

Feb. 5, 1952

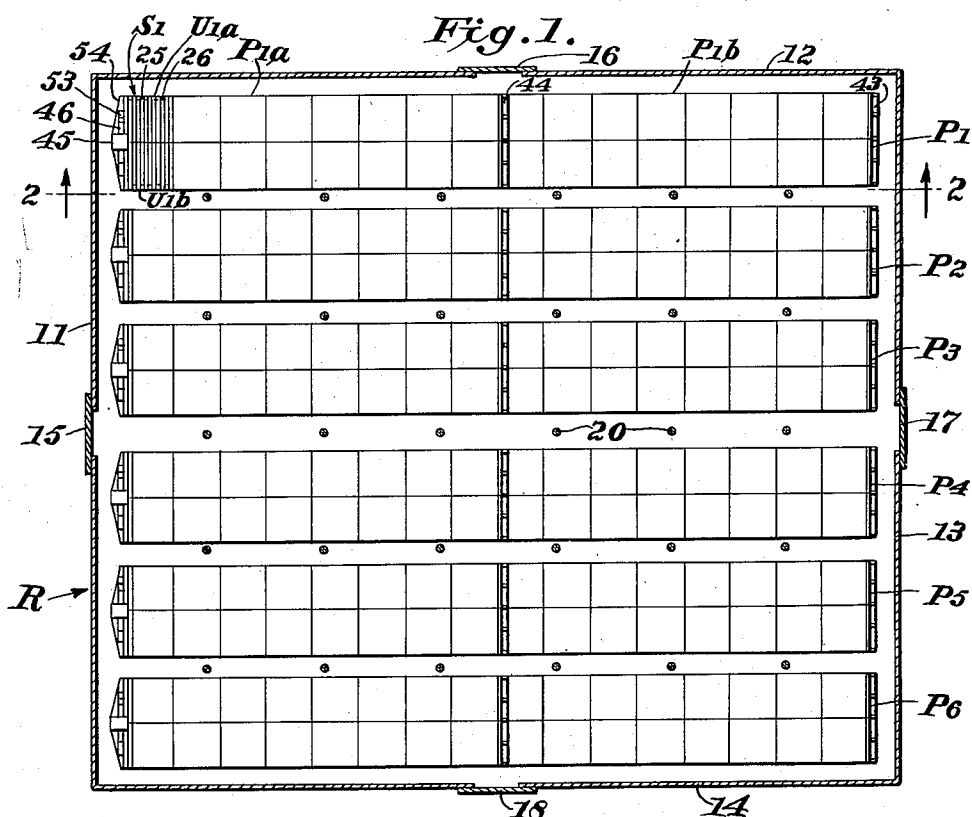
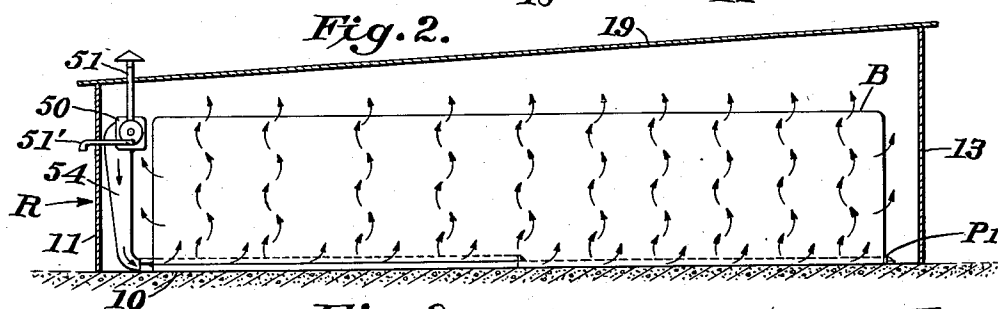
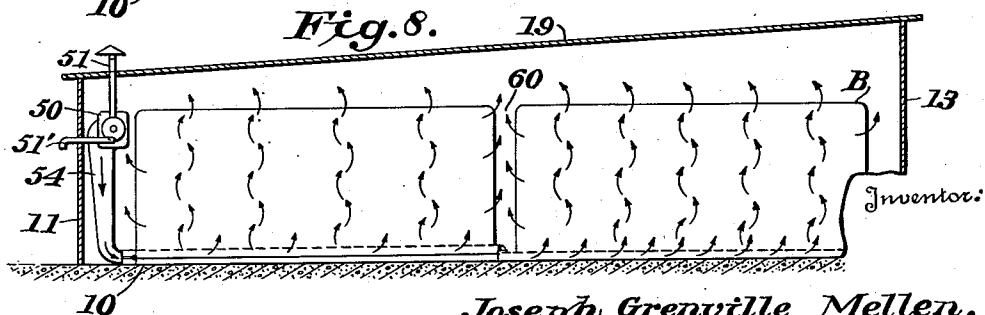
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2,584,727

