May 23, 1939. H. PAXTON ET AL 2,159,047

METHOD OF AND APPARATUS FOR REMOVING SURFACE MOISTURE FROM ROLLABLE FRESH WHOLE FRUIT

Filed March 1, 1938 3 Sheets-Sheet 1

FIG. 1

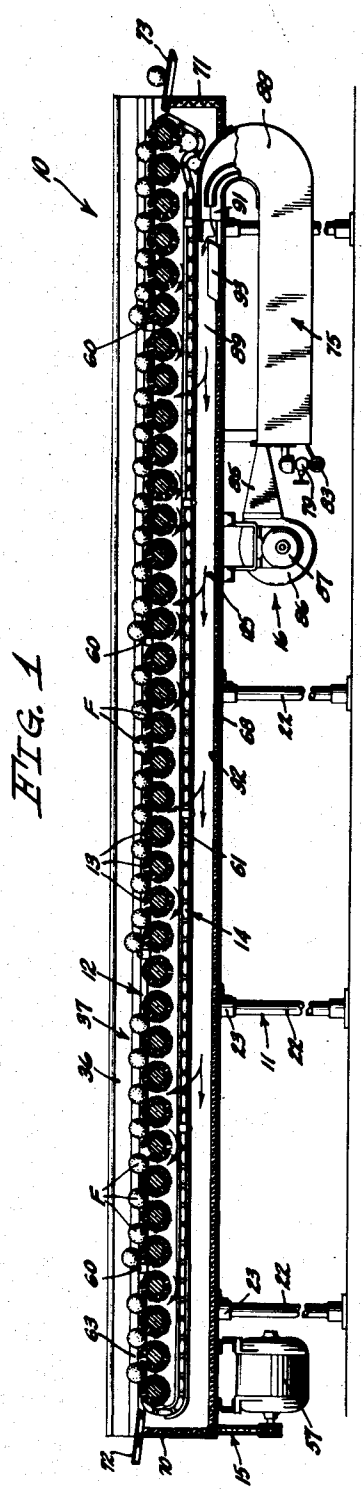
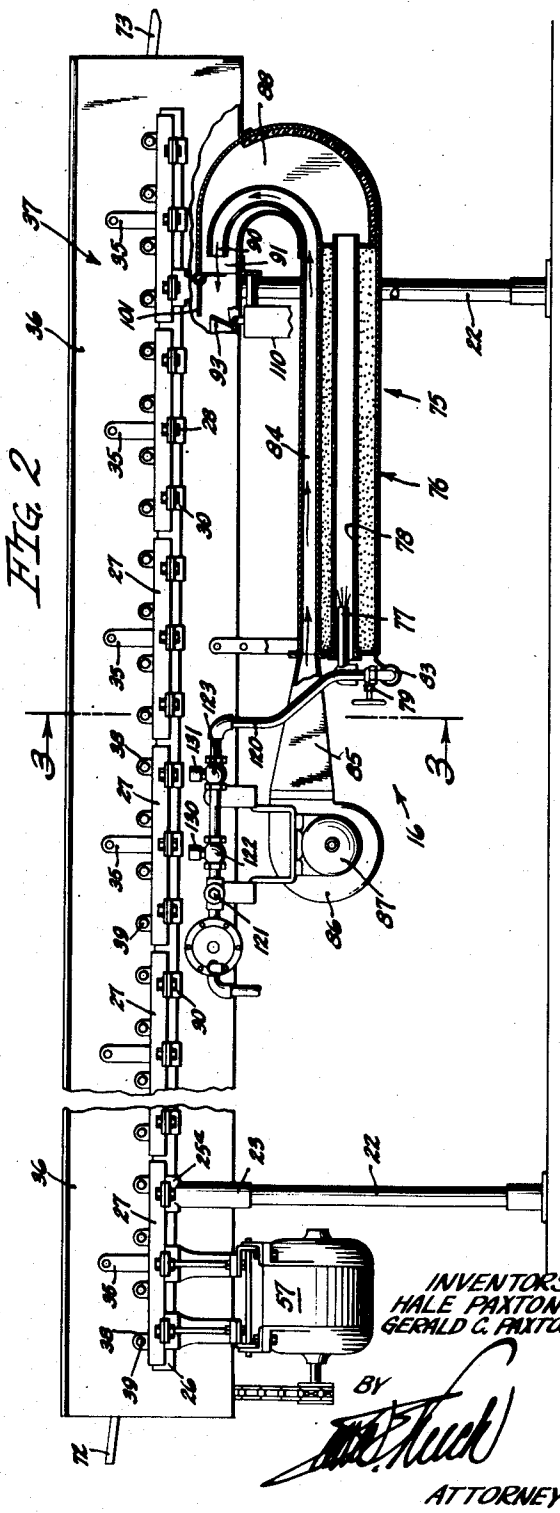


