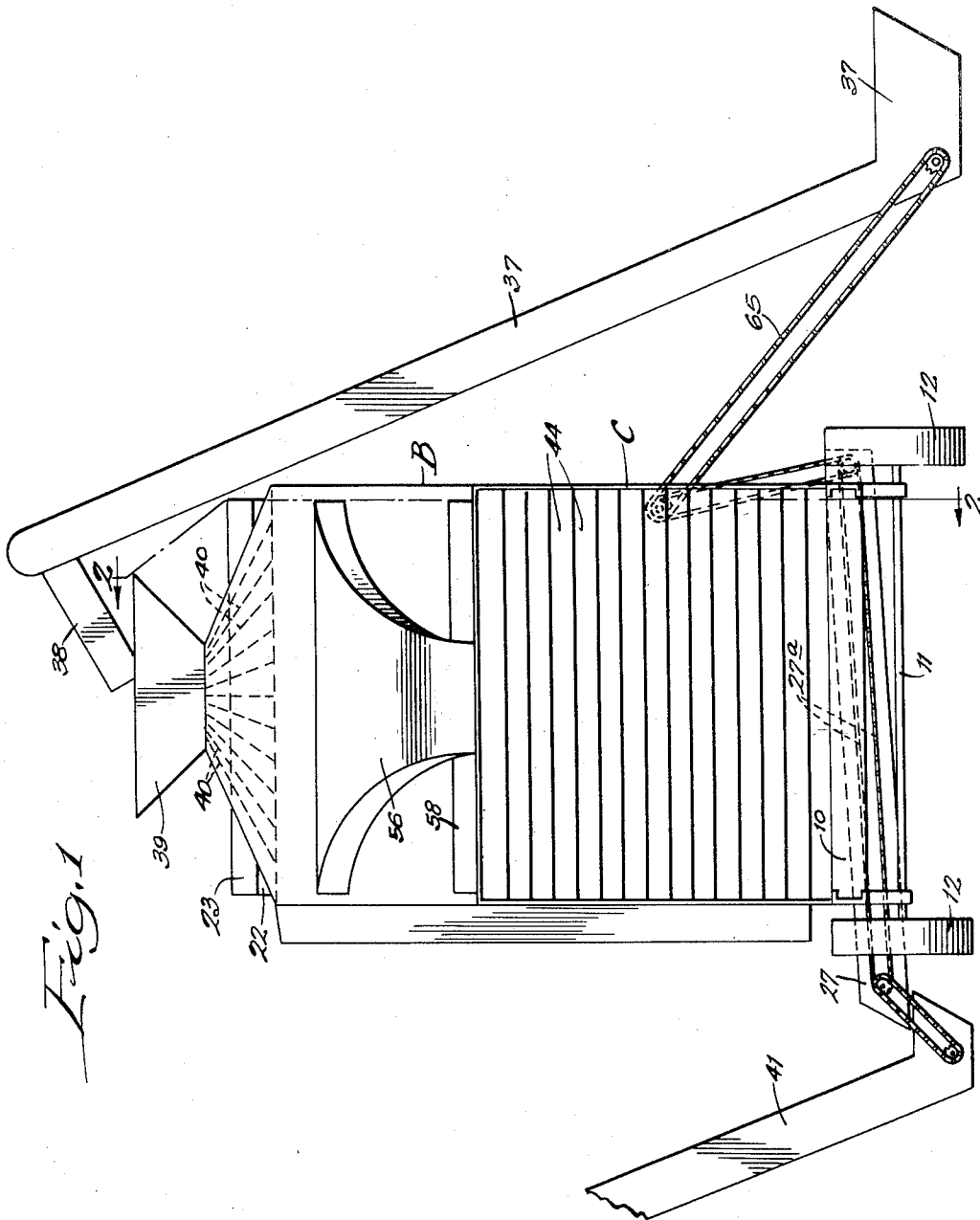
Feb. 14, 1950

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GRAIN DRYING AND TREATING APPARATUS OF
THE TREATED MATERIAL VIBRATING TYPE

2,497,703

Filed July 9, 1945.

