J. L. PIERCE.

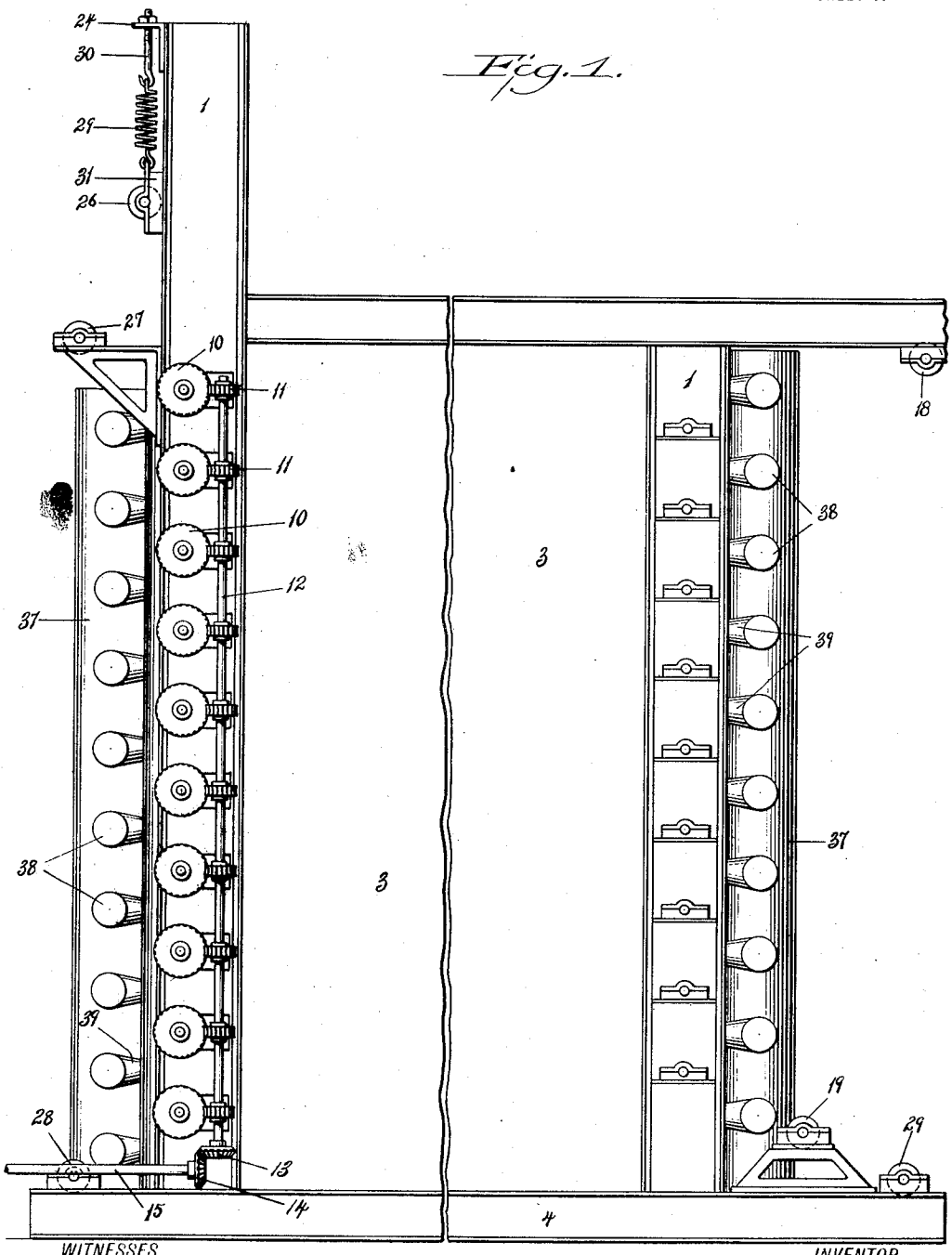
DRYING MACHINE.

APPLICATION FILED JUNE 11, 1919.

1,356,469. **Patented Oct. 19, 1920.**

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

Olive F. Holmes

O. D. Bellhouse

INVENTOR

JAMES LOUIS PIERCE

BY Munn & Co

ATTORNEYS

J. L. PIERCE.

DRYING MACHINE.

APPLICATION FILED JUNE 11, 1919.

