

(No Model.)

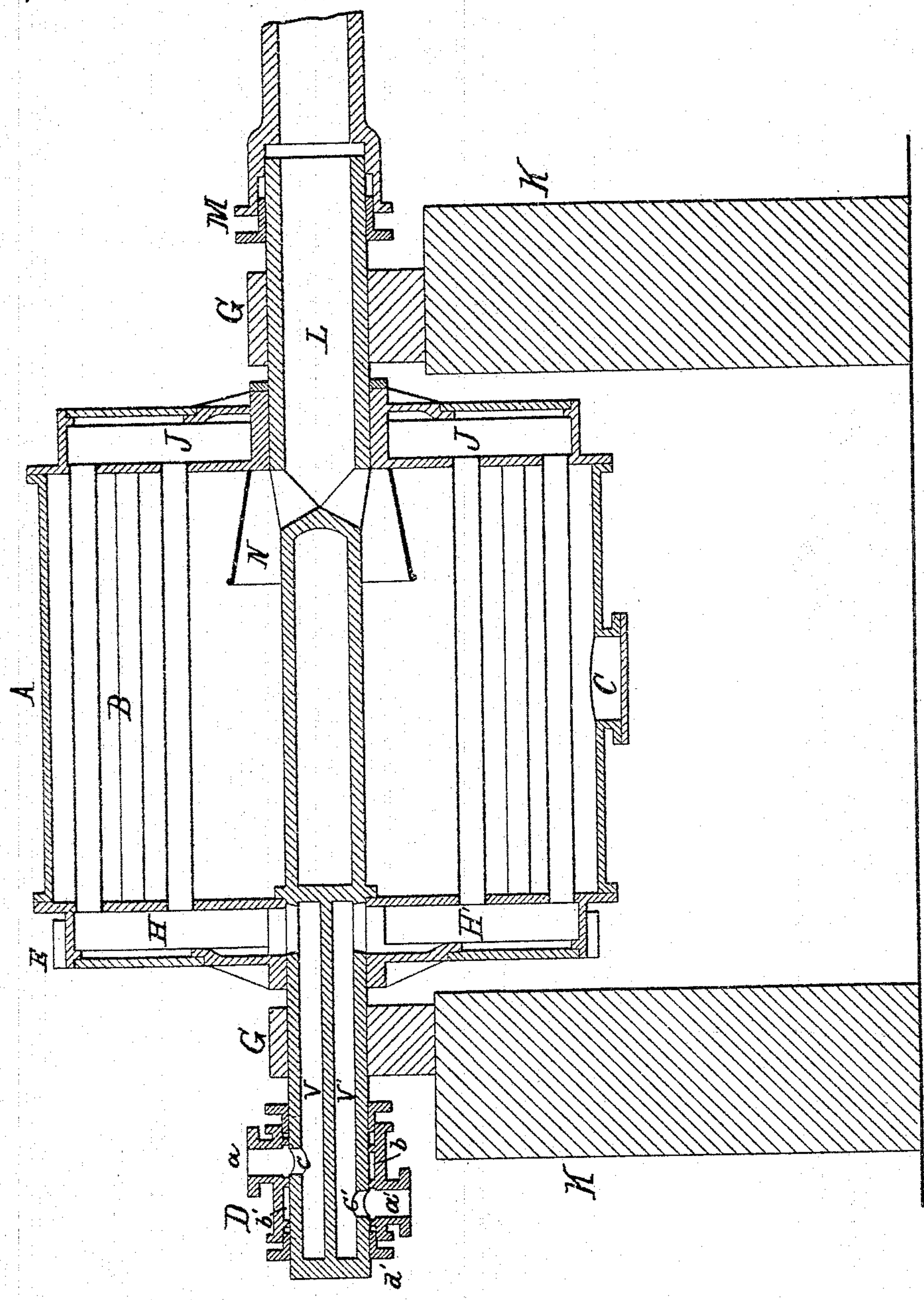
2 Sheets—Sheet 1.

E. DONARD.  
APPARATUS FOR DRYING IN VACUUM.

No. 491,338.

Patented Feb. 7, 1893.

Fig. 1.



