Jan. 7, 1936. D. B. VINCENT 2,026,922

DRIER

Filed Nov. 21, 1934 2 Sheets-Sheet 1

Fig. 1.

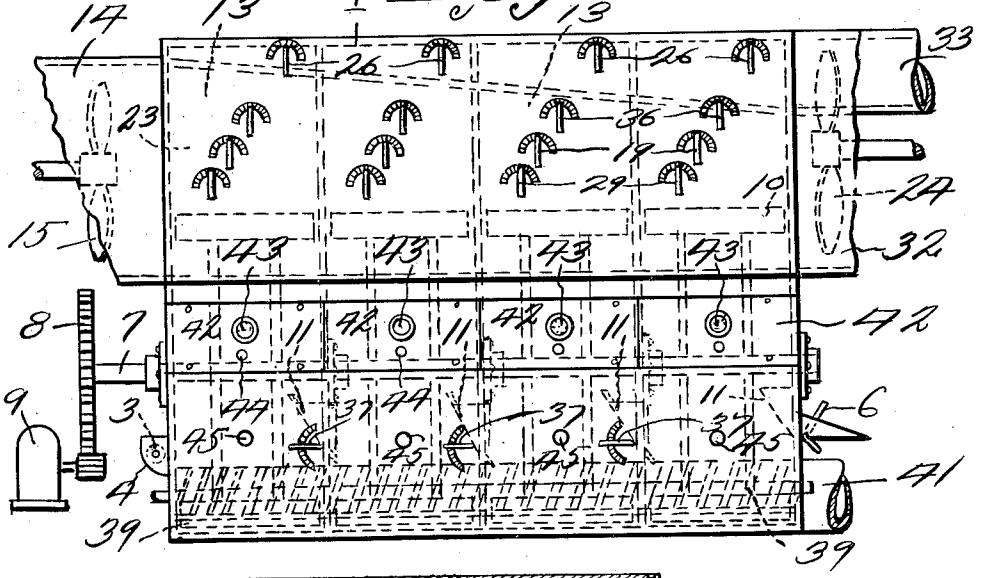
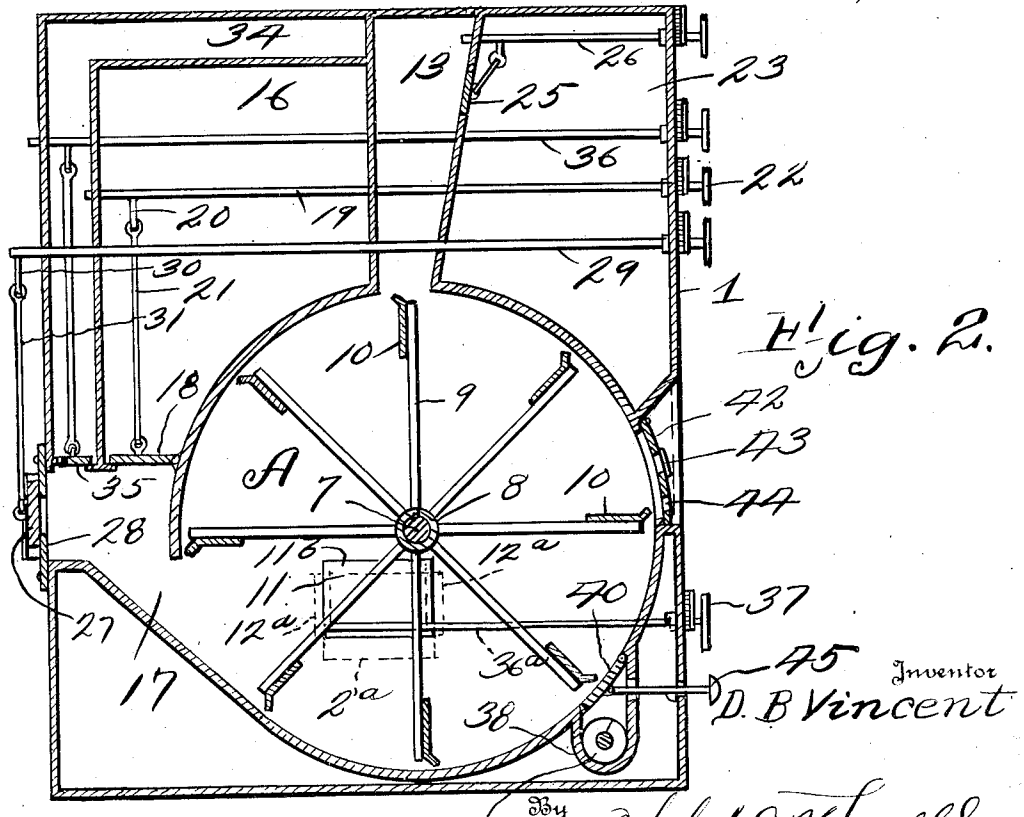