1,356,469.

Patented Oct. 19, 1920.

4 SHEETS—SHEET 2.

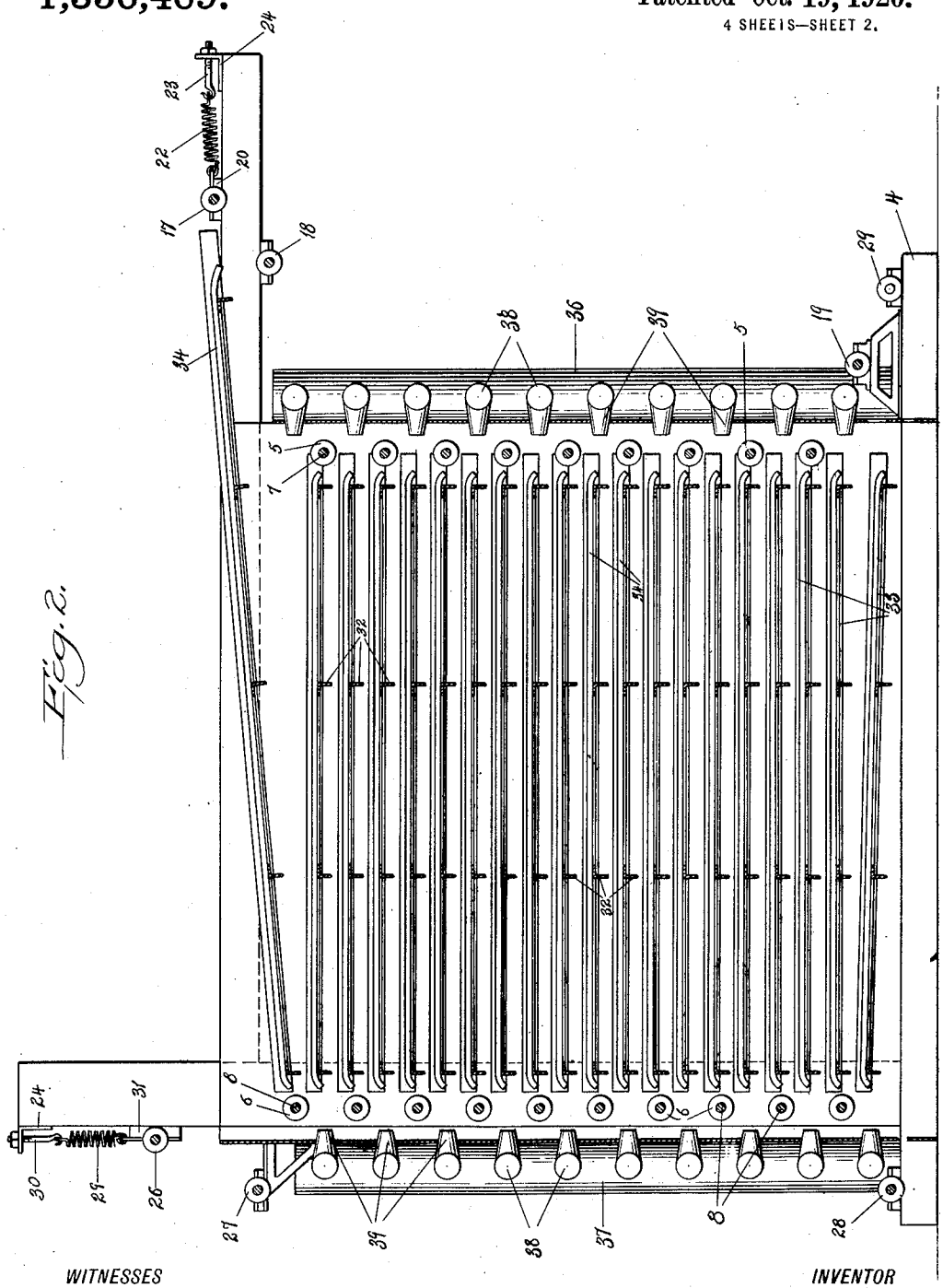


Fig. 2.

WITNESSES

Oliver K. Holmes

C. C. Bellhouse

INVENTOR

JAMES LOUIS PIERCE

BY Munn & Co

ATTORNEYS

J. L. PIERCE.

DRYING MACHINE.

