E. DISDIER.

DRYING APPARATUS.

APPLICATION FILED JAN. 4, 1912.

1,190,127.

Patented July 4, 1916.

5 SHEETS—SHEET 1.

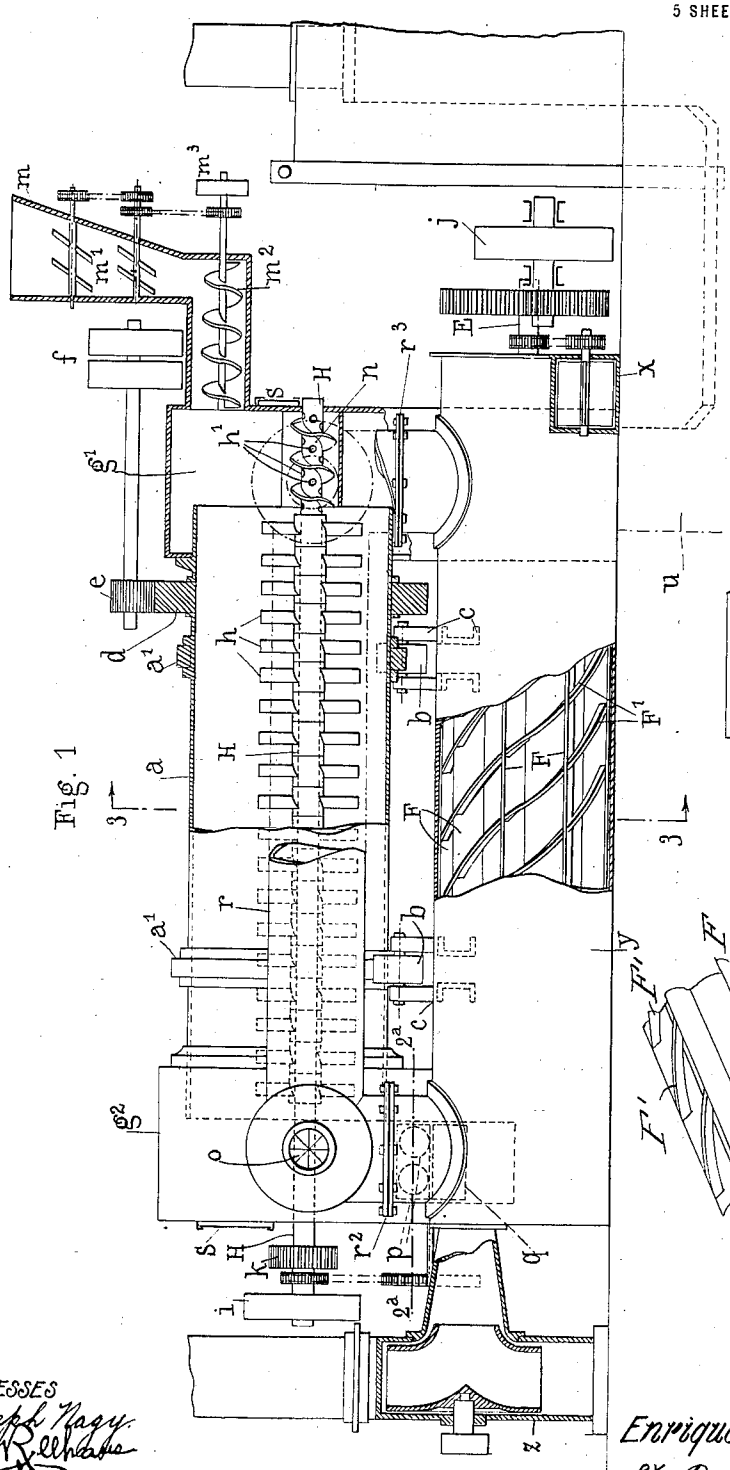


Fig. 1

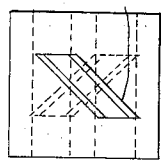


Fig. 8

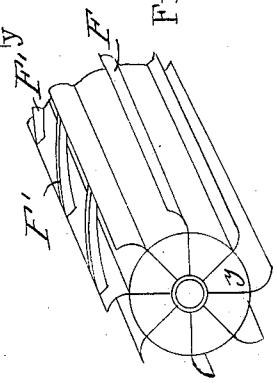


Fig. 7

