

G. H. BENJAMIN.

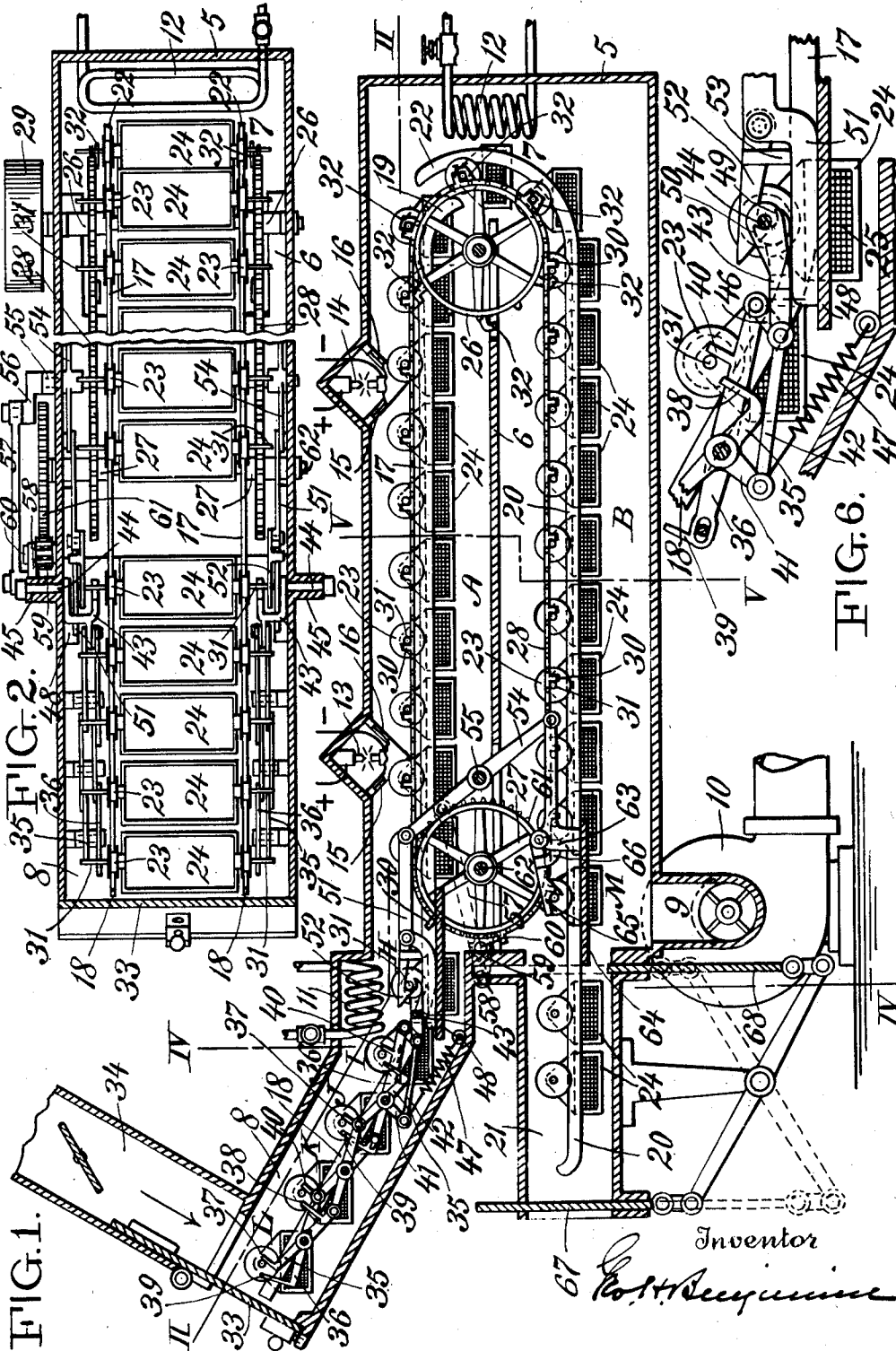
METHOD OF AND APPARATUS FOR DRYING FRUITS, VEGETABLES, AND OTHER SUBSTANCES.