3 Sheets-Sheet 1



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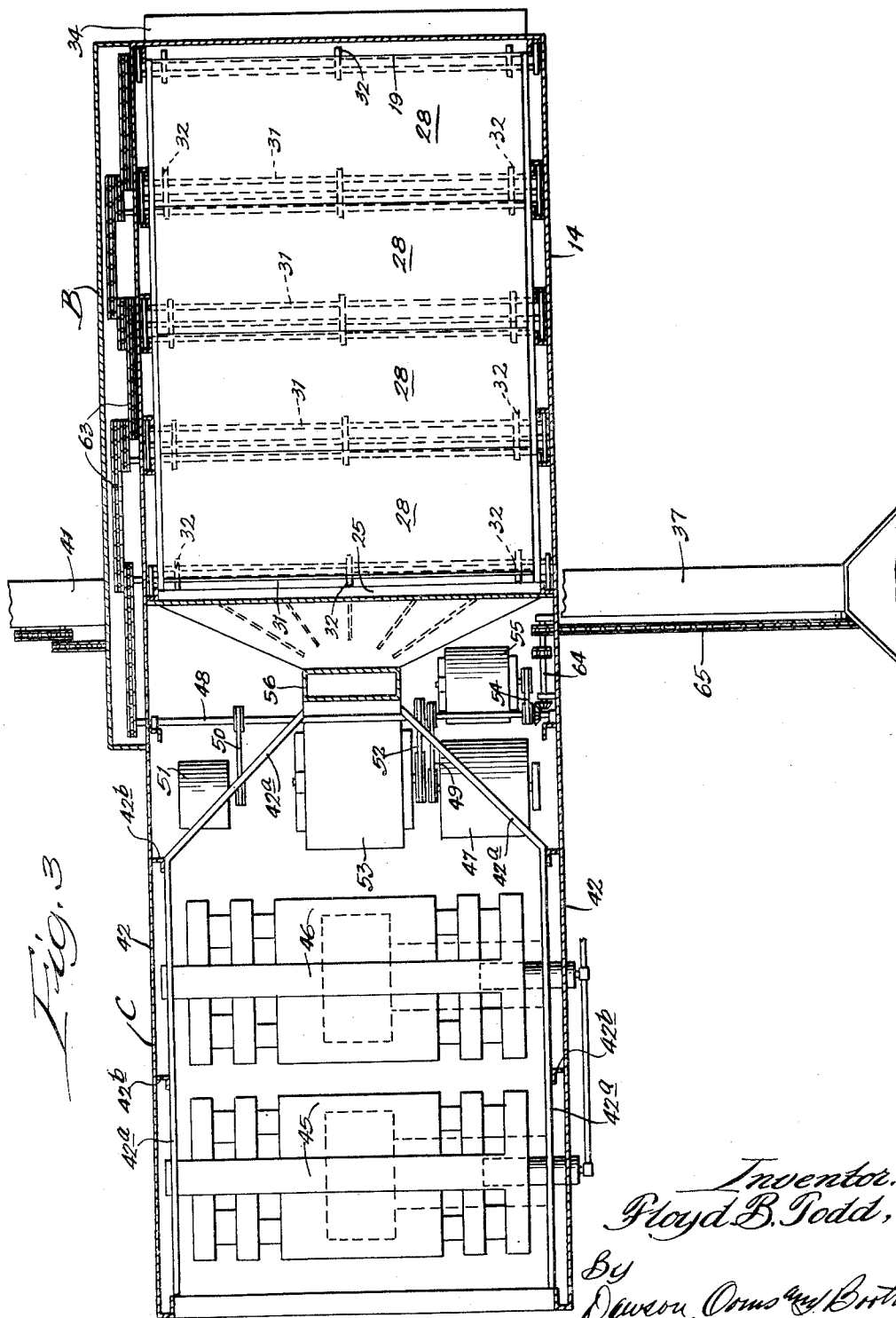
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GRAIN DRYING AND TREATING APPARATUS
OF THE TREATED MATERIAL VIBRATING
TYPE

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4 Claims. (Cl. 34-164)

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This invention relates to apparatus and a method for drying and treating grain and similar materials.

An object of the present invention is to provide compact apparatus and means whereby effective drying and conditioning of grain for storing is accomplished. A further object is to provide a method and means whereby grain and the like is passed through a series of treating zones in which a medium of varying volume and velocities is being circulated, and also into a zone where the temperature is substantially reduced whereby the grain, etc. is conditioned at a minimum of cost for storing, shipping etc. Yet another object is to provide a process and apparatus in which grain and the like may be treated so as to reduce the moisture content to the desired point, eliminate insects, germs, and micro-organisms, and deliver the grain at a suitably cooled temperature for storage, etc. Another object is to provide a new method and means for separating grain according to size or eliminating grain fragments and particulate matter while the grain is being passed through drying and treating stages in a sectionalized air-control apparatus. Other specific objects and advantages will appear as the specification proceeds.

