No. 868,446. PATENTED OCT. 15, 1907.

J. A. JUST.

DRYING APPARATUS.

APPLICATION FILED NOV. 24, 1906.

Fig. 1.

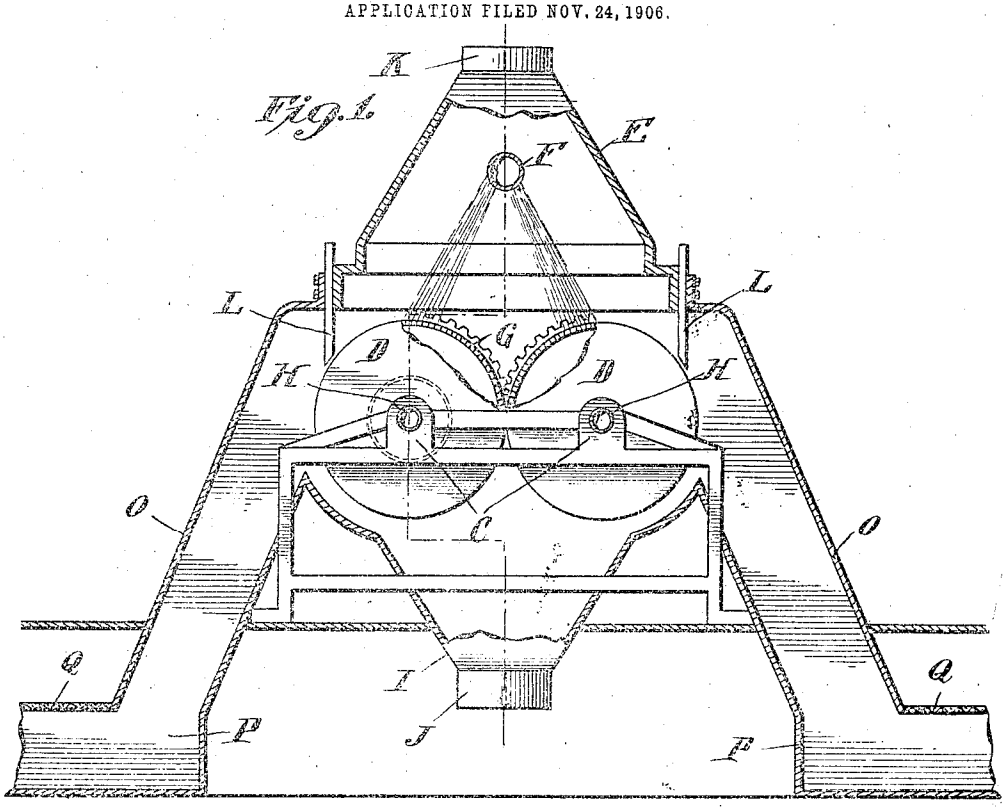
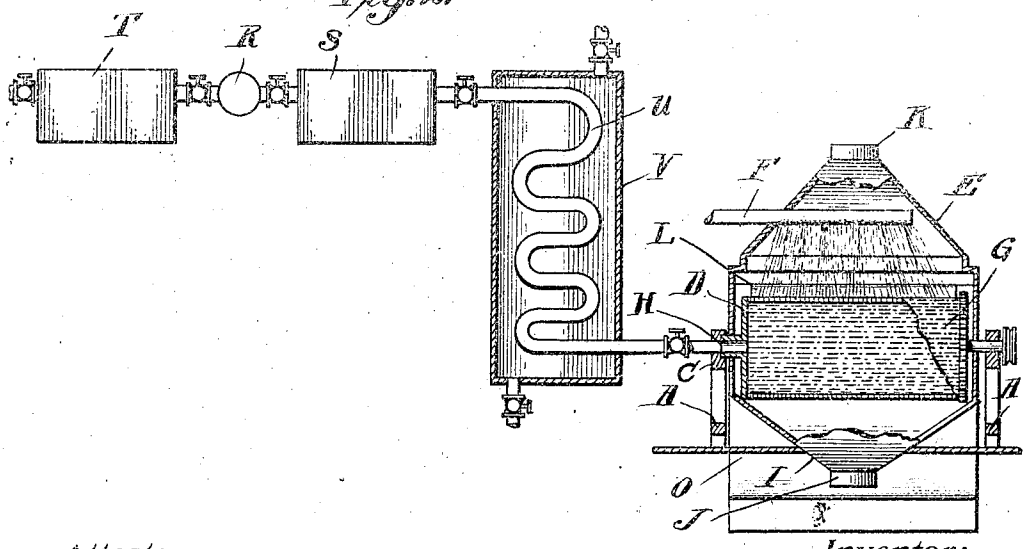


Fig. 2.