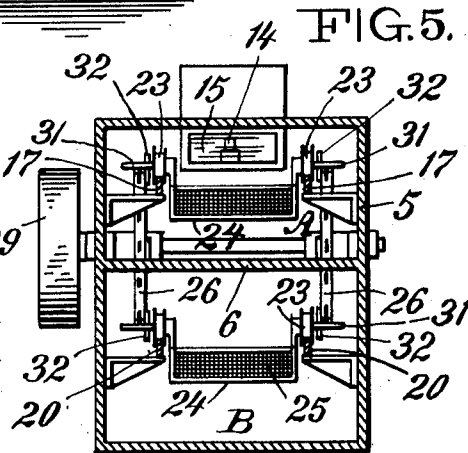
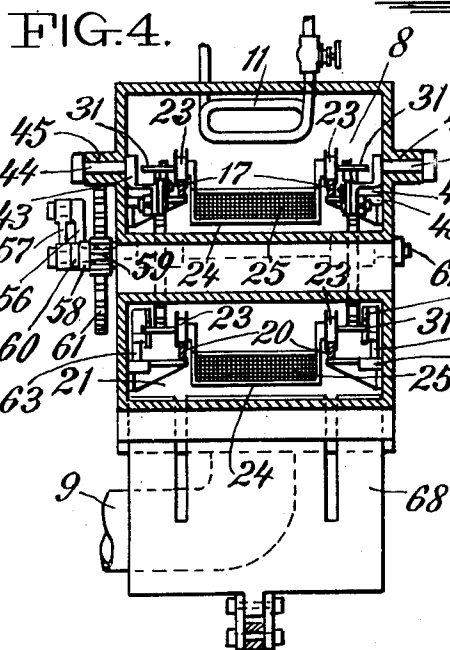
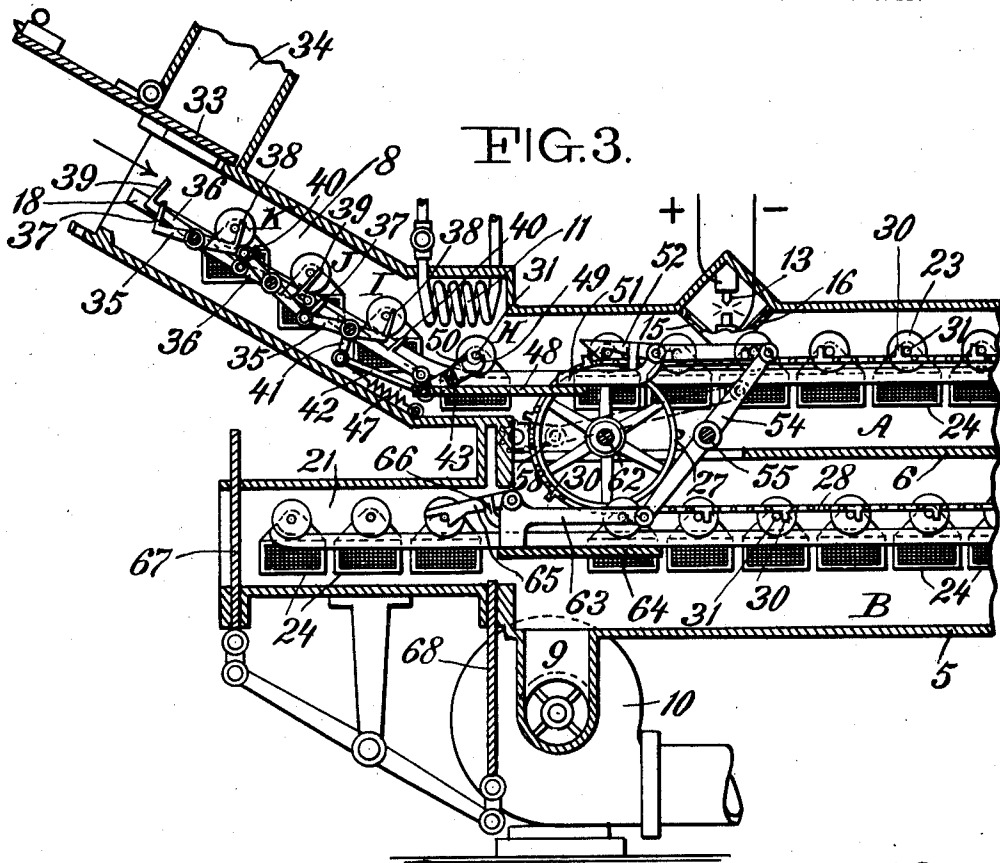
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1,339,092.

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2 SHEETS—SHEET I.





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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR DRYING FRUITS, VEGETABLES, AND OTHER SUBSTANCES.

1,339,092.

Specification of Letters Patent.

Patented May 4, 1920.

Application filed April 16, 1917. Serial No. 162,252.

To all whom it may concern:

Be it known that I, GEORGE HILLARD BENJAMIN, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Drying Fruits, Vegetables, and other Substances, of which the following is a specification.