APPLICATION FILED JUNE 11, 1919.

1,356,469.

Patented Oct. 19, 1920.

4 SHEETS—SHEET 3.

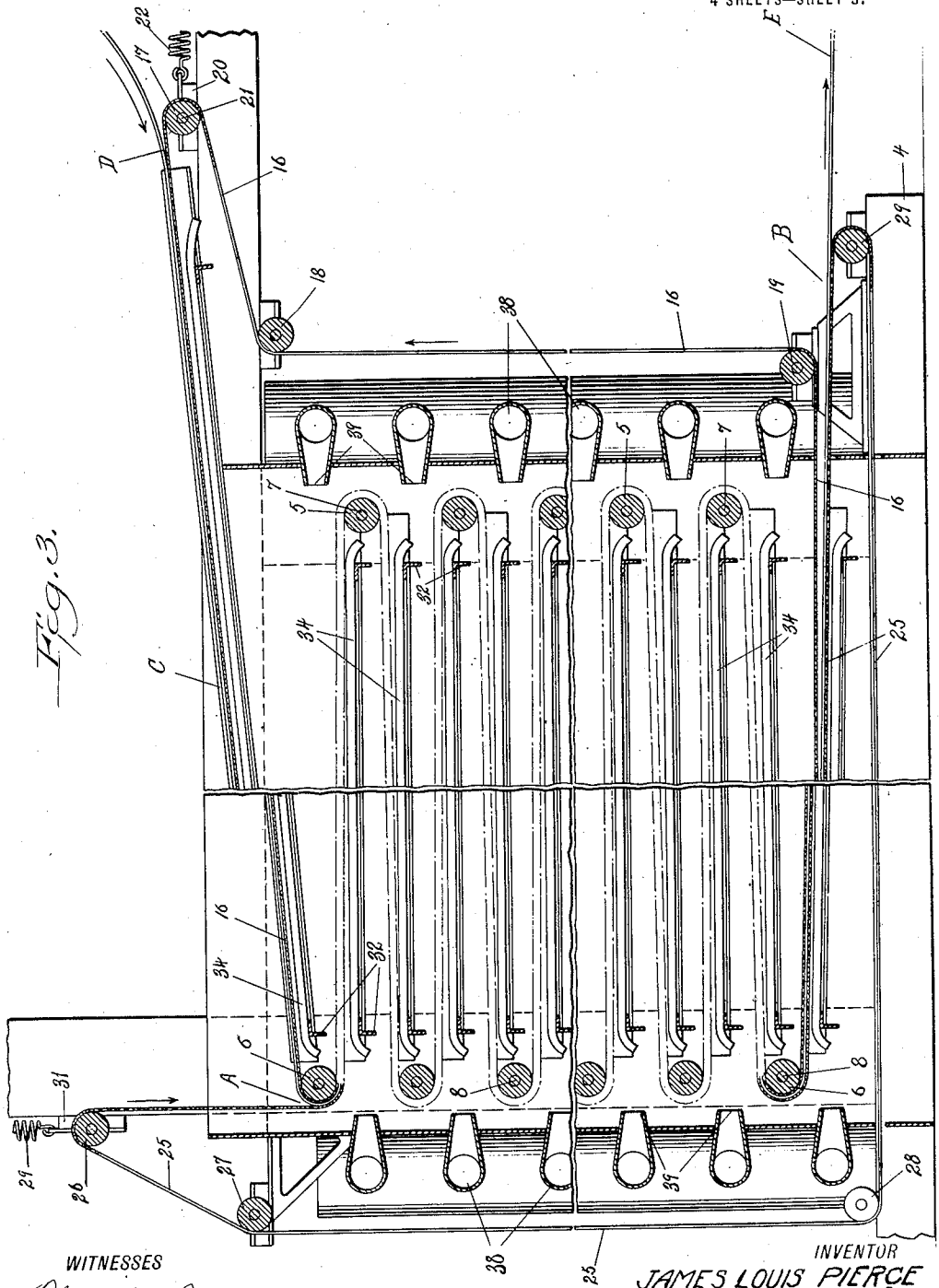


Fig. 3.

WITNESSES

Oliver K. Holmes

P. O. Baldwin

INVENTOR

JAMES LOUIS PIERCE

BY Munn & Co

ATTORNEYS

J. L. PIERCE.

DRYING MACHINE.