FIG. 2



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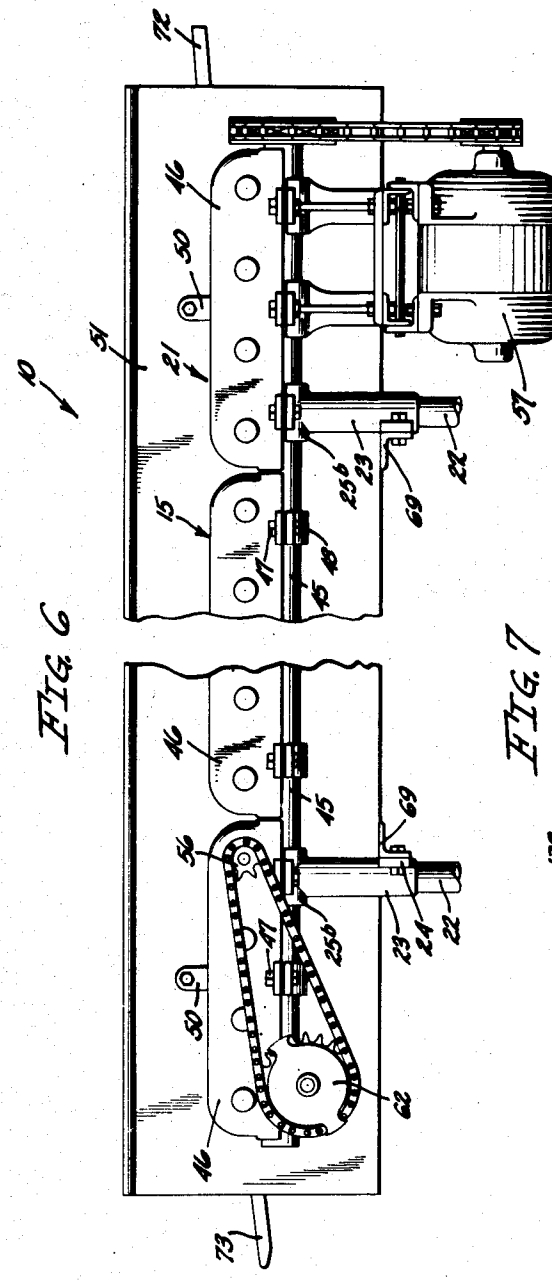