Many bodies which it is desired to dehydrate, cannot be successfully handled by placing such bodies upon fixed trays or moving belts and subjecting them to moving air currents and for the following reasons:

Where the body to be treated is in a finely divided or comminuted form, the air currents pick up the body and either carry it out of the apparatus, or deposit it in situations in the apparatus, where its accumulation is objectionable.

Where the material acted upon is one which, during treatment, exudes its moisture and becomes gummy, it usually packs, where trays are used, and where moving belts are used, spreads over the edges of the belts and gums them up, interfering with the action of the belts and the apparatus as a whole.

To avoid the above objections, as well as others, I have designed the apparatus illustrated and described in this specification, and which consists essentially of an inclosing casing divided into two horizontal zones communicating at one end, a system of supporting rails carried through the zones, a series of baskets adapted to move over the rails, means for moving the baskets progressively through the zones over the rails, and means for causing heated air currents to be delivered into the apparatus, move through the zones and out of the apparatus.

In the dehydration of many substances, it is found that where the body acted on is subjected to heated air currents, the exudation of water is very rapid when the body is first subjected to the air currents, but decreased as the body is moved through the apparatus, usually for two reasons: First, because the air currents transmitted through the apparatus are usually decreased in temperature from the inlet to the outlet of the apparatus, owing to the rapid absorption of moisture from the body acted on, and second, because the rapidity of exudation of

the body acted on by a given temperature is decreased progressively in time.

In order to avoid the objections above stated, I arrange to boost the temperature of the air currents after they have passed over the body traversing the upper zone of the apparatus and before traversing the lower zone. By this means I preserve the absorbing capacity of the introduced air currents uniform throughout the apparatus, or I may increase the temperature and the absorbing value of the air currents transmitted over the lower zone, in accordance with the decrease in the exudation of water from the body acted on as it passes through the lower zone. It has further been observed that in subjecting bodies to the action of dehydrated air in an inclosure in which the hot air is introduced in one zone and drawn out at another, that the air as it absorbs moisture decreases in specific gravity and accumulation in the top of the apparatus. Further, that such air, *i. e.*, moisture saturated or partially saturated, becomes in a sense dead; that is, decreases in molecular velocity. By experiment I have discovered that if such moisture laden air is caused to pass within the influence of the rays transmitted from an electric light, that such rays will impart molecular motion to the moisture laden air, and that the degree of molecular motion or its character may be variously modified by means of screens, which act to diminish the light transmitted, or vary the color of the light. I have further discovered that by varying the light and the color of the light, the physical effects of the light upon the material under treatment may be varied, thus the degree of exudation per unit of temperature and time may be varied; the color of the material may be altered; the character of the gases evolved from the material under treatment may be changed; the physiological effects of the materials of which the body acted on is composed, may be varied; thus, for instance, the conversion of reserve food products into sugar, maltose and the like, may be effected, and very many other results obtained which are not possible where the body is subjected only to heat and moisture, the effects in some cases being due to the catalytic effects of the light rays.

The accompanying drawings will serve to illustrate the general features of an apparatus which embody my invention and through which my improved method may be carried into effect, in which Figure 1 is a vertical section; Fig. 2 a horizontal section taken on the line II—II of Fig. 1; Fig. 3 a vertical section corresponding to Fig. 1 showing the parts in a different position; Fig. 4 a transverse section on the line IV—IV of Fig. 1; Fig. 5 a transverse section on the line V—V of Fig. 1, and Fig. 6 an enlarged view of parts of the mechanism for feeding the baskets to the apparatus.

In the drawings, 5 represents a suitable casing arranged horizontally. In this casing, and about midway of the vertical height, is a partition 6. This partition extends from the left hand end of the casing toward the right hand end, but leaving a space indicated by 7, by which the two horizontal zones marked respectively A and B within the casing, communicate. The zone A of the casing, communicates with an inlet air passage 8; zone B of the casing with the eduction orifice 9 of a blower 10. The air drawn into the casing through 8, passes through the zone A by passage 7 to zone B, and out through the blower 10.

Situated in zone A is a steam coil or other form of supplemental heater 11, and situated in the space 7 between the zones A and B, is a steam coil or other form of supplemental heater 12. Situated in the zone A are electric lights 13 and 14, spaced along the casing. Below these lights are arranged screens 15 and 16. These screens are removable and can be formed of any material and of any color as desired, according to the effect it is desired to obtain through the electric lights and the screens.

Situated in the zone A, and about midway, are a pair of rails 17. The left hand ends of these rails extend into the passage way 8 and coact in a manner hereafter described with a pair of inclined rails 18 in such passage way. The right hand ends of the rails 17 are turned downward as shown at 19. Situated in the zone B, are a pair of rails 20. The left hand ends of these rails extend into a passage way 21. The right hand ends of these rails are turned upward as shown at 22, and in such manner that they will lap the right hand ends 19 of the rails 17, in the zone A, but leave a sufficient distance between them for the passage of the wheels carrying the baskets, as will hereafter be explained.