STORAGE SYSTEM FOR TREATING MATERIAL

Filed Nov. 6, 1945

4 Sheets-Sheet 1



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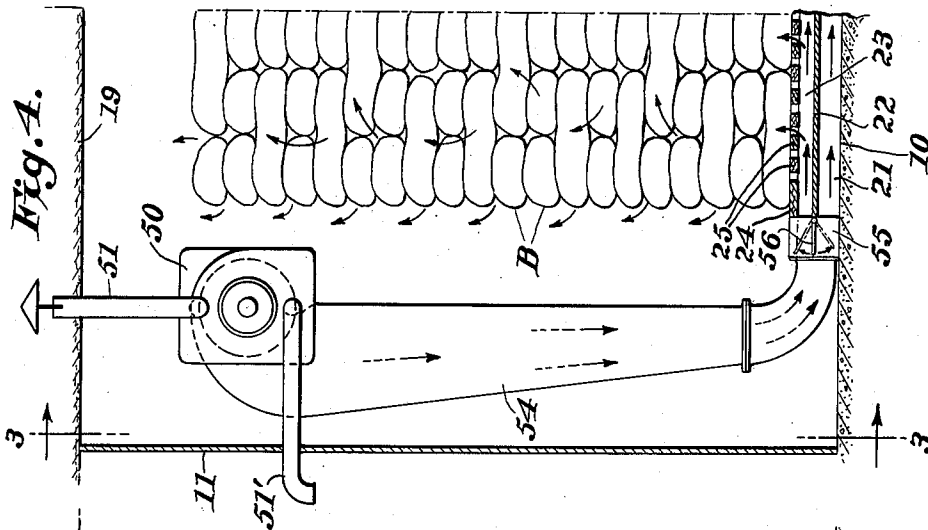
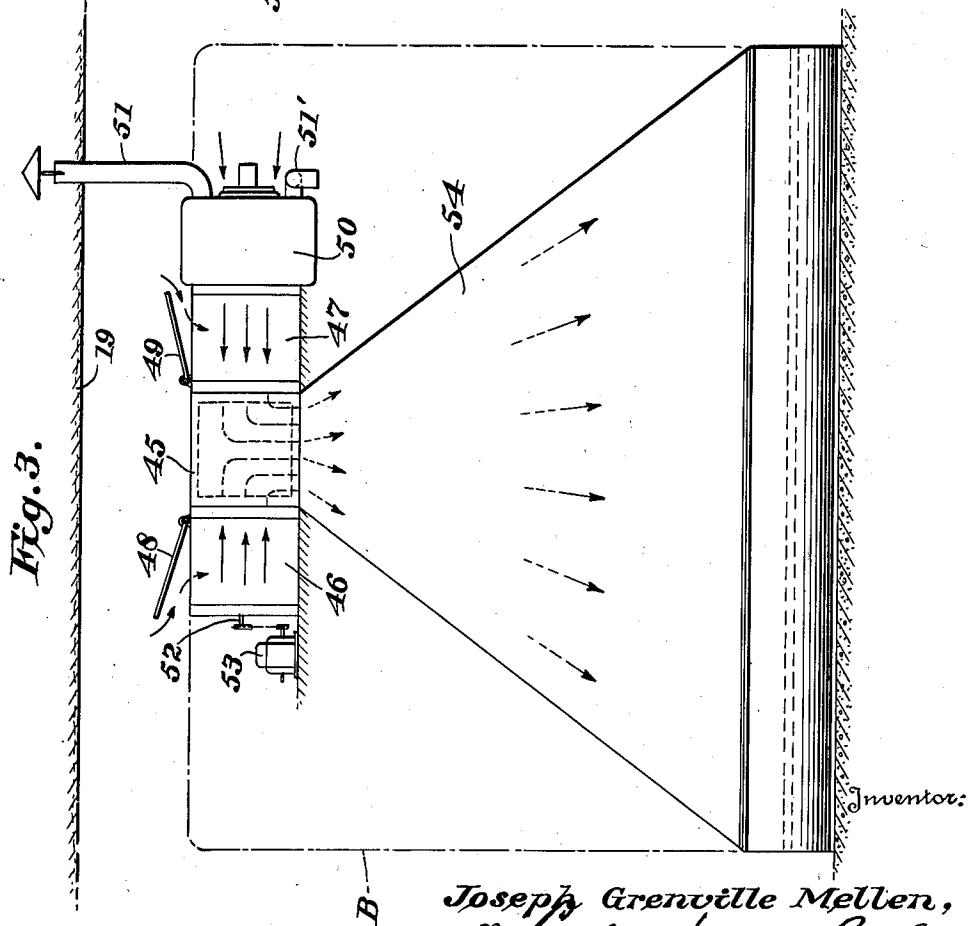
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STORAGE SYSTEM FOR TREATING MATERIAL

