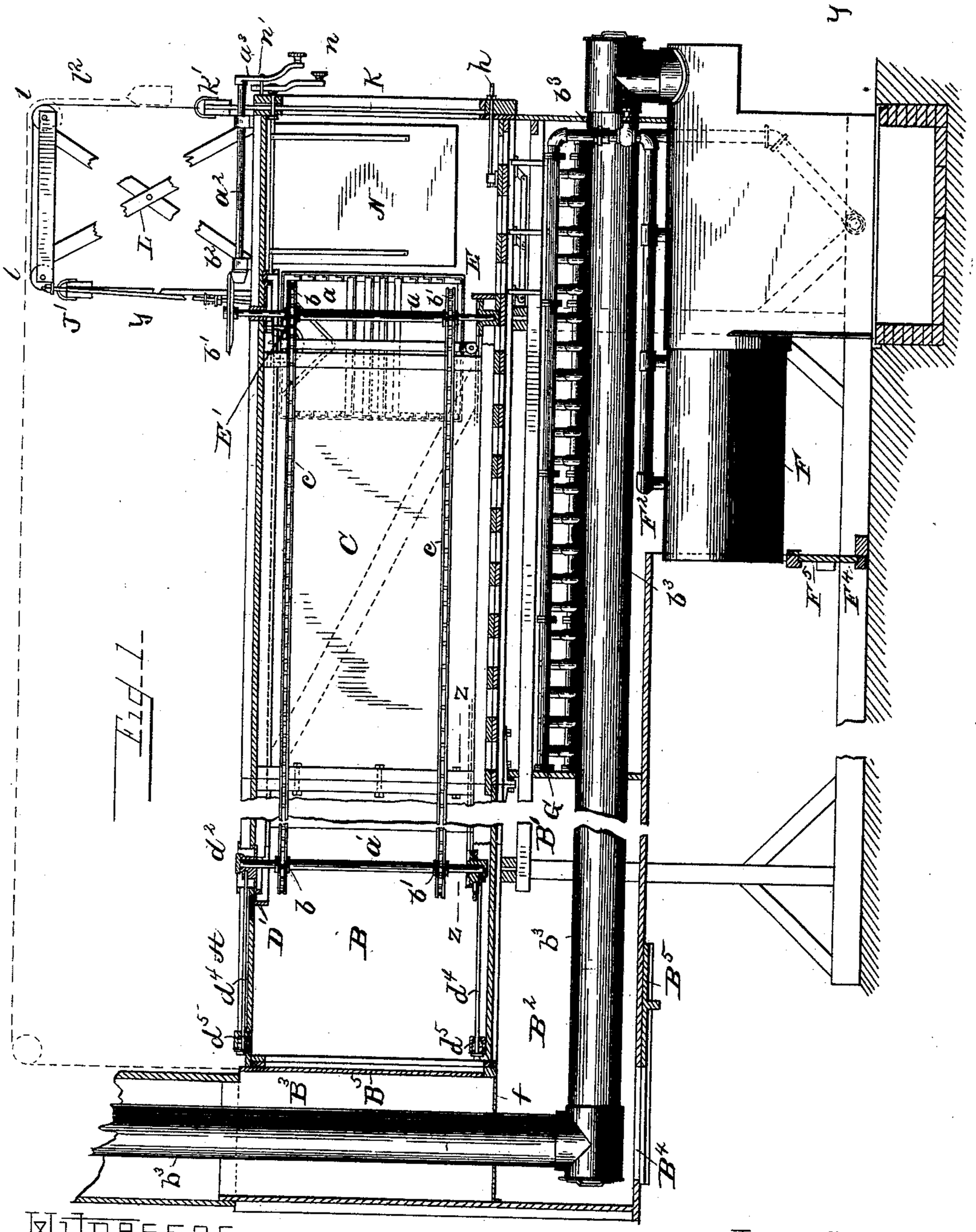
(No Model.)

4 Sheets—Sheet 1.

G. & F. FRICK.

DRIER FOR FRUIT.

No. 414,206. Patented Nov. 5, 1889.



Witnesses

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(No Model.) 4 Sheets—Sheet 2.

G. & F. FRICK.

DRIER FOR FRUIT.

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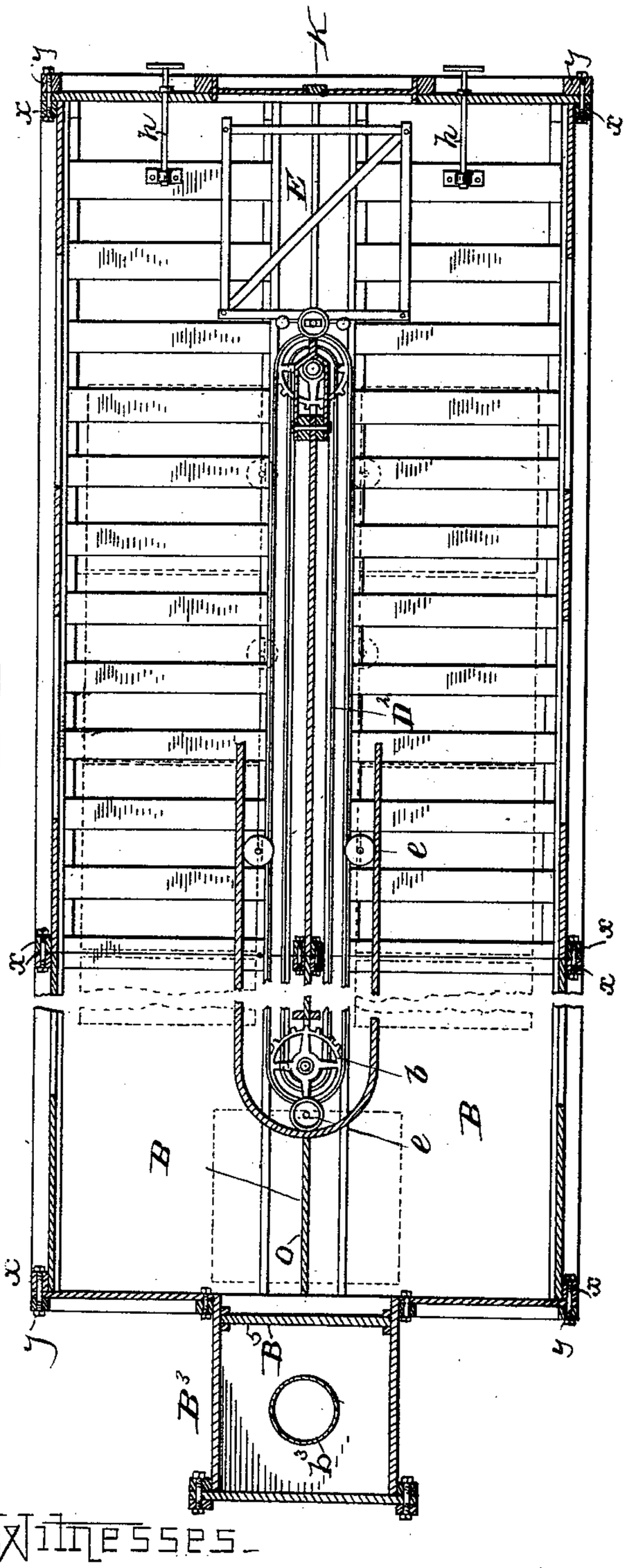

FIG. 2.

