BEST AVAILABLE COPY

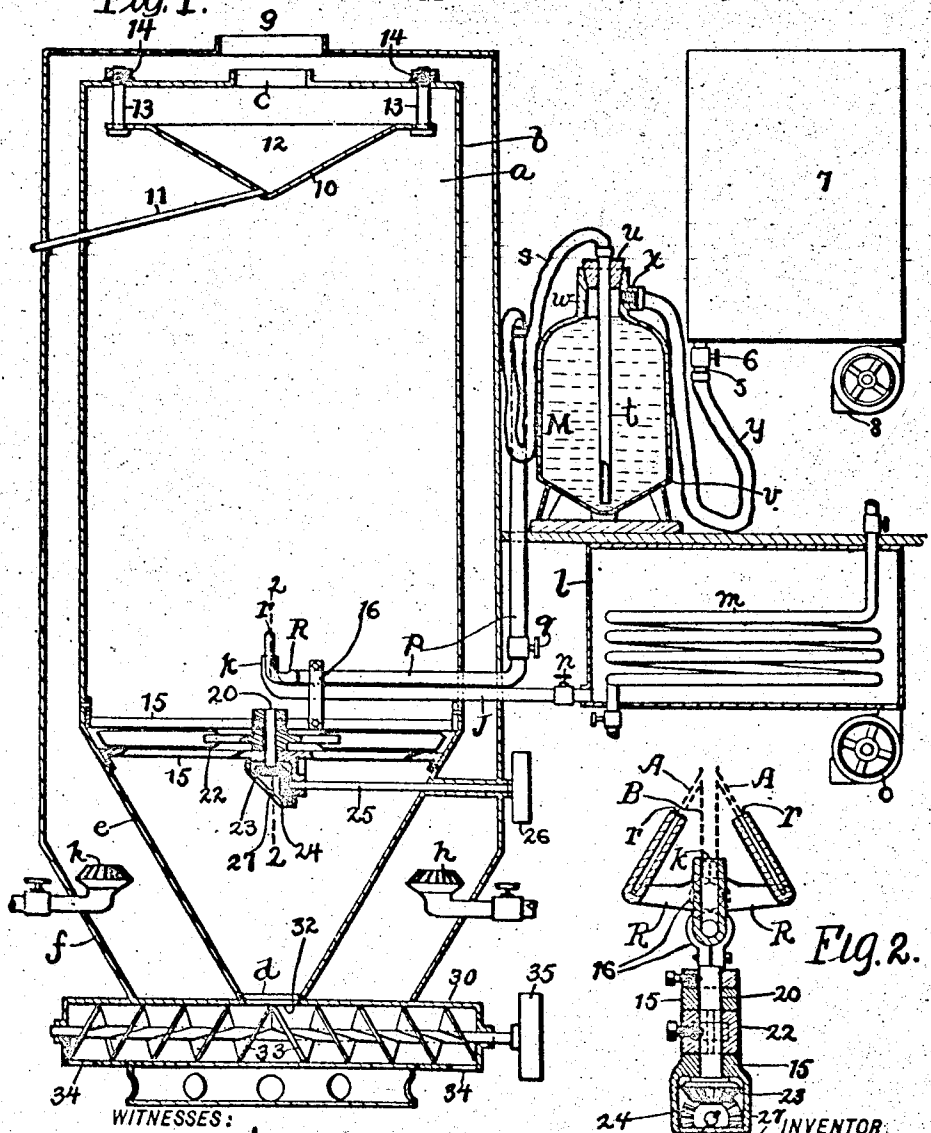
No. 827,153. PATENTED JULY 31, 1906.

W. E. JAQUES.

DESICCATING OR EVAPORATING APPARATUS.

APPLICATION FILED DEC. 8, 1902.

Fig. 1.



WITNESSES:

Daniel E. Daly.

G. Ty. Hayes.

Fig. 2.

INVENTOR:

William E. Jaques

BY

Synnestvedt & Lechner

his ATTORNEYS

THE MORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM E. JAQUES, OF GRAND RAPIDS, MICHIGAN, ASSIGNOR TO INTERNATIONAL DESICCATING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF WEST VIRGINIA.

DESICCATING OR EVAPORATING APPARATUS.

No. 827,153. Specification of Letters Patent. Patented July 31, 1906.

Application filed December 8, 1902. Serial No. 134,302.