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4 Sheets-Sheet 2



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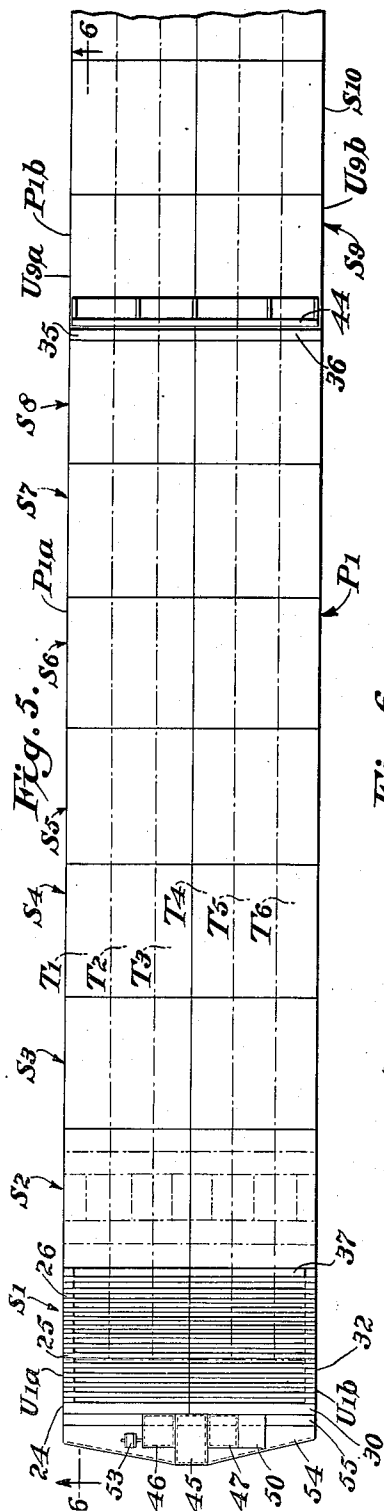
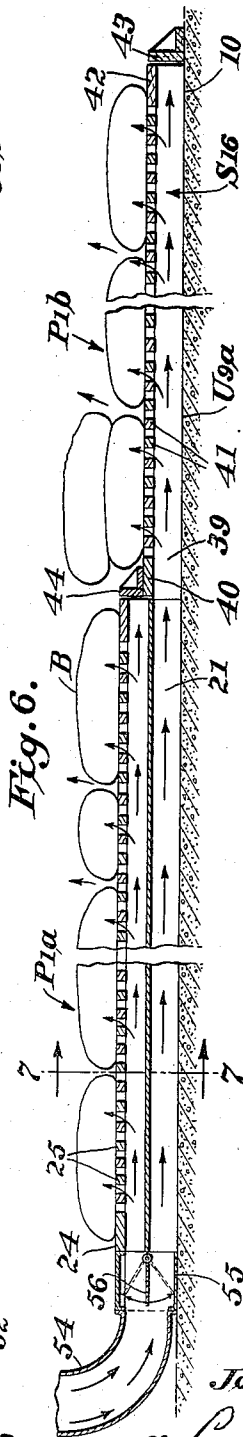
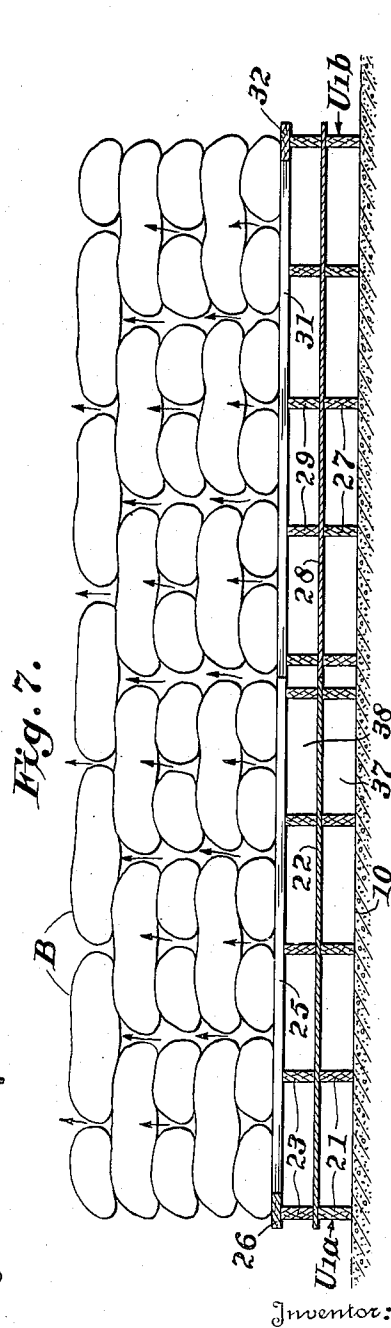
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STORAGE SYSTEM FOR TREATING MATERIAL