APPLICATION FILED JUNE 11, 1919.

1,356,469.

Patented Oct. 19, 1920.

4 SHEETS—SHEET 4.

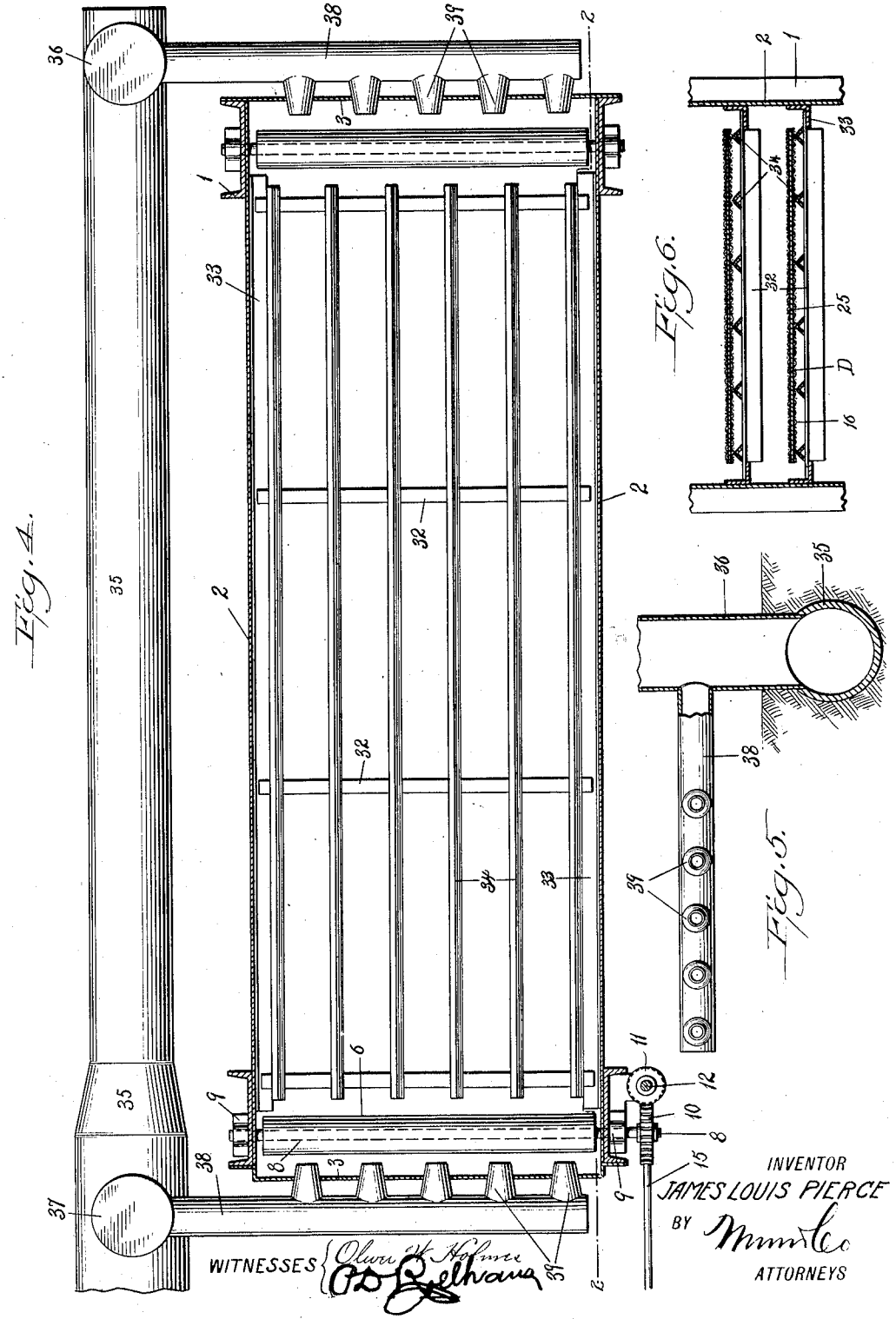


Fig. 4.

Fig. 6.

Fig. 5.

UNITED STATES PATENT OFFICE.

JAMES LOUIS PIERCE, OF MANILA, PHILIPPINE ISLANDS.

DRYING-MACHINE.