FIG. 6

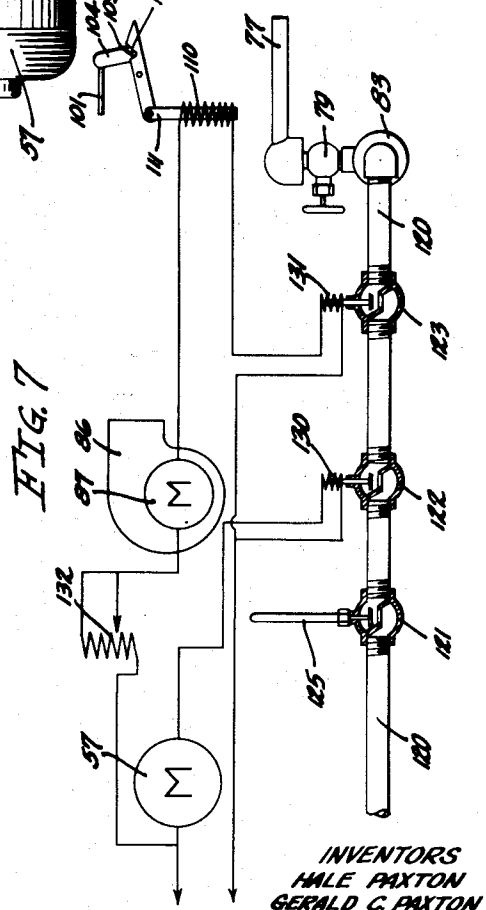


FIG. 7

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METHOD OF AND APPARATUS FOR REMOVING SURFACE MOISTURE FROM ROLLABLE FRESH WHOLE FRUIT

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FIG. 4

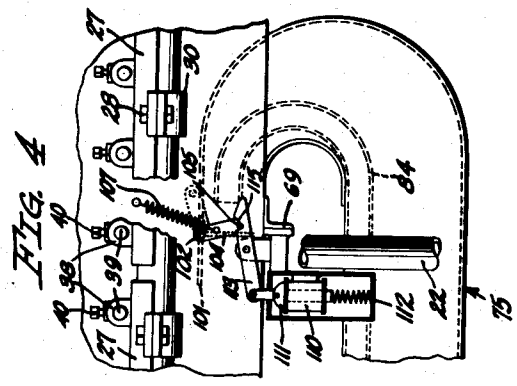


FIG. 3

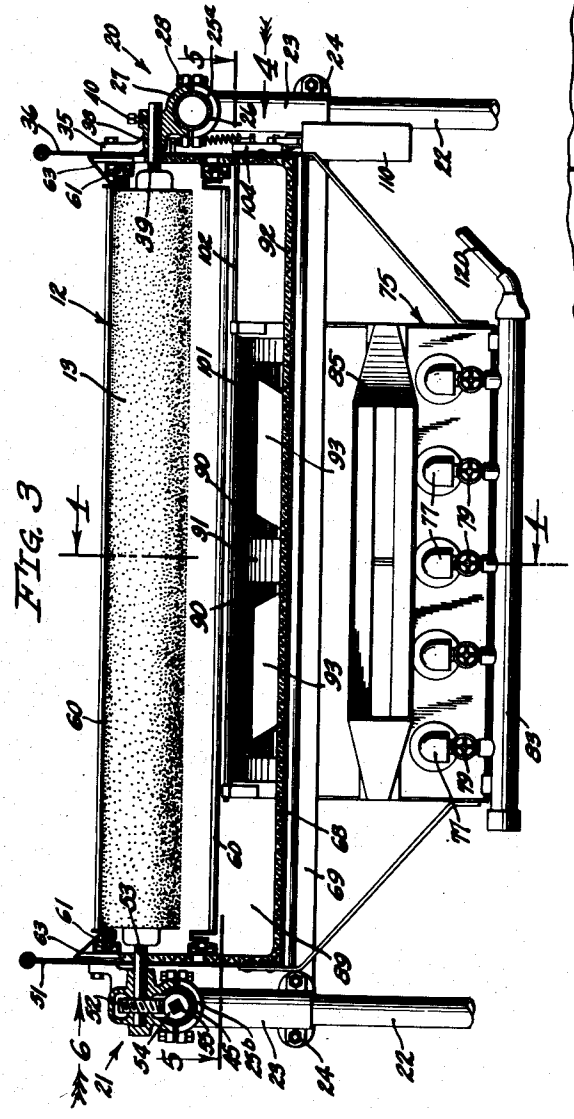
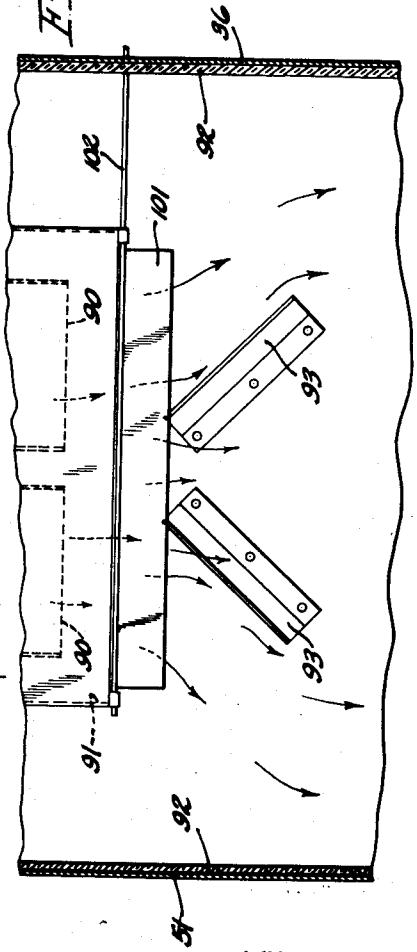