Filed Nov. 6, 1945

4 Sheets-Sheet 3



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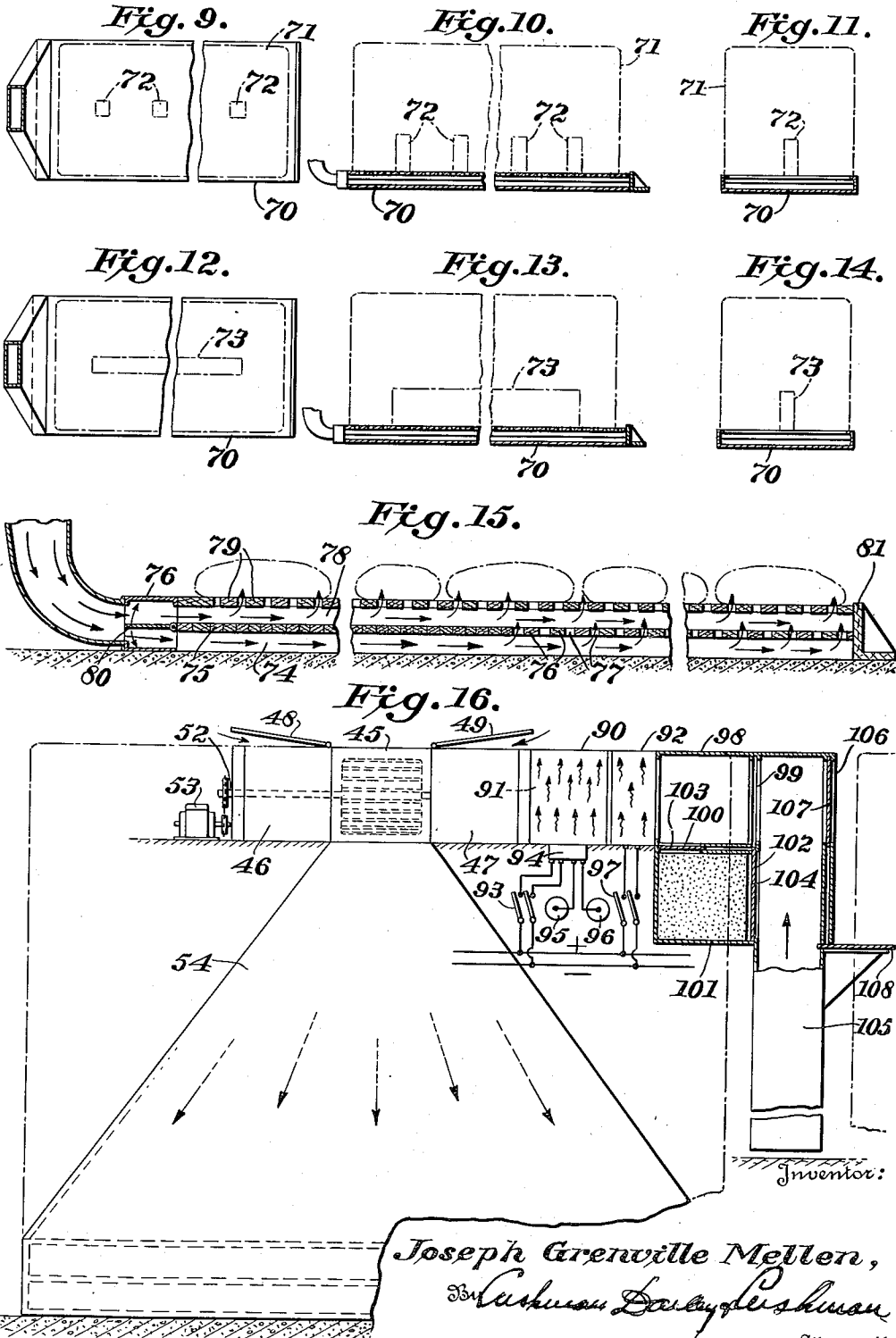
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STORAGE SYSTEM FOR TREATING MATERIAL

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,584,727

STORAGE SYSTEM FOR TREATING MATERIAL

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Application November 6, 1945, Serial No. 627,019

5 Claims. (Cl. 34-225)

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This invention relates to a storage system or installation for material packaged in air-pervious bags, being in particular directed to the storage and treatment of bagged refined sugar.

Due to the hygroscopic character of sugar, its storage presents problems which heretofore have never been satisfactorily met. In the best prior system, the bags of sugar (the bag material being ordinarily an air-pervious textile fabric) are stacked on elevated dunnage mats in a storage room, heated air is openly supplied into the upper room atmosphere, and partially circulated by ceiling fans. The increased higher temperature of the upper zones of the room atmosphere is of value but limited in a general way to the upper and outer bags because the temperature of the room atmosphere shades off downwardly with reduced heating effect as the floor is approached, and with an extended deficiency in the area under the bottom bags and lower central part of the stack. The prior systems are based upon a heat transfer from the heated room atmosphere to the sugar by slow conduction to and through the outer bags inward and through the upper bags downward. The stagnant air spaces between the stacked bags constitute thousands of insulation cells and potential humidity pockets; to say nothing of the millions of smaller air spaces between the grains of sugar in the bags.

If it were merely a question of storing sugar in a continuing hermetically sealed room, and assuming the sugar to be in good condition at the time it is stacked, the care of it would be simple, either by an adequate reduction of the absolute humidity held in the room atmosphere or by an adequate increase in the temperature of the room atmosphere, or partly both. However, in actual commercial practice, warehouse rooms are not absolutely airtight nor positively moistureproof. Further than this, warehouse rooms have to be provided with one or more doors and the room door or doors must be opened for loading in and out at varying intervals throughout all seasons of the year, being sometimes open for the full working day for several consecutive days. Thus in actual practice the room atmosphere is subject to harmful modification by admitted outside air.

If the relative humidity of the air confined in the storage room is reduced by either alternative but without regard to the adequate heating of the sugar itself, and if the stored sugar, as a result of the disregard of its temperature, happens to

be at a heat level below the hygroscopic dew point of the air coming in contact with it for an appreciable length of time, then the sugar will absorb moisture from that air. If this latter condition continues or is repeated, the sugar mass will take up considerable moisture and subsequently become crusty and lumpy in the early stages, and at times whole contents of bags become hard amalgamated masses. This lumping, crusting, and hardening, affects many bags, particularly in the bottom layers and lower core portions of the stack.

In accordance with the present invention, the bagged sugar is stacked on perforate or latticed supporting means such as especially patterned dunnage mats, or elevated gratings, of kiln dry lumber or of light metal T beams or H beams and channels embracing, or beneath which, are conduits for the supply through the openings, as by blower-heater units, of heated air in motion under pressure, the air being caused to rise and spread upward and horizontally throughout the stack, or for a sufficient height throughout its lower portion, so that the stack is heated from the bottom upward and from the inner areas outward, by quickened heat transfer from the succession of moving heated air contacting the numerous bags, by enforced displacement and imparted convection in the spaces between the bags and supplemented by quickened conduction from bag to bag. The hottest part of the stack is thus at the bottom and the directed and partially confined heated air in motion and under pressure blankets the bottom of the bottom bags and distributes amidst the lower layers. That part of the heated air which escapes horizontally from the sides and ends at the lower levels rises in contact with the outer surfaces of the lower outer bags, provides a heating envelop. These features are of great importance in later preventing damage to the condition of sugar as a result of cooler or damper air entering from the outside and "spilling" along the floor, particularly when the room doors are open.