1,356,469. Specification of Letters Patent. Patented Oct. 19, 1920.

Application filed June 11, 1919. Serial No. 303,298.

To all whom it may concern:

Be it known that I, JAMES LOUIS PIERCE, a citizen of the United States, and resident of Manila, Isle of Luzon, Philippine Islands, have invented a new and Improved Drying-Machine, of which the following is a full, clear, and exact description.

This invention relates to new and usefully improved drying machines. In particular it relates to a machine for drying copra, fish, vegetables and other food products and materials in preparation for shipment and for the market.

A broad purpose of this invention is to design and provide a machine capable of drying large quantities of food products or material and which will have an extensive range of uses in food preparing plants and industries. A purpose is to employ a conveyer device within a heating or drying chamber, said conveyer embodying a carrying section and a retaining section for carrying the material through the drying chamber to be dried. Turning means for exposing the materials to the heat for drying, and the provision of a novel hot air circulation medium are features related to this invention.

Still another purpose is to provide a drying machine simple in operation, strong and sturdy in construction and comparatively inexpensive to manufacture.

With the above and other objects in view, the invention has relation to a certain combination and arrangement of parts, an example of which is described in the following specification, pointed out in the appended claims, and illustrated in the accompanying drawings, wherein,—

Figure 1 illustrates in side elevation the drying machine;

Fig. 2 is a sectional view taken upon the line 2—2 of Fig. 4;

Fig. 3 illustrates another longitudinal sectional view taken on the vertical, and illustrating a certain conveyer system embodied within this invention;

Fig. 4 illustrates a longitudinal sectional view, the section being taken horizontally, thus showing portions of the machine in plan view;

Fig. 5 illustrates a detailed view of a portion of the air distributing system.

Fig. 6 illustrates a detailed view of the conveyer belts and supporting means or track upon which it moves.

Referring now more particularly to the drawings, wherein the same parts throughout the several views are designated by reference characters of the same denomination, the numeral 1 points out a set of vertically disposed frame members comprising substantially the foundation of the frame assembly of the drier. These frame pieces 1 are preferably channel members, and the machine will preferably be constructed throughout of steel or iron. The present drawings illustrate such a construction and the specification may refer to the channel and angle construction in connection with sheet-metal without in any way limiting the inventor to his rights of using other materials.

Closure walls 2 are fitted and joined to the channel frame pieces 1 and form the sides of the machine. Walls 3 are provided which further inclose the drier. Beams 4 are employed as a foundation for the drier and support the herein described frame. The foregoing description discloses a substantially inclosed housing and is employed as the drying or hot air chamber. This chamber contains the drying apparatus. The top of the casing is left open to receive a traveling conveyer as later seen. A plurality of rollers 5 and 6 are mounted respectively upon shafts 7 and 8. The rollers are arranged horizontally one above the other in bearings 9 which are bolted or otherwise secured to the vertical frame channels 1. The rollers are evenly and regularly spaced apart one above the other as illustrated. These rollers have a length substantially equal in width to the inclosed casing of the machine, as seen in Fig. 6, and are arranged in sets 5 and 6 at each end of the hot air chamber.

One of the roller sets, in this instance 6, has the shafts which mount the rollers extended through the bearings and fixed thereupon gears 10. These gears are alined one above the other and engage with gears 11 fixed upon the shaft 12 extending vertically the height of the machine from the lower roller to the upper roller. One extremity of the shaft 12 is fitted with a bevel gear 13 engaging with a drive pinion 14. The pinion 14 is mounted on a shaft 15. The shaft 15 will be used as a power shaft for connecting up with any suitable motive power such as an electric motor or gasolene engine. Worm gears are employed

in the drawings for driving the rollers, and the transmission assembly shown in Fig. 1 comprises the means for receiving the power through the shaft 15 driving the operating means of this drying machine. The roller set 5 located at the other end of the machine runs idle in the bearings provided.

A conveyer device comprising coöperating endless belt sections is employed as hereinafter described, and used for holding the materials between said sections and passing it through the hot air chamber.