WITNESSES

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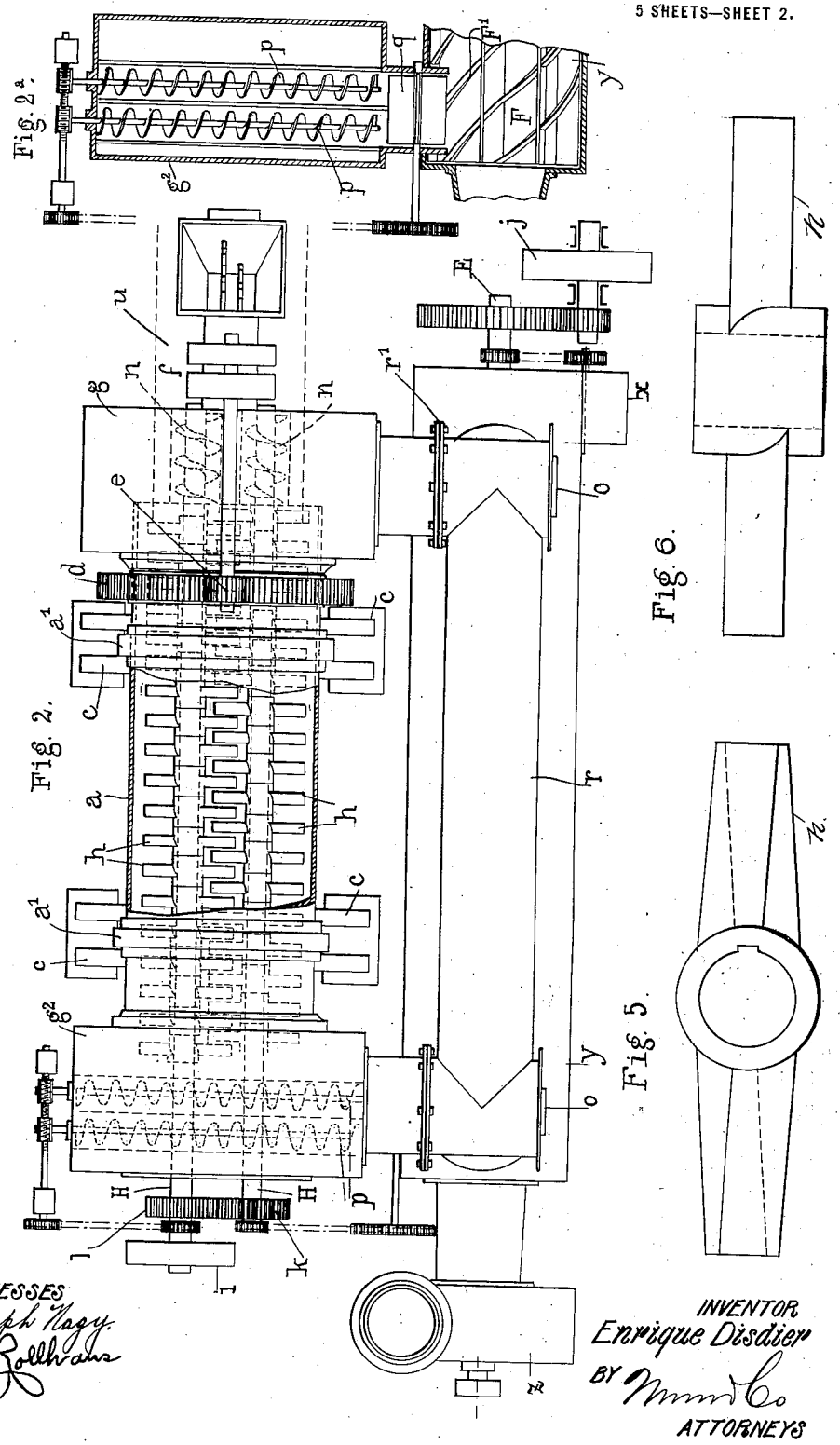
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5 SHEETS—SHEET 2.



WITNESSES

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5 SHEETS—SHEET 3.

Fig. 3.