FIG. 5



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UNITED STATES PATENT OFFICE

2,159,047

METHOD OF AND APPARATUS FOR REMOVING SURFACE MOISTURE FROM ROLLABLE FRESH WHOLE FRUIT

Hale Paxton and Gerald C. Paxton, Santa Ana, Calif., assignors to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application March 1, 1938, Serial No. 193,308

7 Claims. (Cl. 34—12)

This invention relates to the art of commercially treating rollable fresh whole fruits in the process of preparing these for commercial shipment.

It is an object of this invention to provide a novel method and apparatus having substantially the same purpose yet embodying improvements over the Method of and apparatus for removing free water adhering to the outer surfaces of whole fresh fruit, disclosed in our copending application Ser. No. 61,182, filed January 28, 1936.

It is another object of this invention to provide a method and apparatus as aforesaid which is economical in the use of heat and is susceptible of ready control to adapt it to varying atmospheric conditions.

It is another object of our invention to provide an improved apparatus for removing surface moisture from rollable fresh whole fruit which is simple and compact in construction.

It is yet another object of our invention to provide such an apparatus in which brushes may be operated under relatively high temperatures without damaging the bristles thereof.

The manner of accomplishing the foregoing objects as well as further objects and advantages will be made manifest in the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a diagrammatic longitudinal sectional view of a preferred embodiment of the apparatus of our invention, the plane on which said sectional view is taken being indicated by the line 1—1 of Fig. 3.

Fig. 2 is a side elevational view of that portion of the apparatus shown in Fig. 1 which embodies the furnace and control means therefor.

Fig. 3 is an enlarged transverse sectional view taken on the line 3—3 of Fig. 2 and illustrating the furnace and the means for mounting and driving the brush rollers of the drier.

Fig. 4 is an enlarged detail side elevational view taken in the direction of the arrow 4 in Fig. 3 and illustrating the solenoid damper control of the apparatus of our invention.

Fig. 5 is a fragmentary horizontal sectional view taken on the line 5—5 of Fig. 3 and illustrating the hot air damper and distributing baffles of our invention.

Fig. 6 is a fragmentary side elevational view taken in the direction of the arrow 6 of Fig. 3 and illustrating the mechanism for driving the brush rollers and cleanout mechanism of the apparatus of our invention.

Fig. 7 is a wiring diagram illustrating the electric safety control system of our invention.

Referring specifically to the drawings, the apparatus of our invention is there seen to be embodied in a drier 10 which includes a frame 11, a bed 12 formed of rotary brushes 13, a cleanout mechanism 14 for propelling rollable fruit F over the bed 12, a drive mechanism 15 for driving the rollers 13 of the bed 12 and also operating the cleanout mechanism 14, and an automatically controlled furnace unit 16.

The frame 11 includes similar side assemblies 20 and 21, the first of these being referred to hereinafter as the idle side assembly and the second as the drive side assembly. Each of these assemblies has legs 22 and caps 23. Each of these caps has angle iron attaching ears 24 at its lower end. At their upper ends on the idle side of the drier these caps have pipe clamp bases 25a and, on the drive side, similar bases 25b.