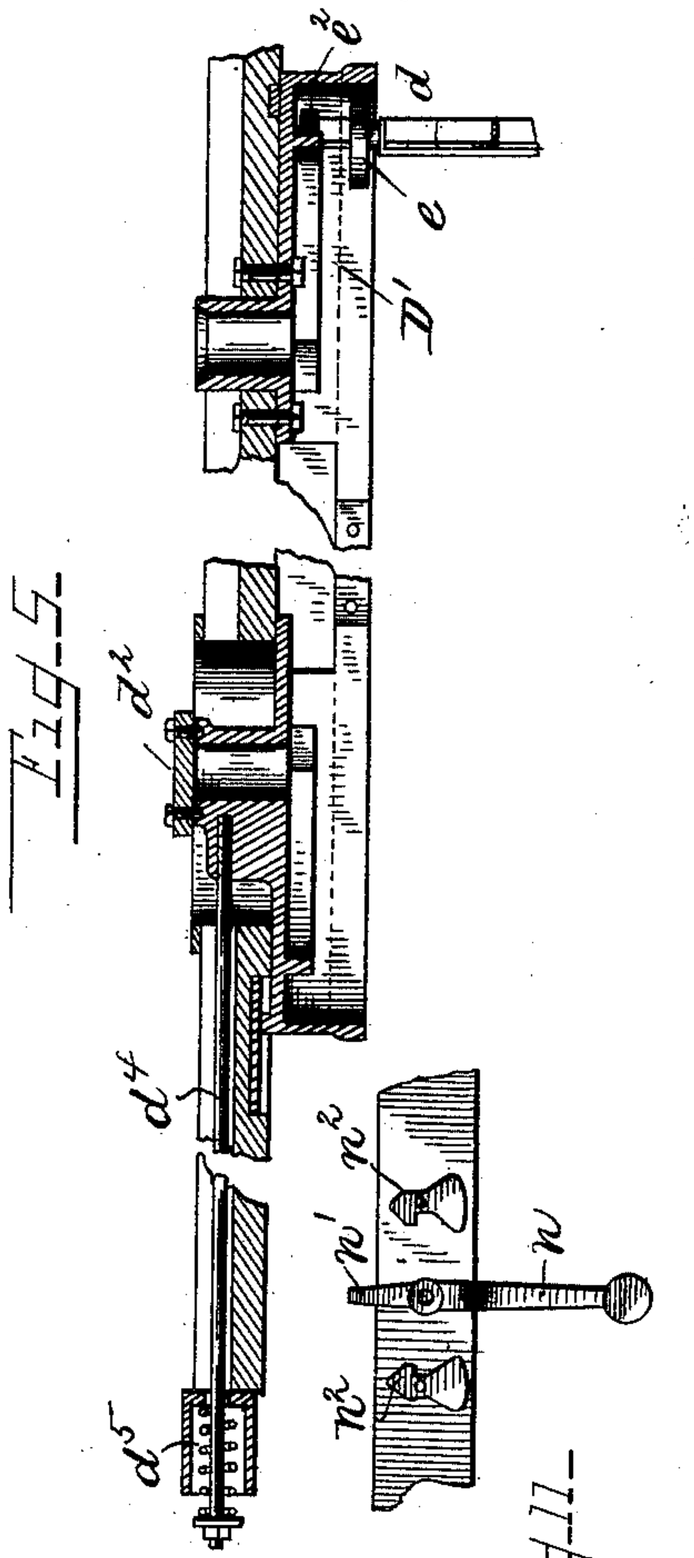

FIG. 3.

FIG. 4.

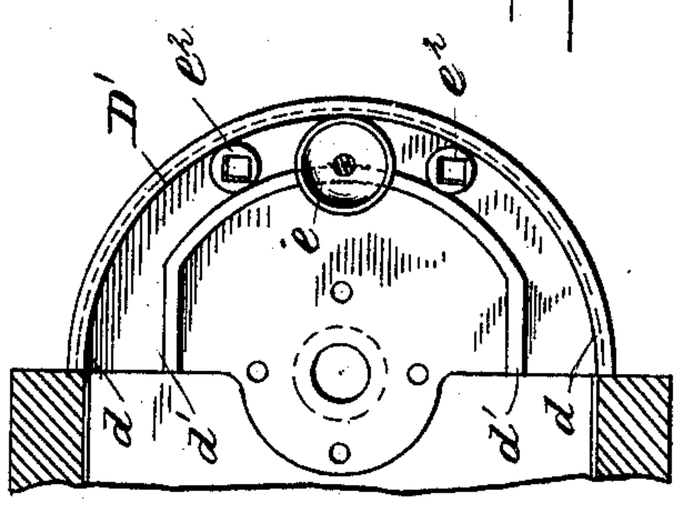

FIG. 5.