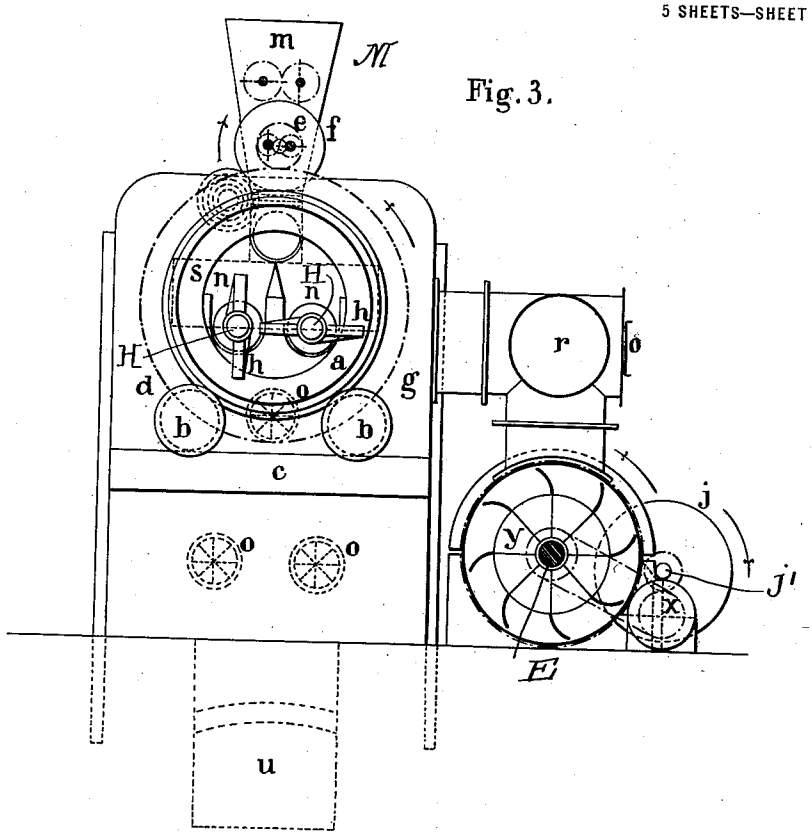
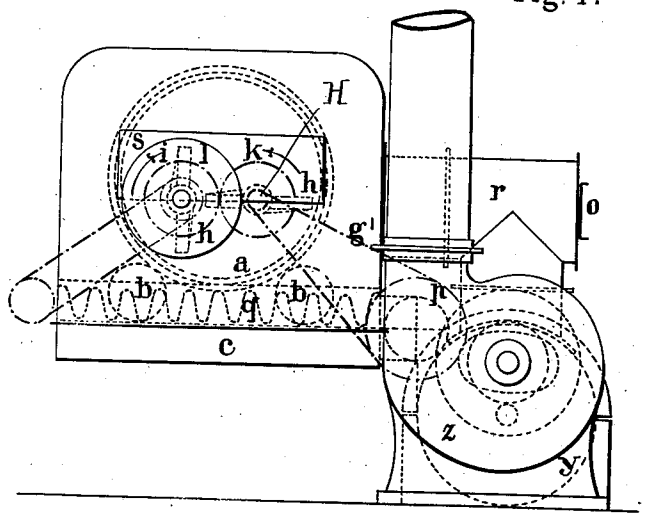


Fig. 4.