Resting in the pipe clamp bases 25a is a longitudinal frame pipe 26 which is held in place by idle pin mounting blocks 27 which rest on top of the pipe 26 and are secured rigidly in place by bolts 28 which unite these blocks with the clamp bases 25a. Other bolts 28 unite the blocks 27 with individual clamp caps 30. Each of the blocks 27 has an arm 35, these arms supporting a sheet metal side wall 36 of a housing 37. Each block 27 also provides a plurality of supports 38 each of which has a bore in which an idle brush roller pivot pin 39 is adapted to be adjustably secured by a set screw 40. The pins 39 extend through suitable apertures formed in the side wall 36.

Resting in the clamp bases 25b is a frame pipe 45 which is held in place by gear housing blocks 46 which are secured by bolts 47 to the clamp bases 25b and to simple clamp caps 48. Each of the blocks 46 has an ear 50, the latter supporting a side wall 51 of the housing 37, and enclosing driven gears 52 which are mounted on individual roller drive shafts 53, and which extend through suitable openings in the pipe 45 to mesh with drive gears 54 provided on a square shaft 55 which extends throughout the length of the pipe and is supported in suitable bearings provided therein. One of the shafts 53 in the unit 46 near the discharge end of the drier 10 extends outwardly through that housing unit and has provided thereon a sprocket 56, the purpose of which will be made clear hereinafter.

The main drive shaft 55 extends from one end of the pipe 45 and has a sprocket and chain connection with a motor 57 by which this shaft is

rotated. Each of the individual roller drive shafts 53 is mounted on the same axis as the corresponding idle pin 39, one of the rollers 13 being mounted between this shaft and pin with its opposite ends supported thereby so as to be driven by that shaft 53. All of the brush rollers 13 are thus rotated by the motor 57 in the same direction as indicated by arrows in Fig. 1.

The cleanout mechanism 14 is preferably substantially like that shown in U. S. Letters Patent to Hale Paxton No. 2,099,226, issued November 16, 1937, this mechanism being driven by the sprocket 56 shown in Fig. 6. This mechanism includes cleanout rods 60 which are supported at their opposite ends by endless chains 61 which travel along suitable tracks supported on the inner faces of the housing walls 36 and 51, so that the upper flights of the chains 61 pass above the pins 39 and shafts 53 while the lower flights of these chains return to their starting point below these pins and shafts. As shown in the patent above referred to, the cleanout mechanism 14 includes an intermittent drive device 62 by which travel of the cleanout rods 60 is accomplished, each of the rods being shifted rapidly from above one of the brushes 13 until it is above the next adjacent brush and pausing for a second or two while located directly above each of the brushes. The purpose of the cleanout mechanism is to insure a positive flow of fruit through the drier 10.

The upper flights of the chains 61 and the tracks guiding these are covered by aprons 63 provided on walls 36 and 51, these aprons preventing contact of fruit F with the chain 61 while said fruit is resting on the brush rollers 13.

The housing 37 includes the side walls 36 and 51, the aprons 63 provided thereon and a floor 68 which covers the open space between the lower edges of these walls and is supported by angle iron cross members 69 which are bolted to the ears 24. The housing 37 also includes intake and discharge end walls 70 and 71 and intake and discharge transfer boards 72 and 73.

The furnace unit 16 includes a furnace 75 including a fire box 76 and a plurality of burners 77 discharging into clay combustion pipes 78 and having control valves 79, which are supplied with gas through a manifold 83. Connected with a draft conduit 84 in the upper portion of the fire box 76 is a discharge adapter 85 of a small blower 86 which is driven by motor 87, this preferably being of about one-sixth horsepower. Discharge of the gases of combustion from the fire box 76 is accomplished through a goose neck stack 88 which extends upwardly through the floor 68 into a hot air chamber 89 provided within this housing beneath the brush bed 12. The draft conduit 84 is divided into two Venturi nozzles 90 which curve upwardly within the goose neck stack 88 and terminate inside the mouth 91 of the stack.

The escape of heat from hot air chamber 89 is prevented by the provision of a layer of insulation 92 covering inner faces of those portions of the housing 37 surrounding that chamber. As shown in Fig. 1, the stack 88 discharges gases of combustion from the burners 77 and air from the blower 86 into the chamber 89 in a horizontal direction, this hot air being spread laterally somewhat so as to fill the entire chamber 89 by baffle plates 93.