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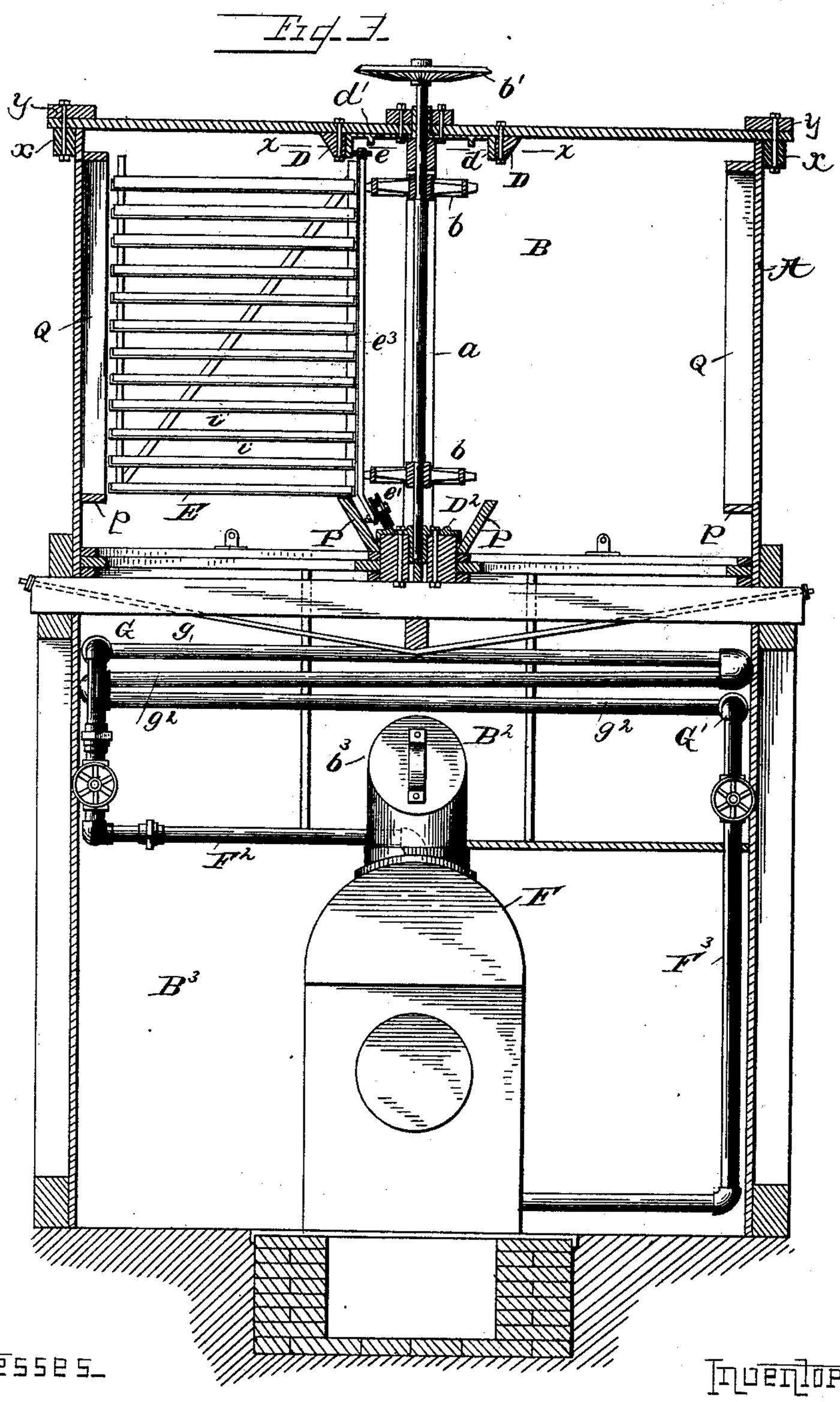
(No Model.) 4 Sheets—Sheet 3.

G. & F. FRICK.

DRIER FOR FRUIT.

No. 414,206. Patented Nov. 5, 1889.

Fig. 3.



Witnesses.

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(No Model.) 4 Sheets—Sheet 4.

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DRIER FOR FRUIT.

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Fig. 1.

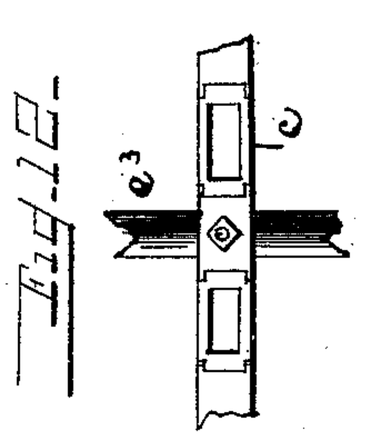


Fig. 8.

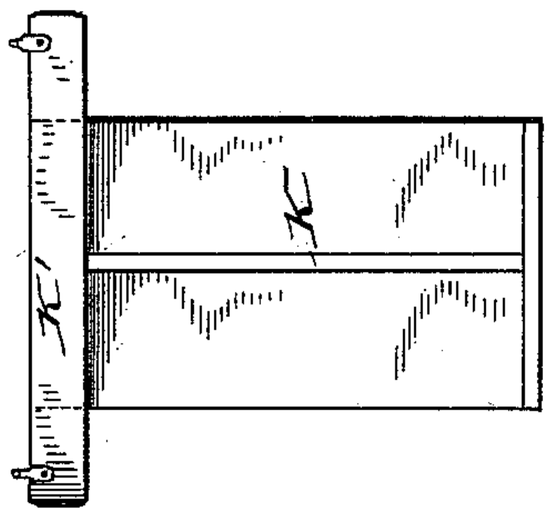


Fig. 4.

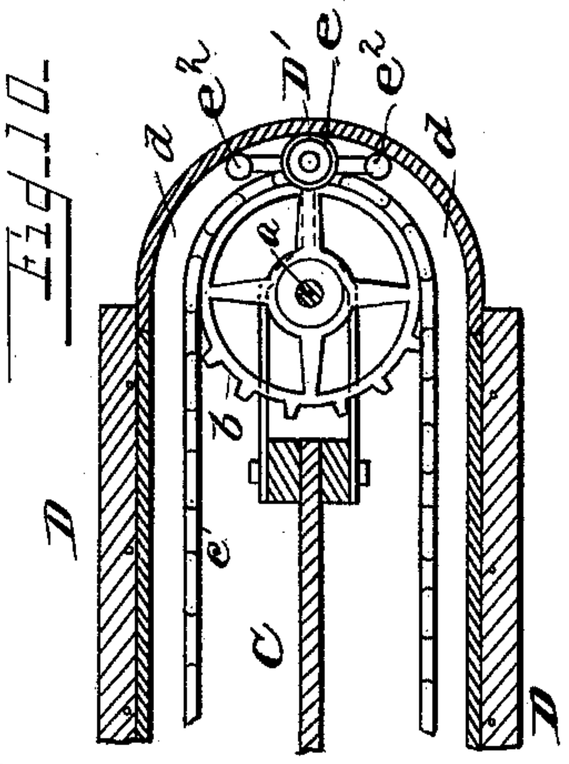


Fig. 6.