WITNESSES

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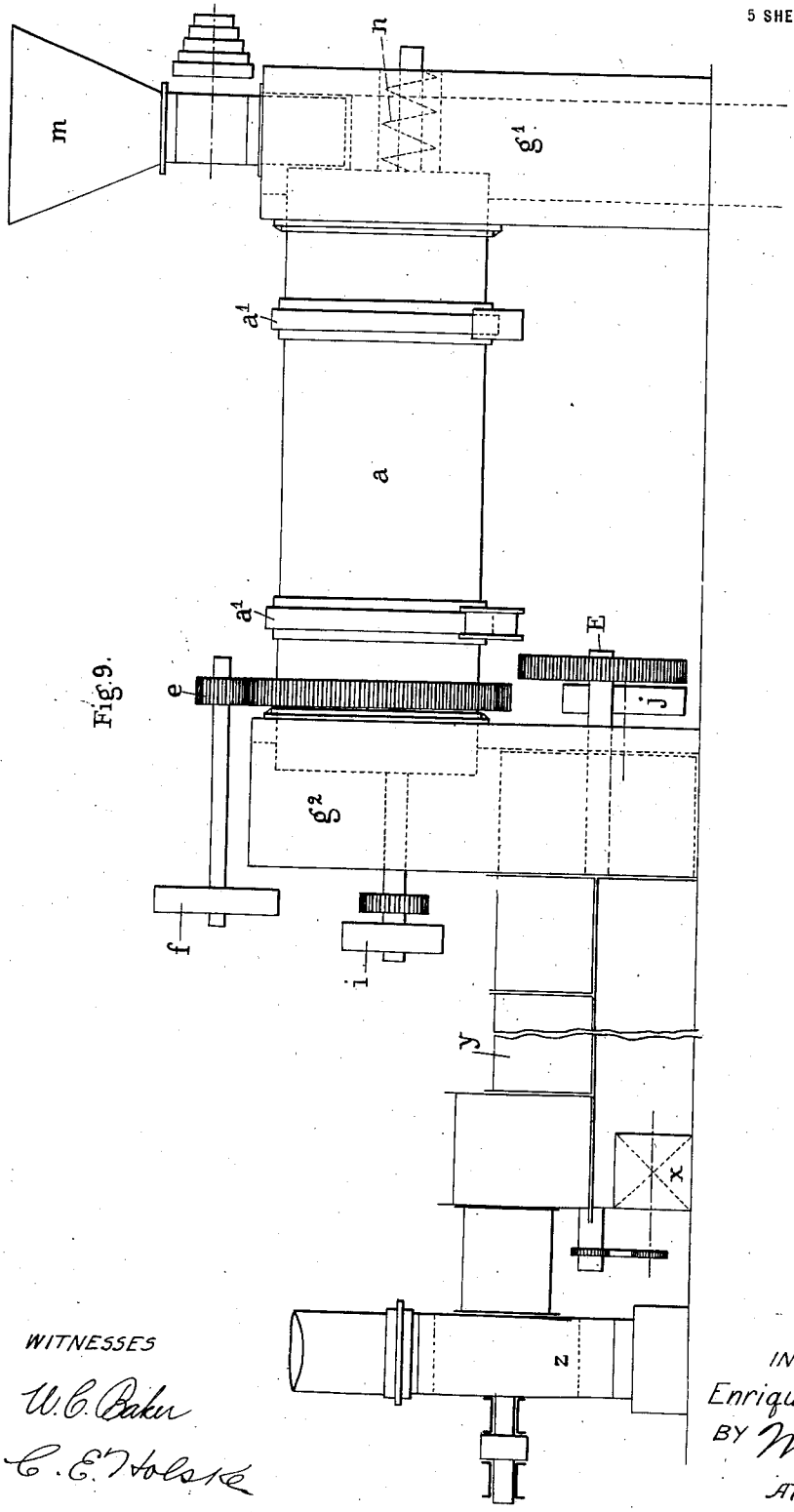


Fig. 9.

WITNESSES

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5 SHEETS—SHEET 5.