Attest:

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by Dickerson, Brown, Reegener & Binney Attys.

UNITED STATES PATENT OFFICE.

JOHN A. JUST, OF SYRACUSE, NEW YORK.

DRYING APPARATUS.

No. 868,446. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed November 24, 1906. Serial No. 344,895.

To all whom it may concern:

Be it known that I, JOHN A. JUST, a citizen of the United States, and a resident of Syracuse, New York, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification, accompanied by drawings.

This invention relates to improvements in drying apparatus and the objects of the invention are to improve upon the construction of such apparatus, increase its efficiency, and enable larger quantities of material to be dried more thoroughly in a given time without injury to the material.

Further objects of the invention will hereinafter appear and to these ends the invention consists of drying apparatus for carrying out the above objects embodying the features of construction, combinations of elements, and arrangement of parts having the general mode of operation substantially as hereinafter fully described and claimed in this specification and shown in the accompanying drawings, in which.—

Figure 1 is an end elevation of apparatus embodying the invention partly in section; Fig. 2 is a side elevation thereof partly in section.

Referring to the drawings, A represents the frame of the machine, provided with bearings C for the drying rolls D, which are adapted to be rotated in any suitable manner in the same direction or towards each other. Above the rolls is provided a hood E and a perforated supply pipe F for the material to be dried, which is spray on to the rollers, preferably on the inner quarters thereof, in such manner as to distribute it evenly over the surface. These rollers are preferably constructed with both ends closed, and the peripheries or surfaces of the rollers are preferably made of perforated or other foraminous metal, thereby forming a foraminous septum. The metal should be very thin and provided with a multiplicity of minute perforations G spaced very close together, as shown by the dots and dashes on the cylinder in Fig. 2 which indicate perforations G.

Dried and heated compressed air is preferably led into the interior of the revolving cylinders D, through the hollow bearings C at one side and the air is forced out through the perforations of the surfaces of the cylinders. A hopper I is provided underneath the revolving cylinders and suction as from a fan may be applied to the aperture J of said hopper, and also to the aperture K of the upper hood E. Suitable knives or scrapers L are provided for scraping the material from the cylinders, and chutes O communicate with the sides of the cylinders and extend downwardly to the boxes P provided with gauze covers Q to permit the exit of air, induced by suction applied to the boxes P.

Any suitable air pump R may be used for forcing air into the storage tank S, and the air may be dried in the drying chamber T before passing to the pump, or dried after passing the pump. From the storage tank S the air passes through any suitable heating apparatus, as for instance the coil U in the chamber V, which may be heated in any suitable manner. From thence the heated and dried air is forced through the pipes H into the cylinders.

In the operation of the apparatus shown, the material to be desiccated or dried, which may be whole milk, skim milk, mixtures of milk and other food stuffs or other like material, is fed on the upper descending quadrants of the two foraminous cylinders or drums which are revolving substantially or nearly in contact. Air is supplied to the interior of the drums under such pressure and in such volume as not only to counterbalance and obviate the tendency of the material to enter through the perforations but as to pass outward through the perforations and through and past the material on the drums. With the apparatus shown, the air bubbles through the material on the upper descending quadrants of the drums and the bubbles persisting in the concentrated material are flattened out, to enable the formation of a film, at the point where the drums rotate in contact or near contact. Below this point, on the lower descending and ascending quadrants, the film of concentrated and more or less viscous material is blown outwards and desiccated by the air passing through the perforations to form filaments or tufts which, so far as they adhere to the drums, are shaved off by the scrapers shown. The duplication of the foraminous drums is a convenient way of securing the formation of a compact and suitable film from the partially evaporated material. In starting the apparatus shown, the air under pressure is first passed into the drums before beginning the feed of the liquid. The desiccated filaments or tufts are constantly removed from the drums by knives or scrapers L, and fall through chutes O into collecting boxes P.