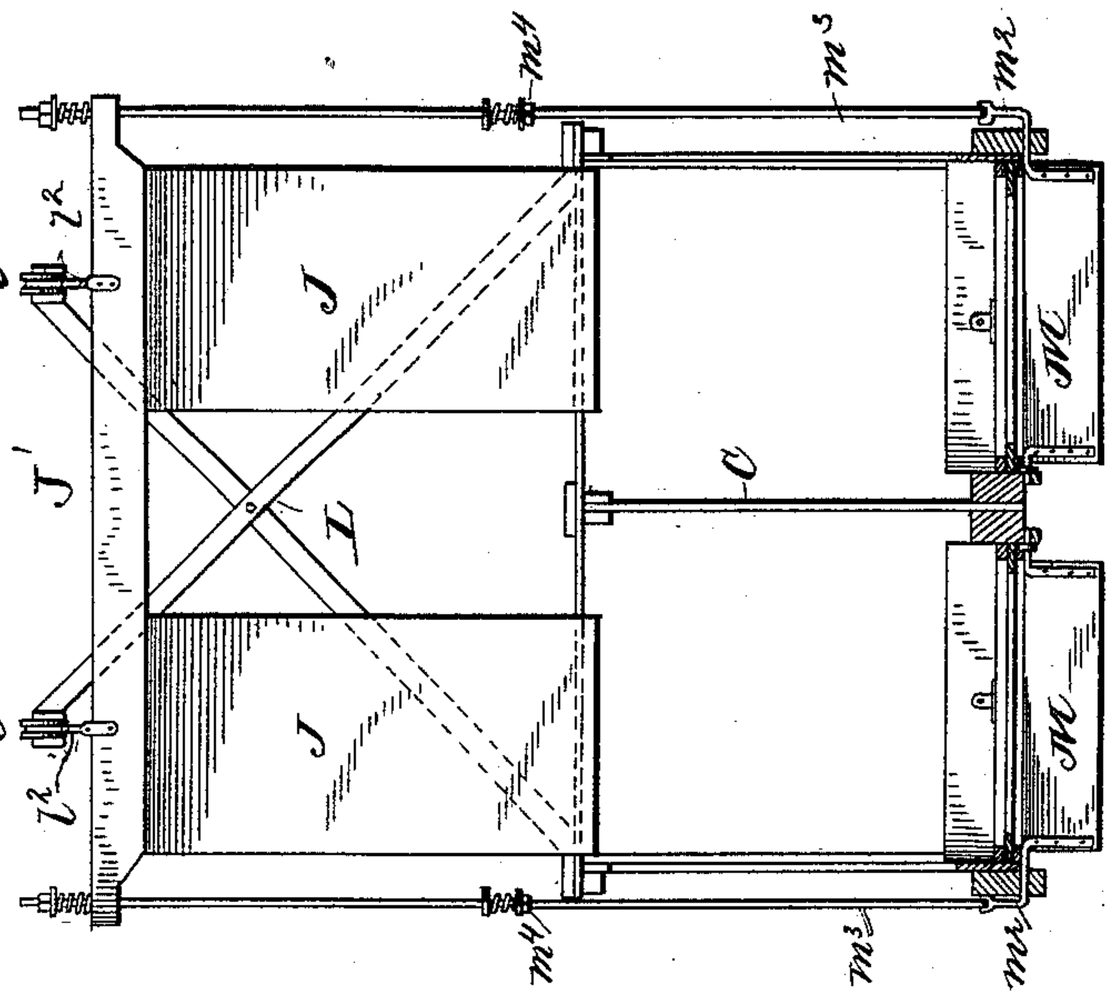


Fig. 7.

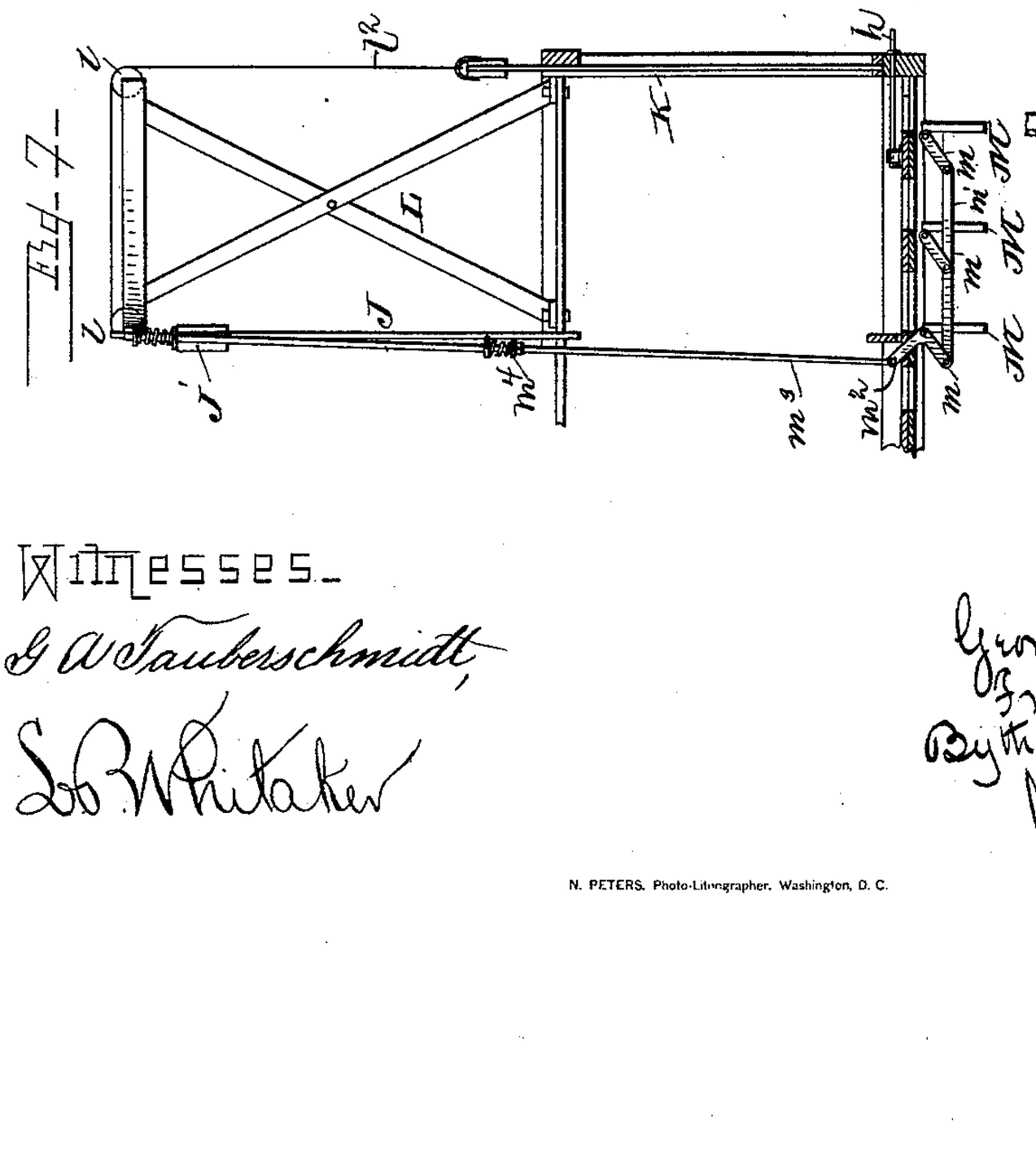
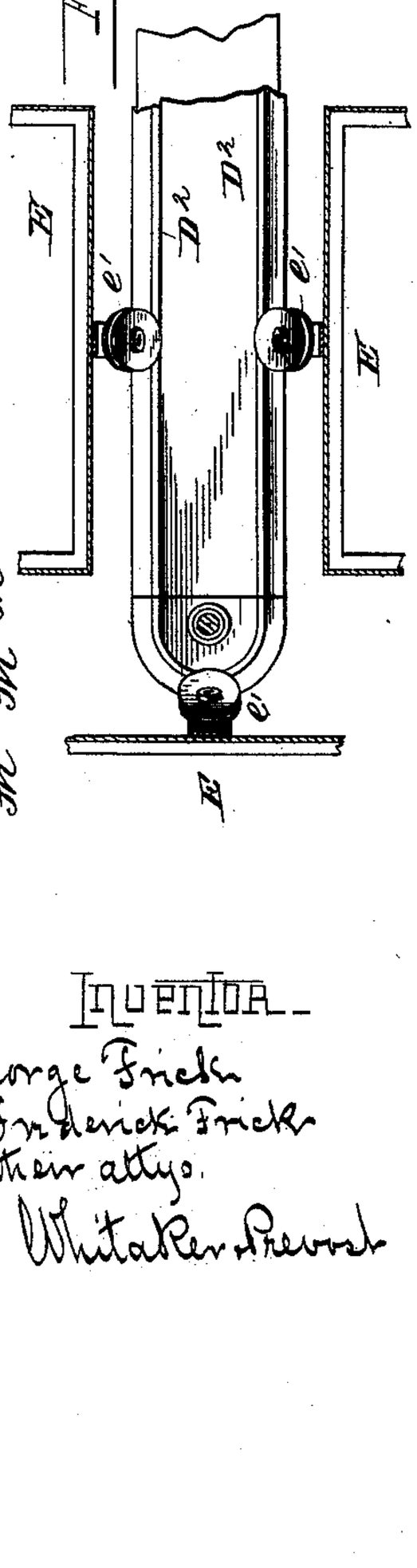