A conveyer belt 16 is passed about the two roller sets as illustrated and thus forms a plurality of horizontal drying tiers of conveyer surface. The upper portion of the conveyer belt passes on a gradual slope above the upper edge of the casing and around a roller 17, thence back over a guide roller 18 and downwardly to the lower portion of the machine and about another guide roller 19, thence along the lower portion of the casing to the lower roller of the roller set 6. The roller 17 is provided with a slide block 20 carrying the bearings and shaft 21 of the roller 17. A spring 22 connects with the slide block and is attached to a screwthreaded bolt 23. The member 23 is passed through a bracket 24 secured upon one of the frame pieces. The tension of the spring can be adjusted through the member 23 so that the conveyer belt will be taut, and thus relieved of sags and tendencies to wrinkle. The roller and spring assembly provide a flexible and yieldable tightening means constantly exerted against the conveyer belt thereby keeping it tight when in operation.

A wire gauze retaining belt 25 is provided and operates in engagement with the conveyer belt. This belt is passed over guide rollers 26, 27 and 28 journaled in bearings supported upon the frame. The gauze retaining belt is directed from the roller 26 downwardly to the upper roller of the set 6, thence horizontally back and forth over the rollers 5 and 6 in engagement with the conveyer belt. The lower portions of the gauze retaining belt is passed around the roller 29 back along the lower portion of the casing and over the guide roller 28, as aforesaid. The arrows in Fig. 3 designate the direction of travel of the engaged conveyer belt and gauze retaining belt. These belts are driven over the rollers by the power delivered to the machine through the shaft 15, as hereinbefore described, and the gauze belt travels in engagement with the conveyer belt, the said gauze belt running idle and receiving its moving relation in connection with the conveyer belt by virtue of its frictional contact therewith. The reference characters A and B point out the position of the conveyer and the gauze retaining belt at the points where they move into engaged relation and separate one from another. The guide roller 26 is fitted with the flexible spring adjusting means similar to the one hereinbefore described used in connection with the conveyer belt. This comprises a tension spring 29 connected with a screw-threaded bolt 30. The roller 26 is carried in the slide block 31. Thus a flexible and yieldable pull is exerted against the gauze retaining belt which keeps said belt in tight and straight relation as it moves into engagement with the conveyer belt at A.

A plurality of horizontal support bars 32 is fixed upon channel members 33 which are themselves secured to the side walls of the casing and extend the length thereof. The support bars 32 impart rigidity and strength to the walls of the casing. A plurality of ribs or laths 34 is supported upon the cross members 32. These ribs are regularly spaced apart and curved down at each end as shown in Fig. 2. The gauze retaining belt runs in close relation with these ribs, the said ribs being provided in tiers for the support of the engaged conveyer and retaining belt when the conveyer is loaded with material. Fig. 6 illustrates this function of the ribs.

A hot air system is used in connection with this drying machine for the purpose of continuously projecting a stream of hot air into the casing of the machine to permeate upwardly through the tiers of the moving conveyer with its material undergoing the drying process. Any suitable form of hot air system which is appropriate in volume will be used and connected with this machine. A hot air furnace or other means for supplying said air will be connected with a conduit 35 which may be incased in the earth to insulate it from cooling effects. Hot air distributing pipes 36 and 37 communicate with the main pipe 35. The air pipes 36 and 37 stand vertically adjacent the end walls of the machine. A plurality of air distributing pipes 38 connect with the distributers 36 and 37. These air pipes 38 extend out horizontally from each distributer and along side the end of the casing. A battery of air projectors or nozzles 39, attached to the air pipes 38 are inserted within the opposite walls of the air chamber with their apertures directed toward and parallel with the tiers of the conveyer belt. The air projectors are so spaced apart and arranged that a stream of hot air will be projected between the tiers of the conveyer and against the opposite roller which forms a stop and thus momentarily retains the pressure of hot air until it escapes upwardly through the top of the air chamber.

In the operation of the machine the materials to be dried such as copra, fish, vegetables or other materials will be placed on

the conveyer belt's upper inclined surface at C. When the material has moved forward to the position A the wire gauze retaining belt will pass into engagement therewith and retain the material under pressure against said conveyer. As the conveyer becomes loaded with material it runs in engagement with the ribs as hereinbefore described and the pressure against the material due to the weight thereof upon the ribs and the pressure of the gauze retaining belt against the material will materially aid in opening the pores of said material and force the moisture therefrom, thus more fully subjecting it to the drying action of the hot air which permeates upwardly through the plurality of tiers.