The invention is illustrated, in a preferred embodiment, by the accompanying drawings, in which—

Figure 1 is a rear view in elevation of apparatus embodying my invention; Fig. 2, a longitudinal sectional view, the section being taken as indicated at line 2 of Fig. 1; and Fig. 3, a plan sectional view, the section being taken as indicated at line 3 of Fig. 2.

In the illustration given, A designates a frame or base; B, a casing providing a plurality of treating zones; and C, apparatus having to do with the intake and conditioning of the air or treating medium.

The frame or base A may be of any suitable construction. In the illustration given, the base provides means for mounting both of the units B and C upon a single wheel-supported structure. 10 designates longitudinal beams which are supported at the rear upon axles 11 by wheels 12. Similar wheels may be provided at the forward end, or a support 13 of well-known construction may be employed after the structure has been carried to a suitable place for operation by a tractor, of which structure A constitutes the trailer.

The structure B is preferably formed of sheet metal welded together to form a rectangular casing 14. Vertical strips 15 support the structure. Horizontal partitions 16, 17 and 18, which extend

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in staggered relation from one side of the casing toward but not quite reaching the other side, provide with the casing four separate compartments. The partitions 16, 17 and 18 may be provided at their free ends with short baffle strips 19, 20 and 21 respectively. With the structure just described, it will be noted that the compartments communicate with each other through outlets which are vertically disposed but in staggered relation. The top compartment is provided with outlets 22 provided with weather caps 23.

Within the chambers described, I provide sieve mechanism arranged at a slight tilting angle whereby grain may be passed from the top chamber through the opening 24 into the next chamber below and thence through the opening 25 into the second chamber from the bottom, and then through opening 26 into the bottom-most chamber. From the bottom-most chamber, the grain falls into the inclined chute 27 which delivers it to an elevator.

The sieving means preferably comprises a series of trays 28, each provided with a screen, and the front end of the tray is preferably notched at 29 on its under side so as to rest upon a round rod 30. A driven shaft 31 supports the rear end of each of the trays 28 and is provided with a series of knob-equipped disks 32 which, when the shaft is rotated, give the tray a rapid movement upwardly and downwardly. The trays 28 are freely mounted, as shown, and may be lifted off for substitution of new trays. Thus, a change in the mesh of the sieve may be accomplished by moving the entire tray and substituting another therefor or by sliding a new sieve into the bottom of the tray.

The compartments are shown equipped with adjustable dampers or gates, by means of which a separate control of the air take-off is insured while also permitting the withdrawal of grain, fragments, and particulate matter from the chambers. The topmost compartment is provided with a control gate 33, the chamber therebelow is provided with a gate 34, and the following chamber with gates 35 and 35a. The lowermost chamber is provided with a gate 36.

I provide a spreader feed device for insuring an even distribution of the grain upon the trays 28. As shown more clearly in Figs. 1 and 2, the elevator 37, which receives the grain to be processed, delivers it through a chute 38 into a hopper 39. From the hopper 39, the grain is directed through a plurality of diverging partitions 40 onto the wide tray therebelow, and thus insuring an even distribution of the grain thereon. A damper or slide may, if desired, be employed to

control the amount of grain delivered to the drier.

The discharged grain entering the inclined conveyor 27, equipped with chain belt 27^a, just below the bottom-most chamber, is moved into a discharge or cold grain elevator 41, as shown more clearly in Fig. 1, which delivers the grain to a bin, truck, or other desired point.

The air conditioning unit C may be of any suitable construction. In the illustration given, a casing 42 provides a rectangular chamber closed at its forward end by wall 43 and controlled at its rear side with a plurality of automatically-operated louvres 44 of well-known construction. As a means for supporting the varied structures within unit C, I provide an inner supporting wall 42^a braced by vertical angle beams 42^b. Within the interior are heating units 45 and 46 which heat the incoming air to the desired temperature. The heating units may be of any desired type or construction, but preferably are heated by oil and through the use of a forced feed supplied by compressed air. Such structures are old and no claim to them is made per se herein. It will be understood that any suitable heating apparatus may be used. A motor for driving the structure is indicated by 47. A central drive shaft 48 is driven by motor 47 through the belt drive 49, and a belt 50 from shaft 48 serves to drive the air compressor 51. A belt 52 from the same shaft drives the blower 53. A belt 54 from shaft 48 drives also the blower 55. The compressed air unit 51 supplies air for the heaters and for the motor 47 which is preferably of an oil-burning type. It will be understood that such structure is described herein merely as illustrative of the invention and any suitable power means and heating means may be employed. It will further be understood that automatic controls, such as thermostats, will be employed to maintain at all times the desired temperature within the main chamber of the unit C. Further, the airflow into the unit is controlled by well-known automatic mechanism actuating the rotatable louvres 44. Since such structure is well known and is not herein claimed per se, a detailed description is believed unnecessary.