Fig. 5.



Witnesses.

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UNITED STATES PATENT OFFICE.

GEORGE FRICK AND FREDERICK FRICK, OF WAYNESBOROUGH, PENNSYLVANIA.

DRIER FOR FRUIT.

SPECIFICATION forming part of Letters Patent No. 414,206, dated November 5, 1889.

Application filed December 13, 1888. Serial No. 293,429. (No model.)

To all whom it may concern:

Be it known that we, GEORGE FRICK and FREDERICK FRICK, citizens of the United States, residing at Waynesborough, in the county of Franklin and State of Pennsylvania, have invented certain new and useful Improvements in Driers for Fruit and Like Articles; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to driers for fruit and like articles; and it consists in improvements in the general class of driers in which articles to be dried are subjected to the action of heated air.

We have illustrated our invention in the accompanying drawings and fully disclosed the same in the following specification and claims.

Referring to the drawings, Figure 1 is a longitudinal vertical section of our improved drying apparatus, certain parts being shown in elevation. Fig. 2 is a horizontal section of the same. Fig. 3 is a transverse vertical section of the apparatus on line *y y*, Fig. 1. Fig. 4 is a view showing the under side of the bearing-guideway employed at the upper end of the front shaft of the apparatus. Fig. 5 is a sectional view of the same and of the bearing and guide for the rear shaft. Fig. 6 is a front view of the air-controlling slides of the drying-chamber. Fig. 7 is a side view of the same. Fig. 8 is a front view of the sliding door of the drying-chamber. Fig. 9 is a horizontal section on line *z z*, Fig. 1. Fig. 10 is a section on line *x x*, Fig. 3. Fig. 11 is a view of a detail of the construction. Fig. 12 is a view showing the manner of attaching the crates to the chains.

In driers of the class to which our said invention belongs it is common to expose the articles to be dried to the action of a current of heated air in a vertical or inclined shaft or flue upon perforated trays or supports placed one above the other and supported from or upon an endless chain or other elevating device to which a constant or intermittent motion through the shaft or flue is imparted; but in this class of driers there is not a scientific and economical application of heat, and the entire weight of the apparatus and the material being operated upon is borne by one or two parts of the apparatus. By our improved construction we avoid these objections and secure an economical drying of the articles by a continuous or progressive movement of the trays or receptacles in a simple and more effective way. We also provide such an arrangement of flues for the products of combustion and air, in connection with steam-pipes, as to secure a raising of the air to the proper temperature in an economical and effective manner. We also provide our drier with means whereby the dried articles can be removed from a part of the apparatus and fresh material inserted while the operation of drying is going on in the other parts of the same and without interfering with, retarding, or otherwise affecting such operation.

In the drawings, A designates the main body of our drier or drying apparatus, which, it will be seen, has its greatest extent in a horizontal direction. Within the upper part of this main body is the drying-chamber B, which is divided longitudinally by a partition C, between the ends of which and the ends of the chamber there is a space about equivalent to the width of the space on each side of the same. At or near the ends of this partition are the shafts *a a'*, mounted in suitable bearings in the roof and bottom of the chamber. Each of said shafts is provided with sprocket-wheels *b b'*, and these wheels are connected by chains *c c* in a well-known way. These sprocket wheels and chains may be made of any preferred construction. The upper end of the shaft *a* extends through the top or roof of the chamber B, and is provided with a beveled gear *b'*, which gears with the beveled pinion b^2 on the horizontal shaft a^2, mounted in bearings on the top or roof of the chamber or in any other preferred manner. The outer end of this shaft extends to the front end of the chamber, and is provided with a crank a^3, or with any other means whereby motion can be communicated to it.

To the top or roof of the chamber B, on each side of the partition C, is secured a track D, having a vertical inner face *d*. The ends of these roof-tracks are connected at each end

of the partition C by the curved portions D′, which are provided with a short rib *d′*, of the form best shown in Figs. 3, 4, and 5. At each side of the lower edge of the partition C is placed a track D^2, which preferably has an abrupt outer edge. These tracks have their ends connected by curved portions of like form.