In practicing this invention, the relative humidity of the air in the storage room during subsequent idle storage periods is maintained at some point below 60% and, preferably at 50% or lower. The temperature of the heated room atmosphere is higher in the upper zones and shades downward to the floor. This must be taken into account in controlling relative humidity of the room atmosphere, as it is extremely desirable that even the

lower zones of the closed room be kept under 60%. Concurrently the sugar itself, as herein described, is directly heated from the bottom upward and inside outward, and the temperature is raised with rapidity to, and maintained at, or above, the heat level necessary to prevent hygroscopic action of the sugar.

Sugar is not only hygroscopic but extremely soluble in water. The combined action of these two factors is the root of the problem in proper care of sugar. It is clear that the quantity of sugar that can be adversely affected as a result of hygroscopic action is limited by the quantity of water available to its hygroscopic action. It then follows that air containing a high measure of absolute humidity contactable with the sugar possesses potentialities of danger even though the immediate relative humidity of that air is within the lower percentages. To illustrate, I present the following: Take air at 30° F. of 100% relative humidity in comparison with air at 90° F. with a relative humidity of 80%. The former is already at its dewpoint and even if it gave up all of the water it contains, it could affect but a limited supply of sugar, whereas in the latter case a steep drop in temperature could force the air to give up a quantity of water far in excess of the entire amount present in the former, and could affect much more sugar.

The illustration is based upon normal dew-points, and the convertible water potentially available is further increased under hygroscopic capacity of sugar.

If the quantity of absolute humidity is abnormally high, there will be required an abnormally higher temperature to reduce its relative humidity to the desired lower percentage. It is desirable to avoid heating the room air to unnecessarily high temperatures. Therefore, if and when the confined room atmosphere, during idle storage, contains an absolute humidity in excess of the ratio of one pound of water to seven hundred cubic feet of the room atmosphere, it is desirable to remove the excess absolute humidity by any means available.

If the air is delivered from the blower-heater units at 130° F., then, under my method the air at this temperature comes into direct contact with the sugar and is delivered in full and rapid succession thereto at a high temperature differential; whereas, blower-heater units used under prior systems merely deliver the heated air into the room atmosphere into which it diffuses. While the number of heat units delivered respectively could be the same, the heat is injected by my method directly into the sugar at a very substantial temperature differential; whereas, under prior system, after the diffusion into the room atmosphere, very little temperature differential is available for heat transfer to the sugar, and then only to the outside bags.

Proper and economical functioning requires a properly designed and well-constructed warehouse with emphasis on insulation against the escape of heat from the room atmosphere and with every practicable precaution against the admittance of moisture through the walls and roof, and with double emphasis on a moisture-proof floor. These requisites apply equally to the points at junction of the walls, the walls and floor, and the walls and roof.

It is desirable to divide a spacious warehouse into several separate compartments or storerooms, each well insulated.

In the accompanying drawings,

Figure 1 is a horizontal section of a room equipped in accordance with the invention, six storage platforms with heat supplying means being shown, the platforms being empty,

Figure 2 is a section substantially on line 2—2 of Figure 1 showing in elevation a loaded platform and associated heat supplying means,

Figure 3 is a section on line 3—3 of Figure 4,

Figure 4 shows the left hand portion of Figure 2 on an enlarged scale,

Figure 5 is a plan view on an enlarged scale of a platform which appears in Figure 1,

Figure 6 is a section on line 6—6 of Figure 5 on a further enlarged scale,

Figure 7 is a section on line 7—7 of Figure 6,

Figure 8 is a view like that of Figure 2 showing a modified stacking arrangement,

Figure 9 is a diagrammatic plan view of a stack showing another stacking arrangement,

Figures 10 and 11 are side and end elevations, respectively, of the stack of Figure 9, the platform being shown in section,

Figure 12 is a diagrammatic plan view of a stack showing still another stacking arrangement,

Figures 13 and 14 are side and end elevations, respectively, of the stack of Figure 12, the platform being shown in section,

Figure 15 is a vertical longitudinal section showing modified platform structure, and

Figure 16 is an end elevation, partly in section, showing modified air treating and supplying means.

In Figures 1 and 2 reference letter R designates a room having a floor 10, side walls 11, 12, 13, and 14 provided with doors 15, 16, 17, and 18, and a ceiling 19. Desirably, with the doors closed, the room is as air tight as possible. Reference letters P1 and P6 designate identical platforms in accordance with the invention, these being spaced from each other and inwardly of the side walls throughout and preferably not less than 2½ feet. Reference numeral 20 designates posts in the aisles between the platforms. As above stated, the platforms are all identical and platform P1 and its appurtenances are shown in Figures 2 to 7 to which reference will now be made.

The platform P1 comprises a head portion P1a and a foot portion P1b, each made up of a number of square units, as here shown, two units disposed side by side constituting a section and establishing the width of the platform.

The first section, S1 is made up of units U1a and U1b. Unit U1a comprises parallel stringers 21 resting on the floor 10 and extending longitudinally of the platform and, as here shown in Figure 7, there are five of the stringers in equally spaced relation. Secured on top of the stringers and extending throughout the length thereof is an imperforate covering 22 and this may conveniently be a plywood panel, or boards nailed in place. Reference numeral 23 designates the stringers of a series of stringers on top of the covering 22 and directly above the stringers 21 respectively.