To all whom it may concern:

Be it known that I, WILLIAM E. JAQUES, a citizen of the United States of America, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Desiccating or Evaporating Apparatus; and I 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 pertains to make and use the same.

This invention relates to improvements in desiccating or evaporating apparatus more especially adapted for use in evaporating or desiccating liquids—such, for instance, as milk.

One object of this invention, although not limited in this respect, is more especially to concentrate and reduce milk into a dry and perfectly homogeneous powder by an apparatus which is exceedingly simple in construction, reliable in its operation, and not detrimental to the liquid or material operated upon.

Another object of this invention is to provide apparatus of the character indicated which has a large capacity and operates with great facility.

With these objects in view the said invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation, largely in section, of apparatus embodying the said invention. Fig. 2 is a vertical section in detail on line 2 2, Fig. 1, looking in the direction indicated by the arrow and drawn on a somewhat larger scale than Fig. 1.

Referring to the drawings, *a* designates a drying-chamber within which the milk or other liquid or material which is to be desiccated or evaporated is treated. The chamber *a* is formed by a suitably-constructed metal casing *b*, which is preferably about twenty-five or thirty feet in height and about ten feet in diameter. The chamber *a* is closed except centrally of the top thereof, where it has an upwardly-discharging vapor-outlet *c*, and centrally of its lower end, where it has a downwardly-discharging outlet *d*. The lower end portion *e* of the casing *b* tapers downwardly and has preferably the contour of an inverted cone—that is, flares upwardly—and the outlet *d* is formed at the lower end of the said inverted-cone-shaped lower end portion *e* of the casing *b*.

A heating-jacket *f* surrounds the casing *b* and extends over the upper portion of the said casing and is provided with an outlet *g* over the vapor-outlet *c* of the chamber *a*. The jacket *f* extends, preferably, a suitable distance below the lower end of the chamber *a* around and below the lower end portion *e* of the casing *b*, and suitably-operated heating-burners or heaters *h* are arranged within the lower portion of the chamber of the said jacket, preferably in suitable proximity to the exterior of the said end portion of the said casing.

An air-conducting pipe *j* extends into the central portion of the chamber *a* at the top of the lower end portion *e* of the casing *b* and is provided centrally of the said chamber with a vertically upwardly discharging outlet *k*, which is preferably straight and uniform in cross-section, so as to render it capable of discharging the air received thereby in the form of a straight continuous stream. The pipe *j* is in open relation with the chamber of a compressed-hot-air reservoir *l*, which is arranged externally of the jacket *f*.

The chamber of the reservoir *l* is heated in any approved manner—as, for instance, by a steam radiator or heater *m*, arranged within the said chamber. The pipe *j* is provided with a normally closed valve *n*. A suitably-operated air-pump *o* discharges into the chamber of the reservoir *l* and is operated whenever required to maintain the desired pressure within the said reservoir. Preferably a pressure of sixty pounds per square inch is established and maintained within the reservoir *l*, so that when the valve *n* is opened a stream of hot air under a pressure of sixty pounds per square inch is discharged vertically upwardly from the outlet *k* into the chamber *a*. The temperature maintained within the reservoir *l* is preferably about 180° Fahrenheit, so that air is discharged into and centrally of the chamber *a* from the pipe *j* at a temperature of about 180° Fahrenheit.

A pipe *p* for conducting the milk, liquid, or material to be desiccated or evaporated has a normally closed valve *q* and extends into the chamber *a* into suitable proximity to the out-

let *k* of the air-conducting pipe *j*, where the said pipe *p* has two short branches R, respectively terminating at their free ends and at opposite sides, respectively, of the said outlet *k* in an outlet *r*, which is arranged to discharge the milk or liquid received thereby upwardly and laterally in close proximity to and over the outlet *k* of the air-pipe *j*. Each outlet *r* is preferably straight and uniform in cross-section, so as to render it capable of discharging the liquid in the form of a straight stream.