WITNESSES:

*George Baumann*  
*James Eraser*

INVENTOR:

*Eugene Donard*  
BY  
*Howdon & Howdon*  
ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

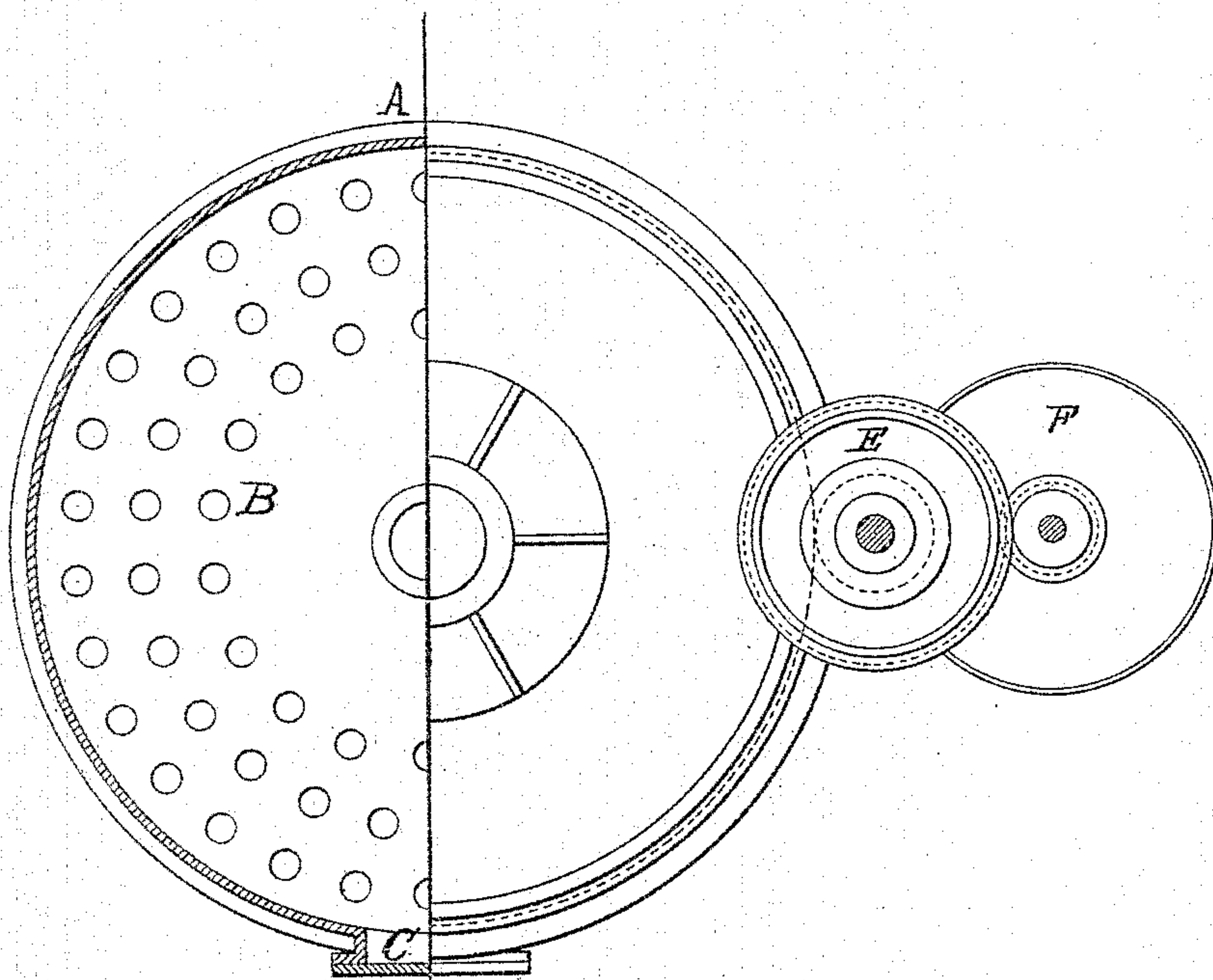
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Fig. 1 A-



WITNESSES:

*George Baumann*  
*James Gracie*

INVENTOR:

*Eugene Donard*  
BY  
*Horace V. Horner*  
ATTORNEYS.



# UNITED STATES PATENT OFFICE.

EUGENE DONARD, OF ROUEN, FRANCE.

## APPARATUS FOR DRYING IN VACUUM.

SPECIFICATION forming part of Letters Patent No. 491,338, dated February 7, 1893.

Application filed February 18, 1892. Serial No. 421,957. (No model.) Patented in France February 13, 1890, No. 196,863, and in Belgium April 15, 1891, No. 94,534.

*To all whom it may concern:*

Be it known that I, EUGENE DONARD, a citizen of the French Republic, residing at Rouen, France, have invented certain Improvements in Apparatus for Drying in Vacuum Solid or Semi-Solid Substances, (for which I have obtained a French patent, No. 196,863, dated February 13, 1890, and a Belgian patent, No. 94,534, dated April 15, 1891,) of which the following is a specification.