Secured on top of stringers 23 at their forward end is a board 24, Figures 5 and 6, and reference numeral 25 designates slats secured to the top of stringers 23 in spaced relation to board 24 and to each other, the spaces between the slat ends above the outside stringer 23 being filled with blocks 26 so that an imperforate lateral margin is provided.

Unit U1b comprises lower stringers 27, a covering 28, upper stringers 29, a board 30 aligned with board 24, slats 31, and filler blocks 32. Preferably, the cross portions of the units project beyond the outer stringers so that when the units are butted together as shown in Figure 7, spaces will exist between the adjacent stringers.

Sections S2 to S7 are exactly like section S1 except that their top surface is composed of slats throughout, the boards as at 24 and 30 being omitted. The slats of adjacent sections are so placed that a normal space will exist between the adjacent slats of the two sections. The final section S8 of the platform portion P1a is like section S1 except that boards 35 and 36 extend along the rear edge of the section. It will be understood that the stringers of the several sections are in respective alignment with the result that bottom conduits 37 and top conduits 38, extending throughout the length of platform portion P1a, are provided. The dunnage mat structure provided by the slats constitutes a perforate supporting surface with imperforate margins throughout its perimeter as provided by the end boards 24, 30, 35 and 36, and the slat ends and filler blocks.

The platform portion P1b is made up of square units of the same area as the units of portion P1a. They differ from the latter in that the upper stringers and covering are omitted. Unit U8a, Figure 6, comprises stringers as at 39 aligned with the stringers 21 of platform portion P1a. Secured on top of stringers 39 are an end board 40 and slats 41 with end filler blocks the same as in unit U1a, and, in these respects, unit U9b corresponds with unit U1b. The final section of platform portion P1b is composed of units corresponding to units U8a and U9b in top structure, including end boards as at 42, Figure 6. Thus, platform portion P1b has a top perforate surface except for a continuous imperforate marginal portion and has conduits between the stringers 39 in continuation of the conduits 37 of platform portion P1a. Reference numeral 43 designates a block resting on the floor 10 and extending across the end of the final platform section S16 and adapted to serve as a damper at the ends of the ducts. A similar damper 44 rests on the boards at the forward end of section S9 and serves as a damper for the control of conduits 38.

The bags B of sugar are stacked on the platform portions in overlying relation to the imperforate margins, as particularly shown in Figure 7, some clearance being left at the bottom of the stack between the two portions to permit adjustment of damper element 44. As here shown, the stack comprises six longitudinally extending tiers T1 to T6, each tier being two bags wide with alternate courses laid cross-wise. For the best results, the outside tiers T1 and T6 are closely stacked, that is, the bags are placed in contact with each other with care so that the apertures between them will be as small as possible. The remaining tiers are more loosely stacked. For the best results, tiers T2 and T5 are normally stacked, that is, the bags are not deliberately placed in contact nor purposely spaced, whereas tiers T3 and T4 are more loosely stacked, the bags being deliberately spaced apart. The stack is shown in Figure 4 as being twenty bags high so that the stack is substantially square in cross section with its top well below the roof.

Supported in any suitable manner between the top of the stack and the adjacent room wall 11 is a blower 45 on an axis extending parallel to the

wall. The blower has axial inlets communicating with inlet chambers 46 and 47 which have control dampers 48 and 49, respectively, for auxiliary air. Additionally, chamber 47 is in communication with a heater unit 50, here assumed to be a gas heater with a flue 51 extending through the roof and an air inlet 51' extending through wall 11. Ordinarily dampers 48 and 49 may be closed so that the entire intake to the blower will be through the heater unit. The blower includes a shaft 52 which extends through chamber 46 to be driven by a motor 53, and has a bottom outlet connected by a spreader 54 with a head box 55 which has an open side extending entirely across the head end of the platform and registering with the conduits 37 and 38. Mounted within the head box on a transverse axis at the level of the covering 22 is a damper 56 by means of which delivery to the top and bottom conduits can be apportioned to the extent of being divertible entirely to one or the other.

With the stack uniformly occupying the entire platform, the heated air delivered uniformly across the head box will be supplied substantially equally to the top and bottom conduits, or perhaps favoring somewhat the lower conduits in view of their greater length. The air in the top conduits of portion P1a is caused to rise through the perforations of the latter due to back pressure caused by damper 44. However, the damper should be arranged to permit some escape at the end of the conduits in order to allow some longitudinal movement of the air at the conduit extremities so as to insure proper delivery under the end bags.

The heated air delivered to the lower conduits 37 is led to the conduits of platform section P1b, damper 43 being ordinarily adjusted to cause a back pressure while still permitting of some escape.

The heated air, thus supplied, rises and spreads throughout the stack, or at least the lower vulnerable portion thereof, lateral escape directly at the bottom of the stack being minimized by the imperforate marginal portions which the bottom outside bags overlie. Direct lateral escape is minimized throughout the height of the stack due to the close stacking of the outside bags. The best total permeation is secured when the stack is not too high in relation to its width. The air flow is indicated by the arrows in Figures 2, 4, 6, and 7.