A hose or flexible tube *s* is attached at one end to the outer end of and communicates with the pipe *p*. The tube *s* is attached at its opposite end to and communicates with the outer end of a tube or pipe *t*, with which the cork or stopper *u* of a receptacle *v* is provided. The receptacle *v* contains the milk or other liquid or material M to be desiccated or evaporated. The receptacle *v* is provided at the top and centrally with an upwardly-projecting neck *w*, whose interior passage-way communicates with the interior chamber of the body portion of the said receptacle. The neck *w* is closed at its outer end by the cork or stopper *u*, and the pipe *t* is arranged centrally and vertically of the said stopper and extends into the receptacle *v* centrally and vertically through the neck *w* without obstructing the neck interiorly and into close proximity to the bottom of the interior chamber of the said receptacle. The neck *w* is provided at one side with a laterally and outwardly projecting pipe connection *x*, which is in open relation with the interior chamber of the receptacle *v*. A hose or flexible tube *y* is attached at one end to and communicates with the said pipe connection *x* and at its opposite end is attached to and communicates with a pipe 5, which has a normally closed valve 6 and leads from and communicates with the chamber of a compressed-air reservoir 7, wherein air under some pressure—say a pressure of about twenty pounds per square inch—is stored, and a suitably-applied air-pump 8 is arranged to discharge into the said reservoir and operated whenever required to maintain the desired pressure within the said reservoir.

The air-outlet *k* of the pipe J has a capacity considerably larger than the combined capacities of the outlets *r* of the pipe *p*. Preferably the outlet *k* has a transverse area which is about three or four times as large as the transverse area of each outlet *r* of the pipe *p*, so that if each outlet *r* were a tenth of an inch in diameter the outlet *k* would be about three or four tenths of an inch in diameter.

An imperforate deflector 10 is suspended in any approved manner within the upper portion of the chamber *a*, preferably near the top of the said chamber. Deflector 10 is arranged below and considerably larger transversely than the vapor-outlet *c* of the chamber *a*, but does not extend clear across the said chamber. The deflector 10 has the general contour of an inverted hollow cone—that is, tapers downwardly toward its central portion—and the chamber 12, formed in the said deflector, is open at the top. The deflector 10 is suspended, preferably, from the top of the casing *b* by suitably-applied bolts 13 and nuts 14. The bolts 13 are shown arranged with their heads projecting in under the deflector and have their shanks extending upwardly through the top of the casing *b*, and the nuts 14 are mounted on the said shanks at the upper side of the said top.

A drain-pipe 11 communicates with the lowest portion of the upwardly-flaring interior chamber 12 of the deflector 10 and extends outside of the jacket *f*, where it leads to any desired place.

Two cross-bars 15 extend transversely of the chamber *a* at the top of the inverted-cone shaped lower end portion *e* of the casing *b* and are secured in any approved manner to the said casing. The two bars 15 are arranged horizontally and a suitable distance apart vertically. The pipes J and *p* are preferably held near their outlets to the upper bar 15 by a suitably-applied clip 16.

A short shaft 20 is arranged vertically and centrally of the chamber *a* and extends between and is supported in any approved manner from the bars 15. The shaft 20 is operatively provided between the two bars 15 with a fan 22. The shaft 20 extends through and below the lower bar 15 and below the said bar is operatively provided with a bevel-gear 23, which meshes with a bevel-gear 24, operatively mounted on a shaft 25, which is arranged horizontally and supported in any approved manner. The shaft 25 extends outside of the jacket *f*, where it is provided with a driving-wheel 26, to which power is applied in any approved manner A case 27 incloses the gears 23 and 24 and is supported from the lower bar 15.

A conveyer-containing case 30, which is arranged in a horizontal plane next below the outlet *d* of the chamber *a*, extends through the lower end of the jacket *f*, and opposite ends of the said case 30 project outside of opposite sides, respectively, of the said jacket. An aperture 32, which is formed in the top of the case 30, registers with the outlet *d* and forms the inlet of the said case. A screw conveyer 33 is arranged within and longitudinally of the case 30 and extends from end to end of the said case. The screw conveyer 33 has a right-handed thread and a left-handed thread extending from a point centrally of the inlet 32 of the case 30 to opposite ends, respectively, of the said case. The case 30 is provided at each end, externally of the jacket *f*, and at the bottom with a downwardly-discharging opening or outlet 34, and the con-

veyer 33 is operatively provided at one end and outside of the said case with a driving-wheel 35, to which power is applied in any approved manner.