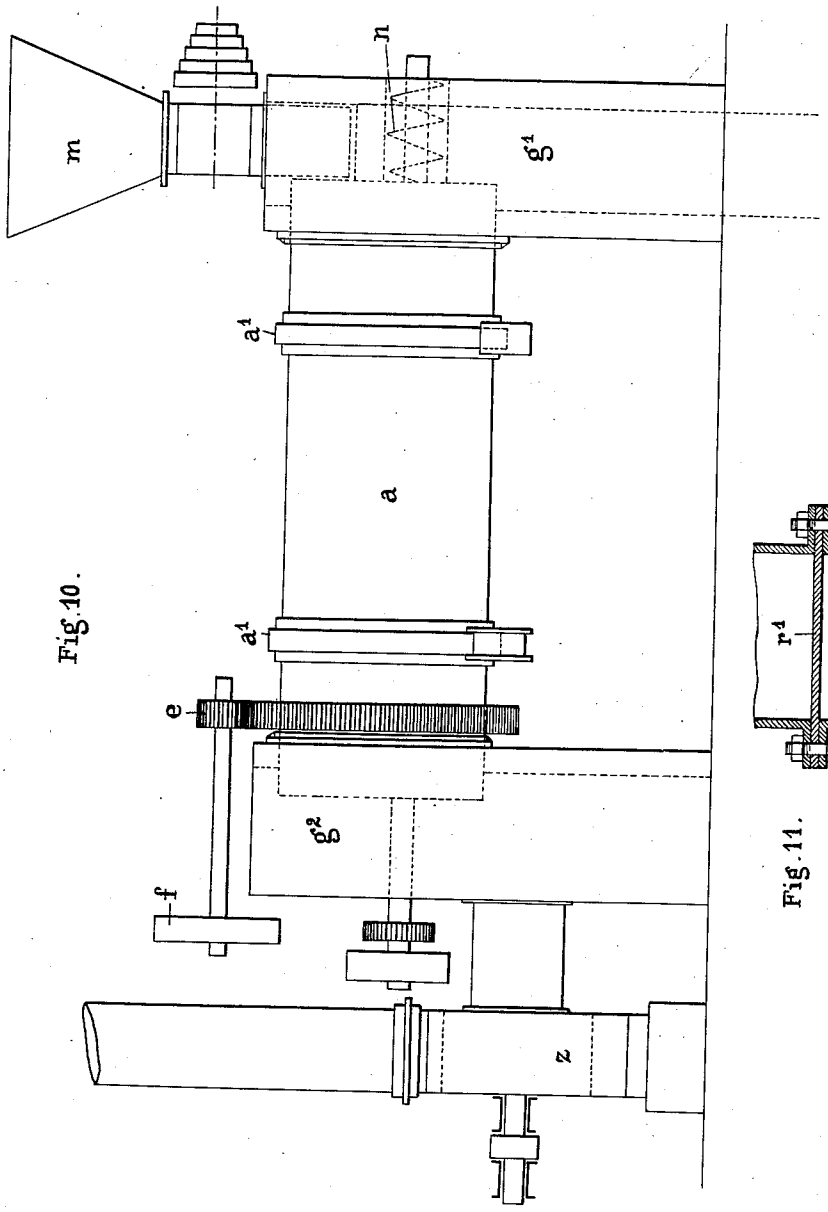


Fig. 10.

Fig. 11.

WITNESSES

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UNITED STATES PATENT OFFICE.

ENRIQUE DISDIER, OF MALAGA, SPAIN.

DRYING APPARATUS.

1,190,127. Specification of Letters Patent. Patented July 4, 1916.

Application filed January 4, 1912. Serial No. 669,303.

To all whom it may concern:

Be it known that I, ENRIQUE DISDIER, a subject of the King of Spain, and a resident of 95 Muelle, Malaga, Spain, have invented a new and useful Drying Apparatus More Particularly Intended for the Drying of Sticky or Pitchy Substances, of which the following is a specification.

This invention relates to an apparatus intended more particularly for the drying of natural or industrial substances which, when moist or warm, are of a sticky or pitchy nature.

The accompanying drawings represent a form of construction of the improved apparatus.

Figure 1 is a side elevation partly in section. Fig. 2 is a corresponding plan. Fig. 2^a is a section on line 2^a—2^a of Fig. 1 showing the arrangement of the members for transporting the material on its exit from the drum *a*. Fig. 3 is a section upon line 3—3 of Fig. 1, seen from the left. Fig. 4 is a section also upon line 3—3 of Fig. 1, but seen from the right. Figs. 5, 6 and 7 show in elevation, plan and end, the details of one of the vanes of the upper drum of the apparatus. Fig. 8 represents in perspective a fragment of the vane shaft revolving in the drum and provided with transversal pallets. Figs. 9 and 10 are side elevations corresponding with Fig. 1 of two different forms of construction of the apparatus; and Fig. 11 is a detail.

For greater simplicity there have been omitted from the drawings the elevator which conveys the material to be dried up to the hopper, and the dust-separator into which the gases are led by the fan.