To the chains *c c* are attached a series of crates or cages E. These crates or cages have one of their sides centrally attached to both of the chains *c c*, and each is provided above the point of attachment to the upper chain with a friction-wheel or traveler *e*, and below the point of attachment to the lower chain with a grooved wheel *e′*. The wheel *e′* engages the lower track D^2 and supports the crate to which it is attached, while the friction-wheel or traveler engages the inner vertical face of the top or roof track.

In attaching these devices to the crate or cage we prefer to secure a bar e^3 of sufficient strength vertically upon the side of the same, causing it to project above and below the crate or cage the required distance and to mount the friction-wheel *e* and the grooved wheel *e′* or their equivalents upon this bar in proper positions; but these devices may be secured to the crate or cage in any other way. This bar is also detachably connected to the endless chains *c c* by any preferred means.

One method of attaching the crates to the chains is shown in Fig. 11, in which a bolt is passed through the bar e^3 and one of the links of the chains and secured by a nut; but other means may be employed for the purpose.

In the drawings we show the grooved wheel located below the crate or cage and at an angle thereto, and although we deem this construction best it is not essential, nor do we limit ourselves thereto.

To each crate or cage are secured anti-friction rollers e^2, which extend above the crate or cage and above the friction-wheel *e*, for the purpose of passing between the rib *d′* and the face *d* of the curved track D′, when the crate or cage passes around the end of the partition C to guide and steady the crate or cage in turning. These rollers are placed in line with the wheel or traveler *e*, and the relative sides are such that the three may all be in contact with the vertical inner face of the curved track D′ at one time. The friction-rollers e^2 e^2 are conveniently secured to the crate or cage, as shown in Fig. 1, by a U-shaped support E′, which is attached to the bar on which the wheels *e e′* are mounted and to the crate; but any other preferred form of support may be employed.

While we have shown the rib *d′* at the top of the drying-room, it may be placed near the track D^2, and the rollers e^2 e^2 may project below the crate or cage.

From the foregoing it will be seen that the weight of the crates or cages E is borne by the track D^2, that the track D and the chains *c c* serve to maintain each in a vertical position, while through the chains, shafts *a a′*, and the gearing connected with the former of these shafts the crates or cages can be moved as desired around the partition C.

Beneath the forward end of the drying-chamber is the chamber B′, which contains the steam-pipes for heating the air. This may extend rearward as far as desired, and preferably is of a depth to afford space for such steam-pipes as may be desired, and to permit the passage therethrough of the smoke-pipe or uptake of the boiler-furnace. This chamber is the full width of the chamber B, and an air-inlet passage B^2 of less width extends from the rear of the chamber B′ backward a short distance beyond the rear end of the drying-chamber.

Beneath the chamber B′ is placed the boiler F and its furnace. The front wall of the furnace is preferably about in line with the front wall of the chamber. The smoke-outlet for the furnace is preferably near the front wall of the chamber B′ and connects with a smoke-pipe b^3, passing rearwardly through chamber B′, air-inlet passage B^2, and then upward the desired distance. An air-outlet for the drying-chamber surrounds the uptake from the point where it leaves the air-inlet. For convenience of construction this air-outlet is made as a continuation of the air-inlet, but it is divided therefrom by a partition or plate *f*. It extends upward around the furnace-uptake to a sufficient distance to secure a proper degree of draft for the drying-chamber and its connections. The boiler and furnace are placed in the chamber B^3 below the chamber B′, and pipe F^2 conducts the live steam from the boiler to a series of coils of pipes within the air-heating chamber B′, while pipe F^3 is the return-pipe of the system.

The system of pipes employed by us for heating the air is best shown in Figs. 1 and 3, and consists of two pipes G G′, extending from front to rear of air-heating chamber, which are connected by a series of intervening bent pipes *g*. Pipe G is connected with pipe F^2, and G′ with the return-pipe F^3. The form of these heating-coils may be varied as desired, and, if preferred, may be placed in the drying-chamber in one coil or in section, and provided with valves, so that the several sections may be operated together or as many thrown out of use as may be desired.

We employ between the air-chamber B′ and the drying-chamber a sliding or grate valve construction, as shown in Figs. 1 and 2, one on each side of the partition C. A rod *h* is attached to each valve and extends through the front wall of the drying-chamber B, so that they can be moved, as desired, to regulate the admission of heated air to the drying-chamber, and each is operated to effect this independently of the other. When the valves are open, there is an uninterrupted communication or connection between the

hot-air chamber and drying-chamber. These grate-valves may be made in several sections, and each section operated by a rod attached thereto and passing through the front wall of drying-chamber to regulate the admission of air to the different parts of the chamber on either side of the partition C.

At or near the rear end of the air-inlet passage B^2 is an opening B^4 for the admission of air, and this is controlled by a sliding valve B^5, which can be provided, when desired, with an operating-rod extending to the front of the drier. The chamber B^3 is also provided at one of its sides with an inlet for air. This is shown in this instance at F^4, and is controlled by a valve F^5, which may also be provided with an operative connection extending to the front of the apparatus. This inlet may, when desired, be located at the side instead of at the rear of the chamber B^3 or other point. It is preferred to construct a conduit to bring the air to the inlet from some convenient point.

The crates or cages E are constructed with one side, which is attached to the chains *c c*, solid or wholly closed, and the opposite side of the crate or cage open. The other vertical sides are open-work framing, and are on their interior provided with horizontally-projecting ledges *i i*, to receive the trays on which are placed the articles to be dried. These trays have open-work or perforated bottoms, which may be of wire-gauze, if desired, permitting the air to pass freely up through them. The top and bottom of the crates or cages are also made of open-work of crossing or interlaced strips or bars. We prefer to make these crates or cages of angle-iron, as shown; but this is not essential.

When the apparatus is in operation and it is desired to fill a crate or cage with fresh articles for drying, or to remove the trays with their burdens of completely-dried materials, the crate or cage is brought into the position shown in Fig. 2. On each side of the drying-chamber there is a vertical slide J, working in guideways at the side of the machine and in openings in the roof of the drying-chamber. These are located so that when let down into their lowest position they will be just in rear of the plane of the rear or closed wall of the cage or crate. These slides will preferably extend inward a short distance in rear of the crate or cage. These slides extend above the roof of the drying-chamber and are both attached to a bar J′. The front wall of the drying-chamber B is provided with a doorway closed by a sliding door K, moving in vertical guides. The width of this doorway is a little more than the width of the trays employed, so that they can readily be removed from or introduced into the crate through the same. This door extends above the roof of the drying-chamber, and is provided above the chamber with a weight-bar K′. On the roof of the drying-chamber between the door and the slide J is located a frame L, provided with grooved rollers or pulleys *l l*. Cords or chains l^2 l^2, attached to the bar J′, pass over the pulleys *l*, and are connected to the weight-bar K′, which is made of such size and material as to cause the door K to counterbalance the slides J J and the parts connected therewith. It will thus be seen that when a crate or cage is brought into position before the door to be filled or emptied, on raising the door the slides will pass downward and with the closed rear wall of the crate or cage will cut off or separate the front portion of the drying-chamber from the main portion of the same, forming a vestibule. The operation of drying the materials contained in all the other cages or crates consequently proceeds without interruption.