Thus, the heated air delivered substantially throughout the bottom area of the stack is caused to rise and spread through the stack with an extremely efficient heat transfer to the bag contents and an air temperature is maintainable in and around the stack such that the sugar can be kept at the required temperature. In short, the stack is enveloped in a heated atmosphere, hottest at the bottom, the sides and top of the envelope deriving from the air which shades downwardly in temperature as it rises and spreads through the stack and escapes therefrom. The blower intake, as shown in Figures 2 to 4, is near the height to which the stack is intended to be built so that the air at this level will be taken in and re-circulated. As above stated, the condition and temperature of the heated air are such that the relative humidity is maintainable below 60% and the sugar at a temperature to prevent hygroscopic section thereof. If these conditions are maintained, the sugar can be stored indefinitely with no caking whatever. Also, as the temperature of the room-air outside of the stack

is only about that of the heated sugar, the temperature in the room is relatively comfortable, in contrast to any system that relies upon sufficiently heating the room as the sole medium for heating the sugar.

Loading out of the stack may begin at its foot end. When the final section S16 has been unloaded, the section can be removed and damper 43 associated with the end of section S15, and so on, and damper 56 appropriately adjusted. If the platform were not made in removable sections, it would be desirable to cover over the unloaded section to prevent waste of heat and unnecessary heating of the room atmosphere.

Where the platform is of any considerable length, the stepped construction, which has been described, is desirable for proper heat distribution, but the invention is not limited to this arrangement. On the other hand, in the case of an exceptionally long platform more steps could obviously be provided.

It is contemplated that the system may be used for the storage and treatment of other materials packaged in air pervious bags, for example, granular material such as cereal grains and legumes. If it is merely a question of drying, the heater unit can be turned off or omitted and air drying chambers may be provided in connection with the blower intake or output in known manner. If desired, fumigants or insecticides can be introduced into the blower intake chambers for the treatment of the stacked material. Generally speaking, the new system is designed for the supply of any gaseous conditioning medium to stacked bagged material.

In Figure 8, the stacking arrangement differs from that of Figure 2 in that a space 63 is left between the stacked bags on the foot and head portions of the platform—that is, separate stacks are built on the two portions. The adjacent stack ends are closely stacked in overlying relation to the imperforate margins, but additional lateral air escape results as indicated by the arrows.

Assuming proper warehousing conditions with the room atmosphere adequately heated, the part of the stack vulnerable to hygroscopic action rarely reaches a height of more than eight feet from the floor, with the bottom bags and lower core portion of the stack the most vulnerable of all. Therefore, as a matter of actual necessity, the upward distribution and diffusion of the heated air need not ordinarily be extended above about the 11th or 12th layer up from the floor. Using my hereinbefore described preferred stacking procedure (close, normal, and loose), it can be terminated at the eleventh or twelfth layer, or thereabout, and the added layers superimposed solely by normal stacking.

In order to promote diffusion in the lower part of the stack I may utilize the stacking systems illustrated in Figures 9 to 14. Referring to Figures 9 to 11, reference numeral 70 designates a single-level duct platform in accordance with the invention and reference numeral 71 a stack of bagged material thereon. Reference numeral 72 designates chimney-like spaces left in the central portion of the shaft and extending from the perforate mat up to the tenth or twelfth layer, or thereabout, with the layers thereabove in normal stacking relation. In Figures 12 to 14 the arrangement is similar except that a continuous elongated space or chimney 73 is left in the central portion of the stack.

The purpose of these two stacking patterns is to permit easier movement upwardly and, thence,

horizontally outwardly, of the heated air first injected under the bottom bags. In all cases care must be taken to prevent depriving the bottoms of the bottom bags of a full spread of the injected highly heated air, especially with respect to the bags remote from the duct inlets.

In Figure 15 I have shown a modified design of platform insuring adequate delivery of heated air lengthwise throughout an elongated stack. In this case, bottom stringers as at 74 support a solid floor 75, say for half their length from the head box 76, the floor being composed of spaced slats 76 with closure blocks 77 throughout the remainder of the length of the stringers. Stringers 78 supported on the platform above stringers 74 extend the full length of the latter and support a slatted mat 79 which extends from end to end of the stringers and includes the lateral closure blocks. In this manner, upper and lower series of ducts extending throughout the length of the platform are provided, both being controllable by an apportioning damper 80 and an end damper 81. The upper series of conduits deliver throughout through mat 79 whereas the lower series carries the gaseous medium, heated or not, past the solid floor 75 before upward delivery occurs, thus insuring adequate supply under the far end of the stack.

In Figure 16 I have shown an air delivery and treating system of preferred design. As hereinbefore mentioned, it is desirable once the stacks have been built to establish quickly the required temperature-humidity effect, although once this has been established, relatively little heat is required in the case of idle storage. It has also been stated that if during idle storage the absolute humidity is in excess of the ratio of one pound of water to seven hundred cubic feet of room atmosphere, the excess should be removed. During the hottest period of the year with the roof of the warehouse directly subject to the heat of the sun during the afternoon hours, and in sustained idle storage, air from the upper part of the room may be drawn from, without need of being additionally heated. But generally it is preferable to draw the room air into the heater from the zone adjacent the floor since the hotter air of the upper room atmosphere is serving a useful purpose. The arrangement shown in Figure 16 illustrates a means for applying the alternatives.

In that figure, the blower 45, compartments 46 and 47, and distributor 54 are the same as before. Arranged in connection with the intake end of compartment 47 is a conduit 90 in which are arranged independent heaters, here shown as two electrical heating units 91 and 92 of which the former has a greater heating capacity than the latter. Reference numeral 93 designates a manually operable switch connecting the power line with a control switch 94 for unit 91, and reference numerals 95 and 96 designate, respectively, a humidostat and a thermostat in joint control of the switch 94. With the control instruments set as required, switch 94 will remain closed until both settings are satisfied, whereupon the switch will open. The power line is in connection with unit 92 through a manually operable switch 97.