The mouth 91 of the stack 88, as shown in Figs. 1 and 3, is pointed directly towards the opposite end of the chamber 89 from that into which this mouth discharges hot air.

Pivotally mounted so as to have an upper, open position and a downward position in which it closes the mouth 91, is a damper 101, this damper being mounted on and controlled by a rod 102 which extends outwardly through the wall 36 and has an arm 104 fixed on the outer end thereof, on the free end of which arm is provided a pin 105. Attached to this arm and to the wall 36 is a contractile spring 107 which continually urges the arm 104 in a direction tending to swing the damper 101 from open into closed position. Mounted upon the frame 11 is a solenoid 110 having an armature 111 which is yieldably urged upwardly by a spring 112. The upper end of the armature 111 connects to one end of a lever 113 which is pivotally fulcrumed on the frame 11 and has a notch 115 at its opposite end which notch engages the pin 105 and retains the damper 101 in open position when the armature 111 is drawn down, the latter being effected by the electrical energizing of the solenoid 110.

The gas manifold 83 is supplied with gas through a pipe 120, this supply pipe having three control valves, 121, 122 and 123, arranged serially therein. The control valve 121 is actuated by an adjustable thermostat 125 which extends into the hot air chamber 89 and increases or decreases the flow of gas to the furnace 80 so as to maintain the temperature in the chamber 89 at a pre-determined value. The valve 122 is controlled by a solenoid 130 which is connected in the electric circuit of the motor 57 so that if the supply of electricity for that motor should fail or the latter burn out, the valve 122 would automatically shut off the supply of gas to the furnace 75. The valve 123 is actuated by a solenoid 131 which is connected in series with the electric motor 87, with a rheostat 132 for controlling the speed of the latter, and with the solenoid 110. The solenoid 131 operates so that when said circuit is energized, the valve 123 is held open and the armature 111 of the solenoid 110 is held down against the action of the spring 112 so that when the damper 101 is open so as to bring the pin 105 within the notch 115 the pin is retained in this notch and the damper 101 is held open.

When this circuit fails, however, as by the electricity going off or by burning out of the motor 87, the valve 123 automatically closes thereby stopping all flow of gas to the furnace 75. At the same time the solenoid 110 relaxes its hold on the armature 111 permitting the spring 112 to lift this thereby freeing the pin 105 and allowing the spring 107 to immediately swing the damper 101 downwardly in a position to close the mouth 91 of the furnace stack 88.

Operation

The preferred manner of operating the drier 10 in carrying out the method of our invention is as follows:

The electric circuits of the blower motor 87 and of the drive motor 57 are first energized to cause the first of these motors to direct a blast of air through the draft conduit 84 and out of the Venturi nozzles 90 thereof and the other of these motors to rotate the rollers 13 and intermittently actuate the cleanout mechanism 14.

The energizing of the electric circuit of the motor 87 also energizes the solenoid 110 thereby causing it to draw downwardly upon the armature 111. As the damper 101 is always automatically closed when the drier 10 is shut down,

it is necessary now to swing the arm 104 downwardly to engage the lever 113 and rock this slightly permitting the pin 105 to come to rest in the notch 115 where it will be retained by the constant tension of the solenoid 110 on the lever 113. This opens the damper 101 and permits the blasts of air from the Venturi nozzles 90 to be projected through the mouth 91 of the stack 88 into the hot air chamber 89.

By opening up any desired number of the valves 79 and lighting the burners 77 controlled by these valves, the clay combustion pipes 78 in which these burners are disposed are filled with blasts of flame from these burners, the gases of combustion from which flames are discharged from the right hand end of these pipes into the stack 88. These gases of combustion are of a very high temperature which of themselves would be sufficient to burn the brushes 13 if allowed to rise upwardly thereagainst from the mouth 91 of the stack. The blast of air produced by the blower 86, however, dilutes these gases of combustion and gives these a velocity which carries the diluted mixture of air and combustion gases from the right hand end of the hot air chamber 89 clear to the left hand end of this chamber adjacent the fruit receiving end of the drier.