The hot air will be brought through the open conduits as described under pressure and distribute throughout the battery of projecting nozzles which will thoroughly fill the casing with a volume of hot air under pressure. A stream of hot air will be projected from each nozzle under and against the conveyer belts and outwardly until said stream of hot air rebounds against the opposite guide roller. This throws the hot air under pressure against the conveyer belts which materially aids the drying of the copra, fish and vegetables within the heated air medium.

The products to be dried such as fish and vegetables undergo repeated turns from one tier to the next. This feature materially aids in driving the moisture from the materials. The reference character D designates a continuous strip of material which may be dried by starting it in the machine in the upper portion of the conveyer bringing it out at the lower portion thereof at E. This material is a diagrammatical illustration of substance or materials to be dried, vegetables or other foods which might be passed through the machine are omitted from the drawings, but will be understood to occupy the same relative position as the strip D.

A control valve will preferably be employed somewhere between the hot air furnishing means and the distributing pipes. This valve can be used to regulate the flow and pressure of hot air through the drier. A thermostat control may also be employed to advantage by installing such a device within the drier and connecting it up with the valve by an appropriate mechanism. The power shaft 15 may also be fitted with a change gear mechanism not shown for varying the speed of the rollers and thus varying the time periods elapsing between the time the material enters the machine until it passes therefrom. Where several different kinds of materials are to be dried the operation of the machine may be facilitated by systematizing the work in such a manner as to designate the different materials by numerals or other means. For example, a certain kind of vegetable will require a fixed period of time and speed of travel through the machine to thoroughly dry same. This time required upon a certain commodity to be dried will be determined by experimentation and tabulated for use by the operator of the machine. The operator of the machine may therefore have at his disposal tabulated instructions directing and designating the proper temperature and speed combination for the specific material to be dried. This system when used in connection with the drying machine will insure a maximum operating efficiency and a minimum expenditure of heat and power energy.

The drying machine and the process and system herein disclosed forms a most adequate and modern method for preparing various kinds of food stuffs for shipment and for the markets.

Claims:

1. A drying machine comprising a hot air chamber, a hot air distributing means for maintaining an evenly warm temperature in the chamber, a conveyer comprising separable endless sections joined together between which joined sections material to be dried is held, rollers for holding the conveyer and moving it through the hot air chamber thus subjecting the material to the heating and drying action of the hot air chamber, and supporting racks comprising ribs arranged under the moving conveyer for supporting said conveyer when ladened with material to be dried.

2. A drying machine comprising a hot air chamber, a battery of hot air projectors introduced in the chamber, a plurality of ribs arranged in tiers and extending substantially the length of the chamber, rollers journaled in the chamber, a conveyer carried on the rollers, a gauze belt applied to the conveyer and adapted to hold material on the conveyer to be dried, and a power shaft and gear set for transmitting motion to the rollers for moving the conveyer through the hot air chamber.

3. A drying machine, in combination with a hot air drying chamber, a hot air feed pipe, a battery of hot air projectors introduced in the drying chamber, distributing pipes connecting the projectors with the feed pipe, tiers of supporting racks extending the length of the chamber, a set of rollers journaled in the chamber, a traveling conveyer mounted on the rollers and in supported engagement with the tiers of supporting racks to prevent sagging of the conveyer when ladened with material to be dried, and means for moving the conveyer through the chamber.

4. A drying machine for preparing food

stuffs for the market comprising, in combination a heating chamber embodied within closure walls of appropriate size, a plurality of air projectors or nozzles inserted in the oppositely disposed walls of the chamber and arranged in rows, air feed pipes connected with a source of air under pressure and delivering air to the projectors, devices comprising substantially parallel sections of exposed surface for holding materials to be dried, and arrangement of the parallel sections in staggered relation to the rows of projectors so that the air flow from the projectors will be blown between the parallel sections of exposed surface.

5. A drying machine comprising in combination a heating chamber embodied within closure walls of appropriate size, a plurality of air projectors or nozzles inserted in the oppositely disposed walls of the chamber and arranged in rows, air feed pipes connected with a source of air under pressure and delivering air to the projectors, a traveling conveyer for carrying material through the chamber to be dried, and said conveyer comprising conjoined sections with material placed therebetween to be dried, and provision for inserting and removing material from the conveyer.

JAMES LOUIS PIERCE.