There are many solid organic matters, animal or vegetable for instance, the mash from distilleries and breweries, the residue from beet root and other industrial residues, the immediate use of which is impossible which are lost because in their state of humidity they cannot be kept. Moreover there are other matters which cannot be submitted to any special process, without having been desiccated first, for example certain residues before the extraction of the oils by displacement. For a long time a practical process has been sought for desiccating matters either in the open air with the aid of steam, hot water or hot air or by vacuum so as to reduce as much as possible the weight and bulk of these products and to allow of their preservation and storage or to prepare them for some further operations. After numerous experiments I have found that it was only under vacuum that moist solid matters could be rapidly and economically desiccated retaining in so doing their nutritive qualities, preventing the alteration of the oils and nitrogenous matters for example. To realize this principle I have invented an apparatus in which the matter to be desiccated being first brought to a suitable state is submitted to vacuum and to a more or less high temperature. The matter moreover is kept in a state of continuous agitation, so as to successively bring each of its particles in contact with the heating surface. The amount of the heating surface must naturally depend on the quantity of heat to be furnished and on the degree of conductivity of the material to be dried.

In the accompanying drawings, Figure 1 is a longitudinal section, and Fig. 1<sup>A</sup> an end view partly in section, of my improved drier or evaporator.

In the drawings, A represents a metallic

shell adapted to revolve with its shaft; B heating tubes; C loading and emptying door; D distributing box for the entry and exit of the steam or other heating fluid; E gear for driving the apparatus; F driving pulley; G K pedestals and bearings; H, J, H' entry and outlet chambers for the steam or other fluid; L outlet pipe leading the vapors produced by the desiccation to the condenser; M stuffing box for vacuum, and N conical screen preventing the suction of matter through pipe L.

The steam or fluid heating the drying apparatus (or evaporator) enters through the hollow shaft and through the distributing box D. This hollow shaft is divided for a portion of its length into two divisions, one, V, serving for the entering steam or fluid, and the other, V', acting as an outlet for the condensed steam. The distributing box D is fixed but the hollow shaft turns with the evaporator. The two divisions V and V' are always and at every point of the revolution in communication one with the branch pipe *a* and the other with the branch pipe *a'* by the openings *c* and *c'* and annular passages *b* and *b'*. The parts *d* and *d'* of the stuffing box prevent any communication between the heating steam or fluid and the outer air.

The steam chamber on the left is divided into two equal divisions H and H', H being in communication with V and H' with V'. The steam entering by *a* and passing through V fills the chamber H and passes through the corresponding half of the heating tubes into the chamber J and then back through the other half of the heating tubes into the chamber H'. The condensed steam collecting in the chamber H' runs out through the passage V' *c'* and *a'* at each revolution when the chamber H' rises above center of shaft. This water passing through *a'* is collected by preference into a self-acting drain. The matter to be treated after being properly prepared is introduced into the body of the evaporator through which the heating tubes pass by suitable opening. This opening being hermetically closed, a vacuum is formed by means of an air pump and condenser. Steam is admitted through V and the apparatus is set turning. Through the influence of the heat and vacuum evaporation begins at once and the vapor so pro-



duced passes off through the hollow shaft L. The products being submitted to a low temperature in proportion to the degree of vacuum retain all their nutritive qualities especially if care has been taken when necessary to line the inside of the apparatus with a metal which is not attacked by the matter submitted to desiccation.

I claim as my invention:—

10 1. In a drying apparatus, the combination of a rotary body closed at each end by a steam chamber, and pipes passing through the said body and connecting the steam chamber at one end with the steam chamber at the  
15 other end, one of the said steam chambers being partitioned to form two divisions, with a hollow shaft divided at one end, one of the passages connecting one of the divisions with the steam supply and the other passage connecting the other division with the exhaust  
20 outlet, whereby the steam is caused to circulate through half the pipes to the undivided steam chamber and back through the other half of the pipes to the outlet.

2. In a drying apparatus the combination 25 of a rotary body provided with a steam chamber at each end and pipes passing through the said body and connecting the said chambers, one of the chambers being divided, and a hollow shaft partitioned at one end to form a 30 steam inlet passage to one division in the divided steam chamber, and a steam outlet passage to the other division, the other end of the hollow shaft opening into the interior of the said body, as and for the purposes set forth. 35

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

EUG. DONARD.

Witnesses:

H. WOUSSEN,  
L. CHABAILLE.