The method of our invention, as broadly set forth in our copending application above referred to, embraces the vigorous brushing of the fruit for a substantial period of time in the presence of heated air which is caused by virtue of its heated condition and at a rate produced thereby to flow over the fruit and the brush bristles employed in brushing the same. In the apparatus disclosed in said copending application, a relatively deep fire box was provided beneath the brush bed employed for brushing the fruit, and hot air and gases of combustion were produced in this fire box by burners located in the bottom of this. The present invention represents an effort to carry out said method with a less expensive apparatus with which equivalent conditions can be produced while at the same time giving a better opportunity for controlling these.

To supply the drier 10 with the necessary heat, the burners 77 of the furnace 75 are adapted to discharge into the stack 88 a mass of combustion gases at a temperature approaching that of the flames producing these. These gases have to be diluted somewhat to prevent their burning the bristles of the brushes 13 and they have to be given enough kinetic energy to cause them to flow throughout the length of the hot air chamber 89 so as to provide hot air available for rising convection currents at the left hand or receiving end of the drier 10 to give substantially the same effect in heating the bristles and the fruit which is obtained at the right hand or discharge end of the drier. The regulation of the speed of the motor 87 by the rheostat 132, see Fig. 7, permits the application of a blast of air of just the right magnitude to the gases of combustion flowing through the mouth 91 of the stack 88 to give the above result.

Thus in the drier 10, it is possible to obtain, by proper choice of the number of burners 77 which are ignited, the extent to which the valves of these burners are opened, and the speed at which the motor 87 is run, to cause with an absolute minimum of heat losses, the maintenance of the optimum temperatures of the air adjacent the bristles of the brushes and the fruit resting thereon throughout the length of the drier 10.

The thermostat 125 extends into the hot air chamber 89 on the axis of the control valve 121, as shown in Figs. 1 and 2, this thermostat lying constantly in the stream of hot air flowing through the chamber 89. As this thermostat is adjustable, it can be set to maintain a desired temperature in the air stream at this point. The adjustment of the speed of the blower motor and the burners 77 of the furnace 75 are necessary to insure that a sufficient volume of hot air is produced and that this is given a sufficient velocity to insure that the stream of air passing the thermostat 125 at the desired temperature is adequate to supply upwardly rising convection currents of hot air for the entire distance between the thermostat 125 and the fruit receiving end of the drier.

As described hereinabove, the damper 101 is controlled by the solenoid 110 so that this damper is automatically closed whenever the blower motor 87 fails. This automatic control is necessary to protect the brushes 13 located in the vicinity of the stack mouth 91 from destruction by the excessive heat of the combustion gases normally discharged upwardly through the stack into the hot air chamber 89.

Failure of the power circuit of the blower motor 87, however, also closes gas valve 123 by deenergizing the solenoid 131. This shuts off the supply of gas to the furnace 75 so that the burners 77 are immediately extinguished. Thus, the furnace 75 will eventually cool down so that no damage will be done to the furnace by the closing of the stack by the damper 101.

In ordinary practice it is preferable that a minimum temperature of 135 degrees Fahrenheit be maintained in the air stream as this emerges from the mouth 91 of the furnace 75.

What we claim is:

1. In a drier for fresh whole fruit the combination of: a relatively long and substantially horizontal bed of rotary brushes; means for continuously rotating said brushes to rotate and brush fruit resting thereupon; a housing for enclosing a relatively shallow chamber coextensive horizontally with said bed and disposed therebeneath, said housing so confining air in said chamber as to permit said air to escape therefrom in practically no other way than upwardly between and through said rotary brushes; and means for supplying a stream of hot air to one end of said chamber at a rate to compensate for loss of hot air from said chamber caused by convection currents carrying said air up through and between said brushes, and being, therefore, sufficient to keep said chamber filled with said hot air despite said losses.