The apparatus consists essentially of a rotary cylindrical drum *a* of sheet iron or the like, provided with two metal rings *a'* which rest upon two pairs of rollers *b* bearing upon four supports *c* also of metal. A gear-wheel *d* which surrounds the drum serves to impart thereto a movement of rotation received from a pinion *e* mounted upon the shaft which carries the driving pulleys *f*. The front and back parts of the drum lead to metal chambers g', g^2 respectively. The front ends of these chambers support four bearings for two shafts H each carrying a conveyer screw *n* and a series of inclined vanes *h* which receive a rotary motion from gears *k l* operated by means of a pulley *i*. The vane shafts H have their axes in the neighborhood of the horizontal plane of the axis of rotation of the drum *a*, that is to say, sufficiently high, so that the vanes *h* of both shafts H will be considerable distance from the top and bottom of the drum, (Fig. 1), while they almost touch the sides thereof, that is to say the vanes of one shaft will almost touch the wall of the drum at one side and the vanes of the other shaft will almost touch the wall of the drum at the opposite side (Figs. 2, 3 and 4). The arrangement allows the vanes rotating at a relatively high speed to grasp the substance brought to their reach by the rotating drum and to throw it, dividing it through the atmosphere of the warm gases circulating in the oven.

The charging apparatus comprises a hopper *m* stirrers *m'*, a conveyer screw m^2 and a pulley m^3, which could be replaced by a speed cone, for the disintegration of the material to be dried, which is delivered upon the conveyer screws *n*; *p* is a distributer to which the substance is brought by the endless screw conveyers *q*; *r* is a conduit connecting the chambers g' g^2 with each other. A pulley actuates by the intermediary of gears, a shaft E disposed at the interior of the fixed drum *y*. Said shaft is provided with blades F, which can have inclined transversal ribs F', which when the shaft rotates cause the advance of the substance, or prevents it from being dragged by the current of hot gases, accordingly as they are traveling in one direction or the other.

At S are shown the manholes for cleaning and inspection, at *t* the furnace, at *u* the gas-supply pipe, at *o* the air-inlets, at *x* the outlet for dried product, and at *z* the exhauster or fan connected to the drum *y*.

The working of the apparatus takes place in the following manner: If it be first supposed that the exhausting fan is connected to the left side of the fixed drum *y*, as in the construction shown in the drawings, and the apparatus is in action and if at the same time the right hand chamber g' is prevented by the interposition in the conduit of a metallic plate r' from communicating with the conduit *r*, and the latter from communicating with the left hand side of the drum *y* by the interposition of a movable metallic plate r^2, the gases enter then at *u* into the right hand chamber g', pass through the drum *a*, the left hand chamber g^2, the whole length of the conduit *r*, and reach the drum

y, from which they pass out at the opposite end. At the same time the material to be dried after being placed in the hopper is delivered regularly by the distributer m to the screw n which causes it to reach the rotary drum a, where it is constantly agitated and broken up, at the same time being pushed forward owing to the rotary movements and to the suitable inclination of the faces of the vanes h until it reaches the transporter q which causes it to leave the chamber g^2 and delivers it to the distributer p to be carried to the fixed drum y, where it is again stirred up and transported toward x where it passes out already dried. In this case the circulation of the substance takes place in the same direction as the gaseous current during the first period of the drying, and in the contrary direction of the gaseous current during the last period, which is very favorable for a large number of products.

At the exit of the product at x, the material is cooled or else put directly in bags, or even passed over once again through the apparatus, if it is too moist to be suitably placed in bags or bales. The fixed drum y may be replaced by any other drying device, or even suppressed: in the latter case the exhauster z can be directly joined to the left chamber g^2 of the drum a, as has been shown in Fig. 10. The vane-carrying shafts may be revolved at equal or different speeds, and placed higher or lower in relation to the center of the rotary drum a according to the nature of the material to be dried and the thickness of the layer with which the vanes h are desired to contact. The ends of the vane-provided shafts passing through the metal chamber g', are cooled by the fresh and moist material which falls upon and covers them.