In connection with the inlet end of conduit 90 is a box 98 having an end opening 99 and a bottom opening 100. Beneath box 98 is a box 101, illustrative of any suitable drying means, containing a desiccant, for example silica gel, and directly below opening 99 box 101 has an open-

ing 102 of the same size. As here shown, opening 100 is closed by a slide 103 and opening 102 is closed by a slide 104.

A conduit 105 has an open end adjacent the floor and extends upwardly in communication with openings 99 and 102. Opposite opening 99 conduit 105 has an opening 106 shown as closed by a slide 107. Below the level of opening 102 conduit 105 is equipped with a slide 108 shown in open position but adapted to close off the conduit.

Assuming that storage conditions are to be established after the building of the stack, switches 93 and 97 are closed and with the slide valves arranged as shown, air will be drawn upwardly through conduit 105 from adjacent the floor and will pass to the heaters through box 98, by-passing the drying means 101. Both of the heating units are active but as soon as the conditions are established for which instruments 95 and 96, or the stack thermostat, are set, heating unit 94 will be cut out while unit 92 will continue to supply the predetermined relatively small amount of heat necessary to maintain the condition, blower 45 remaining in operation until the supervisor manually shuts off the blower and secondary heater after determining that even the operation of the idler heater is no longer necessary for the time being. The blower may be operated with or without the operation of either or both heaters but neither heater will be operated unless the blower is also operating.

If it is desired to draw air from the upper part of the room, slide 108 is closed and slide 107 is moved downwardly to free opening 106. Regardless of whether air is being admitted through the top or the bottom conduit inlet, it can be made to pass through the drying means by moving slide 103 to the right to free opening 100 and by moving slide 104 upwardly to free opening 102 and close opening 99. As indicated, conduit 105 is disposed at the end of the aisle between two adjacent stacks and, hence, does not interfere with stacking and unstacking operations.

The stacks have been shown herein as horizontally elongated, this enabling the localization of the heater-blower means along only one wall, simplifying installation, and conserving space. The stacking could, of course, be arranged on square bases, but this would require the installation of numerous heater-blower units or elaborate air ducts either of which might obstruct handling operations and would sacrifice storage space. Moreover, in the case of stacking on a square or nearly square base, the bags would have to be removed from the top in loading out, whereas by stacking as illustrated in the drawings, the bags may be loaded out either by removing from the top or from the end remote from the source of heat injection, end removal being preferable.

As stated at the outset, the bag material is ordinarily an air-pervious textile fabric. Attempts have been made to use impervious bagging, but however impervious the material may be, it has been practically impossible to keep it absolutely air-tight after handling and stacking the filled bags.

Any bag to the contents of which air has subsequent access in any manner is considered herein to be air pervious and, hence, subject to treatment in accordance with the invention.

It will be understood that the disclosure herein is intended to be illustrative and that variations in procedure and in the construction and

arrangement of parts are contemplated under the claims which follow.

I claim:

1. In combination, a storage room having a door through which bagged material can be loaded in or out, a first plurality of stringers disposed in parallel relation on the room floor and spaced from the room walls, an imperforate covering supported by the stringers and extending from one end thereof a distance short of the other end thereof, a perforate mat supported by the stringers and extending from the inner end of said covering to said other end of the stringers for the support of the bagged material in stacked relation, a second plurality of stringers supported by the first stringers thereabove and in parallel relation thereto, the second stringers extending from said one end of the first stringers to the inner end of said covering, a perforate mat supported by said second stringers for the support of the bagged material in stacked relation, a first duct means being defined between said first stringers and a second duct means being defined between said second stringers for the delivery of a gaseous conditioning medium through the mat perforations substantially throughout the bottom area of bagged material stacked thereon, and means for supplying a gaseous conditioning medium under pressure to both of said duct means at said one end.

2. In combination, a storage room having a door through which bagged material can be loaded in or out, a first plurality of stringers disposed in parallel relation on the room floor and spaced from the room walls, an imperforate covering supported by the stringers and extending from one end thereof a distance short of the other end thereof, a perforate mat supported by the stringers and extending from the inner end of said covering to said other end of the stringers for the support of the bagged material in stacked relation, a second plurality of stringers supported by the first stringers thereabove and in parallel relation thereto, the second stringers extending from said one end of the first stringers to the inner end of said covering, a perforate mat supported by said second stringers for the support of the bagged material in stacked relation, a first duct means being defined between said first stringers and a second duct means being defined between said second stringers for the delivery of a gaseous conditioning medium through the mat perforations substantially throughout the bottom area of bagged material stacked thereon, means for supplying a gaseous conditioning medium under pressure to both of said duct means at said one end, and means at the other end of each of said duct means providing for restricted escape of said medium from the duct means.

3. Structure according to claim 1 wherein said mats have imperforate marginal portions adapted to be overlaid by the bags whereby to minimize lateral escape of the gaseous medium at the bottom of the stack.

4. Structure according to claim 1 wherein means is provided for apportioning the supplied gaseous medium between the two duct means.

5. Structure according to claim 2 wherein means is provided for apportioning the supplied gaseous medium between the two duct means.

JOSEPH GRENVILLE MELLEN.

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