2. In a drier for fresh whole fruit the combination of: a relatively long bed of rotary brushes disposed transversely with the path of travel of said fruit through said drier; means for continuously rotating said brushes to rotate and brush fruit resting thereupon and to assist fruit in travelling from the receiving end to the discharge end of said drier; a housing for enclosing a relatively shallow chamber coextensive horizontally with said bed and disposed therebeneath, said housing so confining air in said chamber as to practically prevent the escape of said air from said chamber otherwise than upwardly between and through said transverse rotary brushes; and means for supplying a stream of hot air to one end of said chamber beneath the discharge end of said drier, said stream being of such a volume and rate of flow as to compensate for the losses of hot

air from said chamber caused by convection currents carrying said hot air up through and between said brushes, and being, therefore, sufficient to keep said chamber filled with hot air despite said losses.

3. In a drier for fresh whole fruit the combination of: a relatively long and substantially horizontal bed of rotary brushes; means for continuously rotating said brushes to rotate and brush fruit resting thereupon; a housing for enclosing a relatively shallow chamber coextensive horizontally with said bed and disposed therebeneath, said housing so confining air in said chamber as to permit said air to escape therefrom in practically no other way than upwardly between and through said rotary brushes; and means for supplying a stream of hot air and directing said stream substantially horizontally into one end of said chamber in the direction towards the opposite end of said chamber, said stream being supplied in such a volume and with such a velocity as to compensate for loss of hot air from said chamber caused by convection currents carrying said air up through and between said brushes, and being, therefore, sufficient to keep said chamber filled with said hot air despite said losses.

4. In a drier for fresh whole fruit the combination of: a relatively long bed of rotary brushes disposed transversely with the path of travel of said fruit through said drier; means for continuously rotating said brushes to rotate and brush fruit resting thereupon and to assist fruit in travelling from the receiving end to the discharge end of said drier; a housing for enclosing a relatively shallow chamber coextensive horizontally with said bed and disposed therebeneath, said housing so confining air in said chamber as to practically prevent the escape of said air from said chamber otherwise than upwardly between and through said transverse rotary brushes; and means for supplying a stream of hot air to one end of said chamber beneath the discharge end of said drier, said stream being of such a volume and rate of flow as to compensate for the losses of hot air from said chamber caused by convection currents carrying said hot air up through and between said brushes, and being, therefore, sufficient to keep said chamber filled with hot air despite said losses, said stream of hot air being directed into said chamber substantially horizontally and pointed in a direction towards the receiving end of the drier.

5. In a drier for fresh whole fruit the combination of: a substantially horizontal bed of rotary brushes; means for continuously rotating said brushes to rotate and brush fruit resting thereupon; a housing for enclosing a chamber beneath said bed, said housing so confining air in said chamber as to permit said air to escape therefrom in practically no other way than through said rotary brushes; furnace means having a fire box and disposed beneath said housing; a stack leading from the fire box of said furnace means and discharging into said chamber beneath said brush bed; blower means for directing a blast of air into said stack, the air so introduced diluting the combustion gases in said stack, reducing the temperature thereof and propelling said combustion gases into said chamber; and damper means automatically closing the discharge mouth of the aforesaid stack when said blower ceases to operate.

6. A method of removing surface moisture from whole fresh fruit which comprises subjecting said fruit to a vigorous brushing action within a certain area in a given substantially horizontal plane, then propelling a current of hot air substantially horizontally from one edge of said area and beneath said plane towards an opposite edge of said area so as to provide quantities of said hot air throughout the space immediately below said brushing area, and permitting said hot air to rise upwardly under the impulse of convection currents produced by buoyancy of said air resulting from its elevated temperature so that said hot air flows over the surface of said fruit and the bristles employed in said brushing action.

7. A method of removing surface moisture from whole fresh fruit which comprises subjecting said fruit to a vigorous brushing action within a certain area in a given substantially horizontal plane, confining a space directly beneath said area and propelling into said space adjacent one edge of said area, a stream of hot air just sufficient in volume and velocity to carry said stream to the opposite edge of said area and replenish losses from said stream caused by convection currents of said hot air rising from said stream to flow over the surfaces of said fruit and of the bristles brushing said fruit.

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