The arrangement and the motion of the vanes h mounted upon the shafts passing right through the rotary drum a have for effect that certain substances taking the form of plates or shavings, as in the case for sugar-canes, maize-stems, sorghum, etc., undergo a desirable sub-division or breakage at the same time as they are dried. To prevent these plates or shavings being too rapidly carried out of the apparatus by the current of gases, and therefore not being suitably dried, as shown in Figs. 5, 6 and 7, the vanes h may be given such an inclination that the revolving shafts throw the material obliquely back, and that in this way the latter opposes a greater resistance to its advance during its passage through the drum a. In order to obtain the same result in the drum y, there may be placed therein the vanes F arranged so as to drive back the material or else by placing them parallel to the axis there may be added intermediate series of projections or transversely inclined ribs F', Fig. 8, which produce the same effects upon rotation of the shaft. The front surface of the chambers g', g^2 and the conduit r are provided with registers o to allow the addition of air to the gases of combustion. The furnace t may be at any convenient distance from the drying apparatus to which the gases are led by means of a suitable conduit or flue.

An important feature of the apparatus described is the continuous cooling of the vane-fitted shafts H. In the arrangement shown in the drawings, these shafts provided with helices n extending across the chamber g', serve to convey the moist product, the contact of which effects the cooling of the shafts.

The advantages of this drying apparatus are numerous. It is known that products very rich in water, such as residues from diffusion or steeping processes, beet-root pulp, potatoes, etc., tend during the first period of drying to form accumulations, clots and strata, which prevent the drying from being accomplished rapidly. It has been recognized also that substances which are sticky when moist or warm, as for example concentrated sugary substances or molasses, readily adhere to the walls of the drier where they finally burn if they are not removed in proportion as they are deposited. The arrangement of a double series of vanes, mounted upon two shafts turning simultaneously with the drum at suitable speeds, has for result to maintain the product under treatment in constant movement and suspension, the product being stirred, agitated, divided, cut up and intimately mixed with the hot gases intended for the drying, at the same time that the parts adhering to the walls of the drum are removed and these walls cleaned. The surfaces of contact between the material to be dried and the gases being thereby considerably increased, there results a much more regular, quicker, more uniform and more complete drying, while at the same time the output of the apparatus becomes greater and more economical. Other advantages may be mentioned: the heating is intense and continuous; the control of the gases and of the material to be dried is easy throughout their travel; it is feasible to add air to the gases and to regulate their temperature; the working is automatic and the production large; lastly it is possible for the operator to regulate at will the precise degree of moisture of the product obtained. It is evident that the size of the apparatus will vary according to the quantities of material to be dried.

I claim:

1. In a drying apparatus, a rotary drum, means for admitting hot gases into the drum, and a pair of rotating shafts in said drum, each of said shafts having vanes radially mounted upon it, said vanes being arranged

for throwing into and through the atmosphere of the hot gases the material admitted into the drum.

2. In a drying apparatus, a rotating drum, means for admitting the hot gases into the drum, and a pair of revoluble shafts mounted in the drum on opposite sides of and below the axis of said drum and each provided with vanes, the vanes being a considerable distance from the top and bottom of the drum and almost contacting with the walls of the drum only at the sides thereof.

3. In a drying apparatus, a rotating drum, a pair of hollow shafts revolubly mounted in said drum, and means carried by said shafts for advancing material through said drum, the said hollow shafts being provided with transverse holes to permit air to pass through said shafts into said drum.

4. In a drying apparatus, a revoluble drum, means for creating a current of hot gases in said drum, a pair of shafts rotating in said drum in opposite directions, and vanes mounted on said shafts, said vanes being arranged to project the substance in a contrary direction to the current of the hot gases.

5. In a drying apparatus, a revoluble drum, means for creating a current of hot gases in said drum, a pair of rotating shafts in said drum, an auxiliary drum for receiving the substances from the first drum, a collecting conduit of the gases communicating by its ends with the two ends of the first drum, and a vane shaft rotating in the interior of the fixed auxiliary drum, the vanes of said shaft being provided with ribs or projections preventing the dragging of the substance by the hot gas current.

6. In a drying apparatus, a revoluble drum, means for creating a current of hot gases in said drum, a pair of rotating shafts in said drum, an auxiliary drum for receiving the substances from the first drum, a collecting conduit of the gases communicating by its ends with the two ends of the first drum and the two ends of the auxiliary drum, and means for interrupting the communications in order to change the direction of circulation of the gases in the auxiliary drum.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

ENRIQUE DISDIER.

Witnesses:

BARTLEY F. YOST,

LEON PEILLET.