Arranged to move over the rails 17, 18 and 20 through rollers 23, are baskets 24. These baskets are preferably formed of a reticulate material 25, so as to allow the air currents and light to penetrate the material in the baskets. The baskets are designed to move progressively through the apparatus,

being introduced through the passage way 8 into the zone A, then passing downward to move through the zone B, and out of the apparatus through the passage way 21.

Very many devices may be employed to effect the progressive movement of the baskets through the apparatus. That employed consists in a pair of sprocket wheels 26—27, carrying an endless chain 28 driven by pulley 29. The endless chain 28 is provided with spaced projections 30 adapted to coact with horizontal axles 31 on which the rollers 23 rotate, and thus as the chain moves forward it moves the baskets forward through the zone. When the rollers reach the end of the rails 17, they are received in hooked projections 32 on wheel 26 and thus carried downward to be delivered upon rails 20 and move over rails 20 toward the left to be delivered into the passage way 21. Movement of the baskets along the rails 17 from left to right, and along the rails 20 from right to left, is, as above described, provided by the sprocket wheels and chain. Movement of the baskets into the zone A and on to the rails 17 and out of the zone B into the passage 21, is provided by the following described mechanism: At the left hand end of the passage 8 is a pivoted door 33 which, when closed, takes the position shown in Fig. 1, closing the passage 8 and opening the passage 34 from the air supply, and when open, takes the position shown in Fig. 3, opening the passage 8 and closing the passage 34 from the air supply. Arranged within the passage 8 are the rails 18.

When the basket with its rollers is introduced into the passage 8, the basket tends to move by gravity down the rails 18 and on to the rails 17. To provide that the motion downward shall be a step by step motion, there are provided two sets of checking levers 35—36, pivoted to the side frame of the casing on each side of the rails 18. These levers are provided with upwardly projecting members 37—38—39—40 which coact with the horizontal axles 31. The lower lever of each of the series 35 is provided with a bell-crank extension 41, which is connected by a link 42 to a lever 43 having a horizontal shaft 44 which is journaled in a bearing 45. The lower lever of each of the series 36 is connected by a link 46 to the lever 43. By means of a spring 47 connected to bell-crank 41 and acting on link 42, the lever 43 is moved to rest against a stationary support 48, thereby causing the levers 35 and 36 to be moved to the position shown in Fig. 3. When lever 43 is in this position, the axle 31 of a basket H rests against an upwardly extending arm 49 of a U-shaped extension of lever 43, the axle 31 of a basket I rests against the projection 38 of one of the levers 35; the axle 31 of a basket J rests against the projection 39 of

one of the levers 36; and the axle 31 of a basket K rests against the projection 38 of one of the levers 35. The other arm 50 of the U-shaped extension of lever 43 extends upward in line with the side of axle 31 opposite to that of arm 49. The center of the axle 31 of basket H stands in line with the center of shaft 44.

Mounted on each support 48 is a reciprocating slide 51 having a hook pawl 52 pivoted thereto and supported by means of a stop 53. When slide 51 moves toward the left, it moves under the lever 43, thereby causing movement of the lever and parts connected thereto from the position shown in Fig. 3 to the position shown in Figs. 1 and 6. This movement of lever 43 causes movement of arm 49 downward away from axle 31, and upward movement of arm 50 against the axle 31, thereby holding the axle during movement of the hook pawl 52 into engagement with the axle. By reference to Fig. 1, it will be seen that the axle of basket I has moved to rest against the projection 40 of one of the levers 36; the axle of basket J has moved to rest against the projection 37 of one of the levers 35, and the axle of basket K has moved to rest against the projection 40 of one of the levers 36. A basket L may have been introduced and its axle brought to rest against the projection 37 of one of the levers 35. When in this position, the horizontal axles 31 are caught by hook pawls 52 and drawn to the right, on to the rails 17, and into a position to cooperate with the upward projections 30 on the chain 28. The movement of the hook pawls 52 and slides 51 to the right, is effected by means of levers 54 secured to a shaft 55, when connected through an arm 56 and a link 57 connected to a crank arm 58 forming part of a small gear wheel 59 which rotates on a short shaft 60. Gear wheel 59 is in mesh with a large gear wheel 61 secured to the shaft 62 to which the chain wheel 27 is secured. The relation of the gears 59 and 61 is such that when the gear 61 makes one sixth of a revolution, the pawl 52 will be moved from the position shown in Fig. 3 to the position shown in Fig. 1, and back to the position shown in Fig. 3, carrying a basket so that its axle stands in front of a projection 30 of chain 28. The oscillating movement of levers 54 also causes reciprocating movement of slides 63 on stationary supports 64. Pivoted on each slide 63 is a pawl 65 which is supported by means of a stop 66, which, when a basket reaches the position M in zone B, takes against the horizontal axle 31 and pushes the basket to the left into the passage way 21. 67—68 represent sliding doors which control the passage way 21.