The blower 53 is preferably supported in the upper portion of the air conditioning compartment and is adapted to discharge air through a plurality of ducts which are separately controlled by adjustable dampers so as to feed into separate compartments varying controlled amounts of air. The upper duct feeding the topmost compartment is indicated by the numeral 56 and this is controlled by damper 57. The chamber below is fed by the intermediate duct 58 controlled by damper 59. A lower duct 60 feeds the chamber second from the bottom and is controlled by damper 61. The lowermost chamber is fed by the separate blower 55 through the damper control duct 62.

Any suitable means for driving the tray-rocking mechanism and the elevators may be employed. In the illustration given, chain drive connections 63, as shown more clearly in Fig. 3, rotate the drive rods 31. At the opposite end of drive shaft 48, a jack shaft 64 is driven by means of bevel gear connections, and this serves to drive the elevator 37 through the chain belt 65.

In the operation of the device, grain or other suitable material to be treated is fed into the loading elevator 37 at its enlarged hopper end and is carried upwardly for discharge through chute 38 into the distribution hopper 39. From

the hopper 39, the grain which partially fills the hopper is evenly distributed through the spaced inclined partitions 40 upon the tray 28 therebelow. It will be noted that the inclined arrangement of the partitions 40 forms an accurate division of the cross section of the grain load within the hopper 39 and thereby guides the equal components of the grain downwardly and over selected segments of the tray. In this manner, an accurate distribution of the grain and in a relatively thin layer over the tray is accomplished. The rotating shaft 31 through the knob-equipped disks 32 causes a sharp upward and downward movement of the tray 28, with the result that the grain is inched forwardly for discharge upon the succeeding tray while at the same time causing the particles smaller than the mesh of the sieve to drop through the sieve upon the compartment wall below. Thus the material which is not to be discharged from the bottom compartment is eliminated during the drying operation. By controlling the mesh of the sieve, any undesirable components of the material from the standpoint of the final product to be discharged into the inclined trough 27 are eliminated upon the various horizontal walls 16, 17 and 18 and the bottom wall of casing. Entrance to the topmost compartment for removal of such material thrown down upon wall 16 is obtained by lifting the closure 33. If desired, the damper 34 in the next compartment may be manually adjusted so as to permit the incoming stream of air from duct 59 to sweep the material out of the casing B. Similarly, the blast from duct 62 may be utilized to remove the material upon the bottom wall of casing 42 out of the casing through the opening controlled by gate 36. If desired, air from the compressor may be used to clean out all of the compartments. Variable connections may be employed with shafts 31 to change the R. P. M. of the shafts to speed up movement of the grain over the trays when desired.

In the treatment of grain, such as corn, rice, wheat, soy beans, and the like, the need for air volume varies as the grain is advanced through a drying chamber. For example, in the top chamber, a substantial flow of air should be maintained so as to start the heating expansion in the grain and produce some drying. The use of a large volume of air here starts a vapor expansion within the grain and a capillary attraction action, which tends to bring moisture within the grain to the surface so that as far as surface moisture is concerned there will probably be much more moisture on the grain at the outlet end of the topmost chamber than at the inlet end. In the chamber below, there is considerably less need for airflow because evaporation can proceed only at a certain rate and the use of a large volume of air at this point, say, an amount equal to that employed in the topmost chamber, represents a waste of air and heat. I, therefore, prefer to reduce the volume in the chamber below the topmost considerably, and further reduction in the airflow is desired for the chamber below. In the bottom-most chamber, cool air is introduced through duct 62.

As an illustration of a satisfactory method for treating corn, a volume of 50 cubic feet of air per minute for each square foot of grain area on trays may be passed through the topmost chamber while the flow through the chamber below is only 25 C. F. M. A satisfactory flow for the chamber above the bottom-most chamber is 15 C. F. M.

In the lowermost chamber, air is fed through duct 62 by means of blower 55 which is located out of casing 42 of the unit C, and the intake to the blower is open to outside air. By this means, a supply of cool air from the atmosphere is introduced directly into the bottom chamber so as to cool the grain and thus condition it for storing. If heated grain were stored in a bin, such heat, together with the remaining amount of moisture, would tend to produce an excessive temperature within the bin highly injurious to the grain.