Fig. 2.



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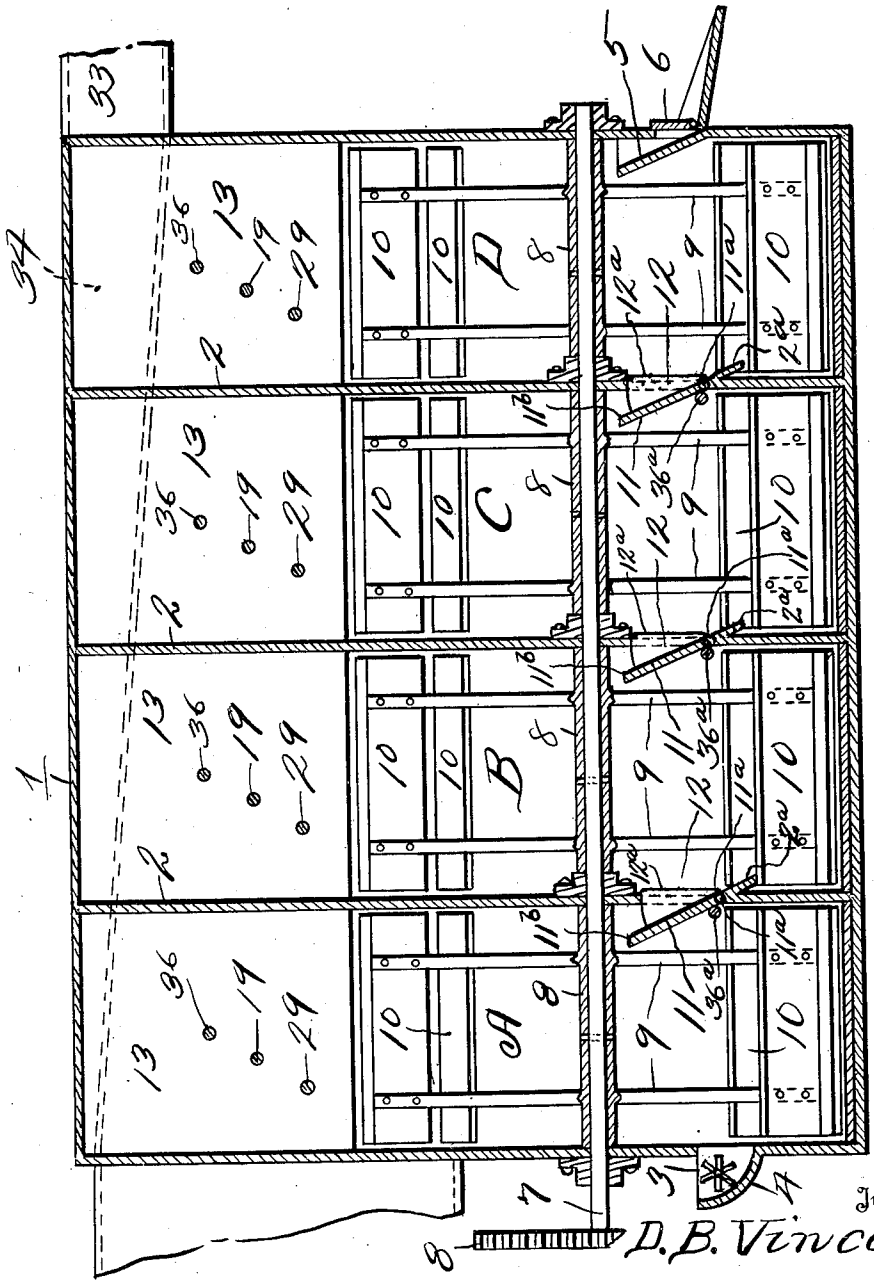