In order to cut off the supply of heated air from the front portion of the drying-chamber at the same time, we provide the following construction: Beneath the floor of the drying-chamber, in front of the slides J, are located the flap-valves M M, adapted when turned into a horizontal position to close the apertures in the floor for admitting the heated air from the chamber B′. To each of these valves is secured the arm *m*, and these arms are connected by a link *m′*. An arm m^2 projects from the axis of the rearward valve, and a rod m^3 is connected to it and extends upward. There is a series of these valves for either side of the front of the drying-chamber connected for operation in like manner. Near the outer end of the bar J′ are secured vertical rods m^3, which are pivotally attached to the arms m^2 for actuating the flap-valves M. These rods engage apertures in the ends of bar J′, and are provided with nuts or tappets m^4. The bar J′ slides freely upon the rods m^3, and the nuts or tappets m^4 are so located that when the bar descends and the slides J shut off the forward portion of the drier the bar J′ will strike the nuts or tappets and force the rods m^3 downward, thereby closing the series of flap-valves M and shutting off the supply of hot air to the front portion of the drying-chamber. When the slides J are raised, the rods m^3 will be released and will allow the valves M to fall of their own weight. We may employ a spring and washer above the nuts or tappets m^4, as shown, to prevent jarring, if desired; but this is not absolutely necessary. It will be seen that upon opening door K the front portion of the drying-chamber containing the crate will be completely cut off from the other part by the operation just described, thereby forming a vestibule, and the slides J can only descend when a crate is in the proper position. (Shown in Fig. 2.) A pivoted wing or flap N is secured by trunnions to the roof of the drying-chamber, and when no crate is in the position shown in Fig. 2 this wing will occupy the position shown in Fig. 1 and form a continuation of the partition C. As the crates pass around they will strike against this wing, which will rise and fall again after the crate

has passed. One of the trunnions of said wing or flap may pass through the front wall and be provided with some operative means whereby it may be controlled, if desired. We have shown it as provided with a crank or handle n, which has a projection n' extending a short distance beyond the trunnion on the opposite side of the same. The crank a^3 on shaft a^2 is provided with a pin in range of this projection, so that a movement of the crank a^3 to bring a crate into its most forward position will cause this pin to strike against the projection n' on crank n and raise the flap or wing N out of the way. We prefer to provide gravity or spring pawls upon the frame-work of the machine, as shown in Fig. 11, so situated as to engage the projection n' on the handle n when the wing N is raised to a horizontal position. By this construction, when the wing N is raised by a passing crate or by hand, it will be maintained in a horizontal position until it is desired to lower it, when the pawl may be disengaged from the projection n'. By means of this flap or wing and the sliding valves in the bottom of the drying-chamber the amount of heated air admitted to either side of the chamber can be controlled.

The bottom of the drying-chamber is provided with deflectors o o' at each end in line with the partition C, and of sufficient height to permit the crates to pass freely above the same. The central part of the flooring or bottom is provided on each side of the tracks with inclined deflectors P P, and the walls of the chamber are also provided with horizontal deflectors P′ P′. These deflectors P′ P′ direct the heated air against the bottom of the crates and force it to pass up through the perforations in the bottoms of the trays. The side walls of the drying-chamber may also be provided with narrow vertical wings Q, to cooperate with the slides J in cutting off the heated air from the forward part of the apparatus.

In making our improved drying apparatus it is our intention to construct the framing of the same in such a manner that the apparatus may be set up or taken to pieces and packed for transportation. To this end we provide the ends of the side pieces of the frame of part A with cleats x, and provide the ends of the framing with similar cleats y. Bolts pass through the cleats x and y and secure the parts firmly together, as shown in the drawings. The air-outlet pipe or tube B^3 is also connected and attached to the main body of the apparatus by the use of cleats and bolts in a similar manner, and the bottom and top portions of the frame will be secured in a like manner. It may be preferred to construct the side walls of the apparatus in sections, and in such case each of the adjacent edges will be provided with cleats and secured together by bolts, as shown in Fig. 2. By employing cleats and bolts in the manner just described a knockdown drier will be formed which may be set up very rapidly, and if it be desirable to remove the apparatus to some other location the bolts may be removed, the framing taken to pieces and transported very conveniently, and again set up with the same bolts, thus making a very convenient and desirable construction. The side walls will preferably be provided with removable doors, which will give the operator access to any portion of the drying-chamber when desired; and we prefer, also, to provide frames of glass at suitable intervals to enable the operator to inspect the contents of the drying-chamber. The central portion of the drying-chamber should be very firmly supported, so as to bear the weight of the track and the crates. The upper track D, which is engaged by the roller e, may be made of wood faced with iron, as shown in Fig. 3. The lower track will preferably be laid as shown in Figs. 1 and 2, and joined at their ends by the curved portions before referred to. We prefer in casting these curved portions D′ to cast the bearings for the shafts a a integrally therewith and secure the castings to the roof and floor by bolts, or in any preferred manner.

In Figs. 1 and 5 we have shown our preferred manner of securing the castings containing the bearings for shaft a'. In these figures the upper casting is attached by bolts to a support d^2, placed across an elongated aperture in the roof, which receives the bearing for the shaft. This frame supports the casting and permits a longitudinal movement of the same. A rod d^4 is attached to the casting and extends to the extremity of the framework of the drying-chamber, where it passes through a box d^5, secured to the frame of the chamber, and is provided with a nut. Between the nut and the box d^5 a strong spiral spring is interposed, which controls the position of the casting D, and by means of this construction the slack of the gear-chains caused by the high temperature of the drying-chamber, or which may arise from any other cause, will be taken up. A similar rod and spring are connected with the lower casting, so that the chain is always held taut, and the variations caused by differences in temperature, wear, or other causes are thus provided for.