With the apparatus described, the incoming grain passes continuously through drying zones which have varying rates of flow of air therein and are freed in the course of such passage from matter that passes through the sieve, and finally, in the same path, is cooled so that a completely treated and conditioned grain is discharged into the outlet cool grain elevator 41 below the bottom-most chamber.

The temperatures maintained in the air conditioning unit C and within the chambers provided by the casing B will be varied according to the condition of the grain, type of grain, and desired results. For example, in a dry period, unheated air may be used to dry the grain satisfactorily. Under other conditions, where the grain is wet and considerable heat is required, the temperatures may be raised to 180° F. or higher. A thermometer D is shown in Fig. 2 carried by the duct manifold.

It will be understood that artificial means may be employed if necessary to cool the air entering the blower 55, but for all practical purposes it is found that the introduction of fresh air along with the rapid rate of flow provides all the cooling that is necessary. In many cases I find that it is unusually efficacious to introduce a germicidal material along with the cooling medium. The material may be introduced by supporting it adjacent the intake of the blower 55. By "germicidal material" I mean fumes, gases or sprays which are used ordinarily in fumigating and disinfecting operations, and such material, by virtue of its being introduced with a cooling medium, tends to remain with the grain for long periods of time and prevents the growth of insects, germs, fungi, etc. therein. When such materials are introduced in the heated air, they become very rapidly dissipated and remain with the grain for an unsatisfactorily short time.

In order to determine the relative amounts of air (cubic feet per minute) flowing into the three upper chambers, the dampers 57, 59 and 61 may be adjusted so that upon the discharge of a volume of air by the blower 33 into the manifold to which the three ducts are connected, the volume will be automatically divided in the ratio desired.

My improved apparatus and process result not only in the drying of grain and the destruction and removal of insects, germs, etc., through the use of heat, but also serve to clean the grain and, if desired, may serve to separate the grain in the different sizes. Further, in the conditioning of the grain for storage, the cooled grain is provided with a material which prevents the growth of undesirable organisms over a substantial period of time.

While in the foregoing specification I have set forth considerable detail for the purpose of illustrating one mode of operation illustrating the invention, it will be understood that such details may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. In grain drying and treating apparatus, a casing providing a plurality of longitudinal chambers in superposed relation and communicating with each other to provide a continuous path for the flow of grain, a plurality of sieves in each of said longitudinal chambers arranged with the lower end of one sieve overlapping the upper end of another so as to provide a continuous path of grain from one end of the chamber to the other, means for shaking each of the sieves, means for introducing separately a drying medium into certain of said longitudinal chambers, and damper means for controlling the proportionate amount of drying medium delivered into each of the separate chambers.

2. In grain drying and treating apparatus, a casing providing a plurality of longitudinal chambers in superposed relation and communicating with each other to provide a continuous path for the flow of grain, a plurality of sieves in each of said longitudinal chambers arranged with the lower end of one sieve overlapping the upper end of another so as to provide a continuous path of grain from one end of the chamber to the other and from the top to the bottom of the casing, means for shaking the sieves, means for introducing separately a drying medium into certain of said longitudinal chambers, and means for controlling the proportionate amount of drying medium delivered into each of the separate chambers.

3. In grain drying and treating apparatus, a casing providing a plurality of longitudinal chambers in superposed relation and communicating with each other to provide a continuous path for the flow of grain, a plurality of sieves in each of said longitudinal chambers arranged with the lower end of one sieve overlapping the upper end of another so as to provide a continuous path of grain from one end of the chamber to the other and from the top to the bottom of the casing, means for shaking the sieves, means for introducing separately a drying medium into certain of said longitudinal chambers, and means for controlling the proportionate amount of drying medium delivered into each of the separate chambers, each of said chambers being provided with a door-equipped outlet below the uppermost of the sieves in the chamber.

4. In grain drying and treating apparatus, a casing providing a plurality of longitudinal chambers in superposed relation and communicating with each other to provide a continuous path for the flow of grain, the openings between the chambers being in staggered relation, a plurality of sieves in each of said longitudinal chambers arranged with the lower end of one sieve overlapping the end of another so as to provide a continuous path of grain from one end of the chamber to the other, the lowermost sieve of one chamber extending over the uppermost of the sieve in the chamber below whereby grain from said first-mentioned sieve will fall through the opening between the chamber onto the uppermost of the sieve below, means for shaking said sieves, means for introducing separately a drying medium into certain of said longitudinal chambers, and means for controlling the proportionate amount of drying medium delivered into each of the separate chambers.

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