The operation of the device is as follows: The door 33 having been closed, heated air from any desired source is transmitted

through the passage 34 into the passage 8, through zone A, to passage 7, through zone B to ejection orifice 9 of the blower 10. As the air passes through the apparatus, the supplemental heat may be imparted to it by the coils 11 or 12 or both, as may be desired. At the same time the electric current is turned on to the electric lights 13 or 14 or both, the wheels 26—27 set in motion whereby the baskets 24 will be fed step by step to the passage 8 and progressively moved through the zones A and B to be delivered out of the apparatus through the passage way 21, the door 67 at such time being open and the door 68 closed. The object of using the doors, 33, 67 and 68 is to prevent ingress of atmospheric air into the apparatus during the time the baskets are fed into and out of the apparatus.

It will be observed that the air introduced into zone A is the hottest and therefore has the greatest absorbing capacity for moisture, and the air passing through zone B is the coolest and has the least capacity for absorbing moisture; that is, supposing the supplemental heater 12 is not in use. By means of supplemental heater 12, air passing from zone A to zone B can be brought to the original temperature or boosted above the original temperature, so that its absorbing capacity for moisture in zone B is greater than in zone A. It will be further observed that by means of the electric lights in zone A (and similar lights may be placed in zone B if desired) the molecular velocity with the molecules of the air current may be increased over that normal to the molecules at the temperature originally given to the molecules. Further, the chemical or catalytic effect of the light may be exerted on the material under treatment during the whole time that the material is passing through the zone A, and by the use of similar supplemental apparatus, through the zone B.

Having thus described my invention, I claim:

1. The method of partially dehydrating bodies, which consists in subjecting them to the simultaneous action of radiant heat, electric light rays of controlled intensity, and a moving drying medium having a controlled temperature and humidity.

2. The method of partially dehydrating bodies, which consists in subjecting the portion of the body having the greatest amount of moisture to the action of air currents having an initial temperature and percentage of humidity, then heating said air currents to compensate for the loss of temperature occurring in passing over such portion of the body, and then transmitting the same air currents over another portion of the body having the least amount of moisture.

3. The method of partially dehydrating

bodies, which consists in causing heated air currents to pass over the body and within the influence of electric light rays, then boosting the temperature of the air currents, and finally causing the boosted air currents to pass over a similar body under treatment.

4. The method of increasing the molecular velocity of heated air currents carrying water, over the original velocity of such heated air currents carrying a less amount of water, which consists in causing the heated currents carrying the larger amount of water to pass within the influence of electric light rays.

5. In an apparatus of the class described, the combination of an inclosing casing, a horizontal partition for dividing the apparatus into two sections, means for feeding heated air into one of said sections, means for discharging the heated air from the other of said sections, and means for projecting electric light rays into the moving heated air, whereby the molecular velocity of the heated air during the time it is traversing such sections, is increased.

6. In an apparatus of the class described, the combination of an inclosing casing, a horizontal partition for dividing the apparatus into two sections, means for feeding heated air into one of said sections, means for discharging heated air from the other of said sections, means for maintaining the temperature of the heated air when pass-

ing through the apparatus and for radiating heat rays, and means for increasing the velocity of the molecules of the heated air during the time the body of heated air is traversing said sections.

7. In an apparatus of the class described, the combination of an inclosing casing, a horizontal partition for dividing the apparatus into two sections, a passage way connected to the upper section, a passage way connected to the lower section, doors controlling said passage ways, an air supply duct connected to the upper passage way, an exhaust blower connected to the lower section, and means interposed between the two sections at the end of the apparatus for imparting heat to air currents passing through the sections.

8. In an apparatus of the class described, the combination of an inclosing casing, a horizontal partition for dividing the apparatus into two sections, a pair of rails in each section, a series of baskets adapted to move over said rails, together with means for moving said baskets progressively over said rails and through said sections.

In testimony whereof, I affix my signature in the presence of two witnesses.

GEORGE HILLARD BENJAMIN.

Witnesses:

HELEN E. KOELSCH,
LESTER BEARDSLEY.