The opening in the extremity of chamber B, through which the heated air passes into the outlet B^3, may be provided with a sliding damper or valve B^5, as shown in Fig. 1. To this valve is preferably attached a cord or chain passing over pulleys provided upon the part B^3 and the frame L, the end of which is provided with a counterbalance-weight at the front of the apparatus. By this means the said damper may be operated from the front of the drier by raising or lowering the weight. The outlet-flue B^3 may be also provided with a damper, if desired.

Each cage as it is filled is moved along one side of the partition C by means of the han-

dle a^3, and this side of the chamber is in most cases subjected to the greater amount of heat, or to a greater volume of air at a suitable temperature, in order to effect a rapid drying of the fresh articles. This is often desirable to prevent browning of the articles. As the material passes around to the opposite side of the drier a smaller quantity of heated air may be admitted to that side, as the partially-dry material will not require so much heat as the green articles. We prefer to operate the drier in such a manner and fill the crates at such intervals that by the time the last crate is filled the material in the first crate will have become dry, so that it can be removed, fresh articles placed in the crate, and the operation rendered continuous. By employing steam-pipes and passing air over them a very even drying of the material is effected. While a crate is being emptied and refilled the front portion or vestibule of the drying-chamber remains cut off from the rest of the chamber by means of the construction before described and the temperature of the rest of the chamber maintained, so that the drying process continues without interruption and is not materially affected by the admission of air. When the crate is filled, another takes its place and the operation may be rendered continuous, and very perfect results obtained.

It is obvious that without some provision analogous to this just described the filling of a crate or cage would seriously interfere with the operation of drying in the main portion of the drier and cause a very considerable loss of heat.

While the crates or cages are provided with quite shallow trays, each adapted to receive a thin layer of the material to be dried, it is obvious that a less number of deeper trays might be employed, or quite deep wicker-wire or other form of baskets might be provided with a supporting-frame to engage the supporting-ledges of the crates or cages, and be filled with light articles, such as hops, herbs, or the like, for drying.

While we prefer to locate the body of the drier in a horizontal plane, it would be understood that the plane of the same may be considerably inclined from the horizontal without departing from the spirit of our invention. Any degree of inclination may be adopted which will permit the main portion of the weight of the cages or crates to be borne by the wheels e'.

The terms "horizontal" or "horizontal direction" used in the specification are intended to include not only an exact approximation to a horizontal plane, but to any degree of inclination which will permit the cages or crates to be thus supported.

What we claim, and desire to secure by Letters Patent, is—

1. A drier having its greatest extent in a horizontal direction formed with two passages extending longitudinally in the same horizontal plane and intercommunicating at both ends of the same, and a series of crates or cages for containing materials to be dried capable of moving through one of said passages in one direction and through the other in the opposite direction, the course of said crates being wholly within the drier, substantially as described.

2. A drier having its greatest extent in a horizontal direction formed with two passages extending longitudinally in the same horizontal plane and intercommunicating at each end of the same for the passage of heated air, and of crates or cages for containing the materials to be dried capable of moving through one of said passages in one direction and through the other in the opposite direction, the course of said crates being wholly within the drier, substantially as described.

3. The combination, with a drying-chamber having its greatest extent in a horizontal direction, of two vertical shafts provided with sprocket wheels and chains, crates or cages for receiving materials to be dried, connected to said chains and provided with supporting-wheels, and an endless track lying wholly within the chamber and engaged by said supporting-wheels, whereby said crates may be supported by said track and moved and maintained in a vertical position by said chains, substantially as described.

4. The combination, with a drying-chamber having its greatest extent in a horizontal direction, of a heater and heating-coils for heating said chamber and an air-passage for supplying air to said coils having an inlet at one end and an outlet at the other, and a smoke outlet or uptake for the heater passing longitudinally through said air-inlet passage, the inlets to the smoke-outlet and to the air-passage being at opposite ends, substantially as described.

5. A drying-chamber having its greatest extent in a horizontal direction, a steam-boiler, and steam-coils for heating air for said chamber, a separate chamber surrounding the boiler and having a discharge opening or openings adjacent to the steam-coils, and an air-inlet to the boiler-chamber, substantially as described.

6. The combination, with a drying-chamber, of an endless chain mounted therein, crates or cages for containing the materials to be dried connected to said chain and having one solid or closed side, and slides in said chamber for closing the spaces between said crate and the walls of the drying-chamber, whereby the closed wall of the crate and the said slides form a partition across the drying-chamber, substantially as described.

7. The combination, with a drying-chamber having grated openings for the admission of hot air, of valves for closing said openings, slides for separating a portion of the drying-chamber from the main body of the same, a door for said drying-chamber, and movable connections between said door and said slides

and valves, whereby the opening or closing of the door affects the movement of the slides and valves, substantially as described.

8. The combination, with the drying-chamber, of the endless chains mounted therein, crates or cages connected with said chains, slides J, and connecting-bar J′, a sliding door for said drying-chamber, pivoted flap-valves M, rods m^3, connected to said valves and engaging the bar J′, and cords l^2, connecting the door and the bar J′, substantially as described.

9. The combination, with a drying-chamber having its greatest extent in a horizontal direction, of a partition dividing said chamber longitudinally, crates on a track in said chamber, endless chains mounted in said chamber and surrounding said partition for holding said crates in a vertical position and for moving the same, and spring-seated bearings for one of the chain-shafts, substantially as described.

10. The combination, with a drying-chamber, of endless chains mounted therein, crates or cages for supporting the materials to be dried connected to said chains, a supporting-track parallel with said chains, a supporting-wheel attached to each crate and engaging said track, a track above said supporting-track provided with a vertical wall parallel with said chains, a rib d', having a considerable portion parallel with the curved portions of the vertical wall of the track, a traveler connected to each crate engaging the vertical wall of the track, and two friction-rollers, one on each side of said traveler, connected to each crate and adapted to engage the said rib, substantially as described.

11. The combination, with a drying-chamber having its greatest extent in a horizontal direction, of a partition dividing said drying-chamber, sprocket-chains surrounding said partition, the pivoted wing or flap N, adjacent to one end of the chamber and forming a continuation of the said partition, a crank on the axis of said wing or flap, a shaft gearing with one of the shafts of the sprocket-chains, and a crank on said shaft having a projection adapted to engage the crank connected with the wing or flap, substantially as described.

12. The combination, with a drying-chamber having its greatest length in a horizontal direction, of two sprocket-chains, one above the other, and a supporting-track, the said chains and track being parallel with the main plane of the drying-chamber, crates or cages connected to said chains and movably supported on said track, and another track in a different horizontal plane from the supporting-track engaged by a rigid projection from said crates or cages, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

GEO. FRICK.
FREDERICK FRICK.

Witnesses:
D. M. GOOD, Jr.,
J. R. RUTHRAUFF.