Fig. 3.

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DRIER

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4 Claims. (Cl. 34—44)

The invention relates to driers particularly adapted for drying particles of citrus fruit peel used as a cattle food, however applicable for general drying purposes.

A further object is to provide a drier comprising a plurality of compartments in a casing and divided from each other by partitions and means for feeding material to be dried into one of said compartments where it will be rotated by a revolving agitator in a heated atmosphere and gradually transferred during the agitating operation through the partitions to adjacent compartments for further agitation and transfer to other compartments.

A further object is to provide means whereby the heat may be controlled and varied in any of the compartments during the agitating and drying operation and means whereby material from any of its compartments during the agitating means may be discharged longitudinally from the drier.

A further object is to provide means to remove the moisture laden air from each compartment and control the volume of moisture laden air desired to be removed from each compartment.

A further object is to provide the machine with means whereby the temperature within any compartment will be indicated and hand holes through which samples from any compartment may be removed for test purposes.

A further object is to mount the rotatable agitators on a single shaft extending through the machine and to provide the agitators with agitating blades carried by arms spaced inwardly from opposite sides of the chambers, thereby allowing the utilization of transfer hoppers extending upwardly towards the drive shaft and into the chambers so that as the agitators rotate a portion of the material as it falls will be received in the hopper and transferred to the next compartment, at a point opposite where the material entered the chamber.

A further object is to provide closure means controllable from the outside of the drier for controlling the flow of material through the hoppers to adjacent compartments and from the drier.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawings, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention,

In the drawings:

Figure 1 is a view in elevation of the drier.

Figure 2 is a vertical transverse sectional view through the drier.

Figure 3 is a vertical longitudinal sectional view through the drier.

Referring to the drawings, the numeral 1 designates the elongated casing of the drier which is divided into a plurality of compartments A, B, C, and D by means of vertical transverse partitions 2, as clearly shown in Figure 3. During the operation of the drier, material is fed into the compartment A by means of a rotatable blade member 3 in a hopper 4 and is agitated in said compartment and subjected to heated air, and is then transferred to compartment B where it is further subjected to agitation and heating; and this operation continues from compartment to compartment until the dried material is discharged from the last compartment D through the discharge hopper 5 controlled by the hinged closure 6. It is to be understood that any number of compartments may be utilized, however a sufficient number is used to insure a positive drying operation.

The drier is particularly adapted for drying orange peel, or citrus fruit peel, rag and seed which has been previously shredded and crushed, and which shredded and crushed material contains a large percentage of moisture and oil; also jelling properties which must be agitated and dried at controlled temperature to prevent caramelization and coagulation and dried by evaporation before a succulent stock food, having a large absorbent property can be obtained. It has been found with material of this character best results are obtained by subjecting the material to successive drying operations which may be controlled in temperature.