Any suitable temperature for the air may be employed suitable for the particular material to be dried. The water vapor and air escaping through the cylinders is suitably sucked away through the hood E and hopper I. The suction apertures may be properly screened not shown to prevent any of the product from passing through.

Milk as it is delivered from the dairies and farmers has a varying acidity, and preferably the acidity of all the milk to be dried is rendered alike by neutralizing the excessive acidity with a suitable alkali or alkaline salt. By so doing the dry milk is of uniform quality and does not differ in its acidity so that even better results are obtained than from fresh milk. The milk may be pasteurized or sterilized before subjecting it to the drying process, or may even be concentrated and some of its water thus expelled.

The speed of the revolving cylinders should be so regulated that the film is dried when it reaches the

scrapers, and the thickness of the film can be regulated by adjusting the distance apart of the cylinders. The force of the current of air, its dryness and its temperature may be regulated in any desired manner to dry quickly or slowly. If the material to be dried is of a delicate nature and sensitive to heat, it may be dried without changing its nature or its composition, so that when sufficient water is added to the resulting dry powder the original solution is regained. This simple and very efficient mode of drying, when applied to milk yields a powder which contains the milk solids in an unchanged state, and when water is added to the powder, it is restored to milk with all its constituent parts intact. The powder is stable and can be stored for future use in all climates. It retains its nutrient quality and furnishes a valuable product, since milk for instance in its natural state can only be kept at the very best for several days, while the dry powder can be kept for years if not damaged by water or otherwise.

Obviously some features of this invention may be used without others and the invention may be embodied in widely varying forms, therefore, without limiting the invention to the devices shown and described, and without enumerating equivalents,

I claim and desire to obtain by Letters Patent the following:

1. A drying apparatus comprising a rotatable drum having a foraminous surface, means communicating with the interior of said drum for forcing air outwardly through said foraminous surface and means for distributing liquid to be dried upon such foraminous surface.

2. A drying apparatus comprising a rotatable drum of perforated sheet metal, means communicating with the interior of said drum for supplying air under pressure and means for distributing liquid to be dried upon the exterior of the drum.

3. A drying apparatus comprising a pair of rotatable drums placed to rotate in close proximity, one or both having a foraminous surface, means for forcing air outwardly through said foraminous surface and through liquid thereupon and means for distributing liquid to be dried upon such foraminous surface.

4. A drying apparatus comprising a pair of rotatable drums placed to rotate in close proximity, one or both said drums being of perforated sheet metal and means communicating with the interior of a drum for supplying air under pressure to and through liquid on the exterior of such drum and means for distributing liquid to be dried upon the exterior of said drum.

5. A drying apparatus comprising a rotatable drum having a foraminous surface, means for heating and drying air, means for forcing such air into the interior of said drum and outwardly through said foraminous surface and means for distributing liquid to be dried upon such foraminous surface.

6. A drying apparatus comprising a rotatable drum of perforated sheet metal, means for heating and drying air, means communicating with the interior of said drum for supplying such air under pressure to and through liquid upon the exterior of the drum and means for distributing liquid to be dried upon the exterior of the drum.

7. A drying apparatus comprising a pair of rotatable drums placed to rotate in close proximity, one or both having a foraminous surface, means for heating and drying air, means communicating with the interior of said drums for forcing such air outwardly through said foraminous surface, and means for distributing liquid to be dried upon such foraminous surface.

8. A drying apparatus comprising a pair of rotatable drums placed to rotate in close proximity, one or both of said drums being of perforated sheet metal, means for heating and drying air, means communicating with the interior of a drum for supplying such air under pressure outwardly through its perforated surface and means for distributing liquid to be dried upon the exterior of said drum.

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

JOHN A. JUST.

Witnesses:
OLIN A. FOSTER,
A. L. O'BRIEN.