Extending longitudinally through the casing 1 and through the various chambers thereof is a drive shaft 7 having a drive gear 8 thereon, and which drive gear may be driven in any suitable manner for instance by a motor 9. Mounted on the drive shaft 7 in the various chambers A, B, C and D are agitator reels 8 having spaced radial arms 9, the outer ends of which are provided with paddles 10 adapted to engage the material and carry the same upwardly as it is fed into the chambers A, B, C and D and allow the same to fall from the top of the reel in a separated condition so that the heated air passing through the chambers, by mechanism hereinafter set forth, will dry the material on all sides. Particles which may be stuck together by the oils and jelling properties of the material will be broken

apart when the material hits the bottom of the compartment where it is again taken up by the paddle wheels and pass through the air. It will be noted that the material is kicked into the chamber A by the bladed rotatable member 3 so that it enters the side of the reel between the blades 10 and that the material will be continuously agitated, lifted and dropped through the heated air in the chamber. As the material is rotated and agitated a portion thereof will fall into the hinged hopper 11 forming a closure in the adjacent partition 2, and when the hinged hopper thereof is open the material in the hopper 11 will be discharged into the adjacent compartment B. This operation continues through the various compartments, hinged hoppers 11 and to the discharge hopper 5, the material being agitated and subjected to the action of the heated air at each stage of the operation. It will be noted that the hinged hoppers 11 incline into the compartments above the blades and slightly to the rear of shaft 7, hence falling material will collect therein and the hinged hoppers will be out of the path of blades 10. The hinged hoppers 11 are hingedly mounted at 11*a* and may be easily oscillated.

By oscillating the hoppers 11 any material which may become clogged or stuck therein may be dislodged so that it will fall by gravity into the adjacent compartment, and is preferably guided and deflected inwardly over the deflecting flanges 2*a*, at the lower ends of the hinged hoppers. The hinged hoppers are provided with end walls 12 which terminate in flanges 12*a* which overlie the opposite sides of the partition openings and limit the movement of the hoppers towards their open positions and in combination with the upper end 11*b* of each hopper forming jarring means for the hoppers at the ends of the oscillations thereof.

The chambers are provided with upwardly flarred exhaust chambers 13 through which the moist exhausted heated air from the compartments A, B, C and D is discharged. The heated air is obtained from a furnace or any other suitable source and is forced through the hot air pipe 14 by means of a fan 15 into the hot air duct 16 which runs longitudinally through the casing 1 at the rear thereof and hot air from said duct is admitted to the various chambers A, B, C and D through the throat 17 at the rear end thereof when the closures 18 are opened, therefore it will be seen that the falling rearwardly projecting material from the blades 10 will pass through the heated air entering the chambers. Closures 18 are controlled by means of rotatable rods 19 having arms 20 provided with link connections 21 with the closures 18, and with handle members 22 located outside the drier so that the operator can regulate the amount of heated air admitted to any of the chambers. By referring to Figure 2, it will be seen that the flared exhaust chambers 13 are in communication with the exhaust duct 23 through which air is sucked by the exhaust fan 24, which exhaust fan creates a vacuum in the upwardly flared auxiliary chambers 13 when the closures 25 are opened to various degrees by the control rods 26, therefore it will be seen that the rapidity of movement or circulation of the heated air through the various compartments can be regulated and varied at the various steps of the drying operation. During the drying operation the operator may admit cold outside air to any of the compartments by opening the slidable closures 27 carried by the removable cleanout plate 28 at the rear of the machine and which closures 27 are controlled by rotatable rods 29 having arms 30 and links 31.

If desired the moist exhaust air from the discharge pipe 32 may be recirculated through the return pipe 33 and angularly shaped return duct 34 and at which time the hinged closures 35 are opened through the medium of the control rods 36. When a re-circulation is desired pipe 33 is connected to pipe 32. It will be noted that cold outside air, hot air and return moist air, when used, all enter the machine adjacent each other, hence are thoroughly mixed when they enter the various drying compartments for contact with the material to be dried.

The hinged hoppers 11 are carried by rods 36*a* which extend through the forward side of the drier and terminate in handle members 37 whereby they may be controlled for allowing or varying the feeding of material from one compartment to the other. Extending longitudinally through a discharge trough 38 adjacent the bottoms of the compartments is a discharge screw 39, through which material from any particular compartment may be discharged as desired when the operator opens the hinged closures 40. This allows the discharge from any particular compartment when the operator finds that the material is sufficiently dry. The discharge is through the pipe 41, Figure 1.

The forward side of each chamber is provided with a removable plate or panel 42 having temperature indicators 43 thereon and openings 44 through which samples of the material may be removed from any of the paddles 10 for testing the moisture content thereof. This gives a positive guide to the operator as to when to discharge the contents from any particular compartment during the progressive drying operation. It will be noted that the trough 38 is slightly above the bottom of each of the drying compartments, consequently when the closure 40 is open all of the material would eventually be forced into the trough for removal from the machine.

The hinged closures 40 are preferably controlled by push rods 45 as shown in Figure 2, however this structure may be varied if desired.

From the above it will be seen that a successive step drier is provided wherein material is fed from chamber to chamber into the path of rotating agitator reels and that a rapid circulation of hot air is maintained in any or all of the chambers, which circulation is induced by an exhaust means which creates a vacuum at the discharge end of the hot air and that portions of the material in the chambers will be discharged into adjacent chambers during the drying and agitating operation.

The invention having been set forth what is claimed as new and useful is:

1. A drier comprising a casing having a plurality of chambers therein, rotatable reels within said chambers, an air supply duct for said chambers and through which hot air passes to the chambers, means for controlling the flow of hot air to said chambers, an exhaust duct for said chambers, said exhaust duct being in communication with the chambers through auxiliary chambers, means for controlling the flow of air from the auxiliary chambers to the exhaust chamber, whereby the circulation of air within the chambers may be independently controlled, means whereby material will be transferred from one chamber to the other during the rotation of the agitating means, conveyor means extending

across the chambers adjacent the lower sides thereof and through which material from any of the chambers may be discharged and means for controlling the flow of material through said conveyor and from any of the chambers.

2. A drier comprising a casing having a plurality of round chambers therein, bladed agitators disposed within said chambers, a drive shaft on which said agitators are mounted, spokes carried by said agitators and inwardly set in relation to their sides, vertical partitions dividing said chambers, upwardly and inwardly extending hoppers carried by the partitions below the shaft and to the rear thereof and into which portions of the material being agitated will fall and be transferred to adjacent chambers, means for circulating hot air through said chambers, a hot air duct extending transversely above the chambers, damper control means whereby hot air from the duct may be admitted to any of the chambers in a position where material falling from the agitator will pass therethrough at the point of entrance into the chambers, an exhaust duct above the chambers, an auxiliary discharge passage above each chamber and damper control means between said auxiliary discharge passages and the exhaust duct.

3. A drier comprising a casing having a plurality of round chambers therein, bladed agitators disposed within said chambers, a drive shaft on which said agitators are mounted, spokes carried by said agitators and inwardly set in relation to their sides, vertical partitions dividing said chambers, upwardly and inwardly extending hoppers carried by the partitions below the shaft and to the rear thereof and into which portions of the material being agitated will fall and be transferred to adjacent chambers, means for circulating hot air through said chambers and a discharge conveyor extending transversely of the chambers and into which material from any of the chambers may be discharged independent of the other chambers.

4. A drier comprising a casing having a plurality of chambers therein, bladed agitators disposed within said chambers, a drive shaft on which said agitators are mounted, spokes carried by said agitators and inwardly set in relation to their sides, vertical partitions dividing said chambers, upwardly and inwardly extending hoppers carried by the partitions below the shaft and to the rear thereof and into which portions of the material being agitated will fall and be transferred to adjacent chambers, means for circulating hot air through said chambers, a hot air duct, damper control means whereby hot air from the duct may be admitted to any of the chambers in a position where material falling from the agitators will pass therethrough at the point of entrance into the chambers, an exhaust duct above the chambers, an auxiliary discharge passage above each chamber and damper control means between said auxiliary discharge passages and the exhaust duct.

DANIEL B. VINCENT.