The operation of the hereinbefore-described apparatus is as follows: A temperature of about 90° Fahrenheit is established and maintained exteriorly of the drying-chamber by the operation of the heating-jacket, and the air within the reservoir *l* is heated and maintained at a temperature of about 180° Fahrenheit and under a pressure of about sixty pounds per square inch, as already indicated. The valve *n* of the air-conducting pipe J is then opened to permit the passage of hot air under pressure into the drying-chamber, into which the said air is discharged vertically upwardly centrally of the said chamber from the outlet *k* of the said pipe and in the form of a stream. The valve *q* of the pipe *p*, employed to conduct the liquid or material to be desiccated or evaporated into the drying-chamber, is then opened, whereupon the valve 6 of the pipe 5 is opened to permit the passage of air under pressure from the reservoir 7 to and on top of the liquid or material within the receptacle *v*, so as to result in forcing liquid or material from the said receptacle through the pipe *t*, tube *s*, and pipe *p* into the drying-chamber, and the liquid or material to be evaporated or desiccated is within the drying-chamber discharged in the form of streams A, as shown in dotted lines, Fig. 2, against opposite sides of and carried upwardly and heated and scattered by the stream B of hot air, as shown in dotted lines, Fig. 2, and the intersection of the streams of liquid or material to be desiccated or evaporated with the stream of hot air, more especially when the latter is considerably larger in volume than the former, instantly results in the formation of a mist or cloud within the drying-chamber and in the absorption by the air of the moisture and in a rapid vaporizing and elimination of the moisture from the said cloud or mist, which moisture emanates or arises from the heated, scattered, and finely-divided liquid or material to be desiccated or evaporated and passes upwardly to and around the deflector 10 and over the said deflector to the vapor-outlet *c* of the drying-chamber. Any solid constituents of the liquid or material to be evaporated or desiccated which rise to and impinge against the downwardly-facing surface or surfaces of the deflector 10 are deflected or returned downwardly, and hence the escape of solid particles to the vapor-outlet *c* is prevented. The deflector 10, having the shape of an inverted cone, is instrumental in spreading or distributing any material impinging against the downwardly-facing surface or surfaces of the said deflector. The drain-pipe 11, extending from the interior chamber of the deflector 10, is instrumental in conducting off out of the way any water or liquid which may result from condensation of vapors within or adjacent the vapor-outlet *c*. The dried or partially-dried solid particles, descending from the mist or cloud formed within the drying-chamber during the operation of the apparatus, settle by gravity into the lower portion of the said chamber, and obviously the said particles descend more slowly as they become drier. The fan 22 is rotated slowly during the operation of the apparatus, and the operation of the fan is instrumental in gathering the descending solid particles toward the central portion of the inverted-cone-shaped lower end portion of the casing *b* and in retarding the descent of the said particles. The solid particles thus descending through the lower portion of the drying-chamber will be perfectly dry by the time they reach the discharge aperture or outlet *d* of the drying-chamber and will pass through the inlet 32 of the conveyer-case 30 and be conveyed by the conveyer 33 to both ends of the said case and discharged downwardly through the outlets 34 of the said case externally of the heating-jacket. The conveyer-case 30, being arranged within and extending through the heating-jacket, will be kept in a dry condition interiorly.

The evaporating or desiccating process carried out by the apparatus which constitutes the subject-matter of this application forms the subject-matter of a contemporaneous application filed simultaneously with the filing of this application.

What I claim is—

1. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top with a vapor-outlet and formed by a casing whose lower end portion tapers downwardly and is provided with an outlet at its lower end; a deflector arranged within the upper portion of the said chamber and under and transversely larger than the aforesaid vapor-outlet; a heating-jacket surrounding the drying-chamber; means for conducting the liquid or material to be desiccated or evaporated into the drying-chamber and discharging it a suitable distance below the aforesaid deflector, and means for heating and scattering the said liquid or material into the form of a mist or cloud below the aforesaid deflector.

2. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at its top and centrally with a vapor-outlet; an imperforate deflector arranged within the upper portion of the said chamber under and transversely larger than the aforesaid vapor-outlet; means for heating the drying-chamber; means for conducting the liquid or material to be desiccated or evaporated into the drying-chamber and discharging it centrally within the drying-chamber

and arranged a suitable distance below the aforesaid deflector, and means for heating and scattering the said liquid or material between the place at which the said liquid or material is thus discharged and the aforesaid deflector.

3. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top with a vapor-outlet; a deflector arranged within the upper portion of the said chamber and under the aforesaid outlet; means for conducting hot air into the drying-chamber and discharging it under considerable pressure in the form of a stream upwardly into the drying-chamber, and means for discharging the liquid or material to be desiccated or evaporated with, though at an angle to, the said stream of hot air.

4. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top and centrally with a vapor-outlet; a deflector arranged and suspended within the upper portion of the said chamber and under the aforesaid vapor-outlet; means for heating the drying-chamber; means for discharging a stream of heated air under pressure upwardly into the drying-chamber, and means for conducting the liquid or material to be desiccated or evaporated into the drying-chamber and discharging it in the form of a stream with, though at an angle to, the aforesaid stream of air.

5. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top and centrally with a vapor-outlet; a deflector arranged within the upper portion of the said chamber below the said vapor-outlet, which deflector tapers downwardly toward its central portion; a heating-jacket surrounding the said chamber; means for discharging a stream of heated air under pressure upwardly into the drying-chamber, and means for conducting the liquid or material to be desiccated or evaporated into the drying-chamber and discharging it in the form of a stream.

6. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top with a vapor-outlet; a deflector arranged below the aforesaid vapor-outlet within the upper portion of the drying-chamber, which deflector tapers downwardly toward its central portion and has an interior chamber which is open at the top; a drain-pipe leading from the lowest portion of the deflector-chamber to the exterior of the drying-chamber; means for heating the drying-chamber; means for scattering the liquid or material to be evaporated or desiccated within the drying-chamber below the aforesaid deflector.

7. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided at the top and centrally with a vapor-outlet; an imperforate deflector arranged within the upper portion of the said chamber and below the aforesaid vapor-outlet; a heating-jacket surrounding the said chamber and extending over the top of the aforesaid casing and provided with an outlet adjacent to the aforesaid vapor-outlet; means for conducting the liquid or material to be desiccated or evaporated into the drying-chamber and discharging it in the form of a stream within the lower portion of the drying-chamber, and means for heating and scattering the said liquid or material below the aforesaid deflector.

8. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet and reduced in dimensions horizontally toward its lower end and having an outlet at the said end; means for discharging the liquid or material to be desiccated or evaporated within the drying-chamber a suitable distance above the lower outlet of the said chamber; means for scattering the said liquid or material in the said chamber, and means for retarding the descent of the dried or partially-dried particles within the lower portion of the drying-chamber.

9. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet and reduced in dimensions horizontally toward its lower end and having an outlet at the said end; means for discharging the liquid or material to be desiccated or evaporated within the drying-chamber a suitable distance above the lower outlet of the said chamber; means for scattering the said liquid or material in the said chamber; means for deflecting downwardly within the said chamber any solid particles which tend to rise to the extreme upper end of the said chamber; means for retarding the descent of the dried or partially-dried particles within the lower portion of the drying-chamber, and means for conducting the dried solid particles from the lower outlet of the said chamber.

10. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet and formed by a casing whose lower end portion tapers downwardly and is provided with an outlet at its lower end; a fan arranged within the lower portion of the drying-chamber; means for operating the fan; means for discharging the liquid or material to be desiccated or evaporated within the drying-chamber above the said fan; means for heating and scattering the discharge of liquid or material to be desiccated or evaporated, and means for heating the drying-chamber from the exterior.

11. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet and formed by a casing whose lower end portion is inverted-cone shaped and has an outlet at its lower

end; two cross-bars arranged horizontally and a suitable distance apart vertically and extending transversely of the lower portion of the drying-chamber; a vertically-arranged shaft arranged centrally of the drying-chamber between and supported from the said bars; means for driving the shaft; a fan operatively mounted upon the shaft; means for discharging the liquid or material to be desiccated above and near the upper cross-bar, and means for heating and scattering the discharge of the said liquid or material.

12. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet and formed by a casing whose lower end portion tapers downwardly and is provided with an outlet at its lower end; means for discharging the liquid or material to be desiccated or evaporated within and centrally of the lower portion of the drying-chamber; means for heating and scattering the discharge of the said liquid or material; a heating-jacket surrounding the drying-chamber; a conveyer-containing case extending through the lower end of the heating-jacket and provided, at the top, with an inlet which registers with the aforesaid lower outlet of the drying-chamber, which case extends to the exterior of the heating-jacket and is there provided with a discharging-aperture, and a screw conveyer arranged within and extending longitudinally of the said case.

13. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet, means for discharging the liquid or material to be desiccated or evaporated within the drying-chamber; means for heating and scattering the discharge of the said liquid or material; a conveyer-containing case arranged below the drying-chamber and provided, at the top and centrally between its ends, with an inlet which is in open relation with the drying-chamber, which case is provided, at each end, with an outlet, and a screw conveyer arranged within and extending longitudinally of the said case and having a right-handed thread and a left-handed thread extending from in under the aforesaid inlet to opposite ends respectively of the conveyer.

14. Desiccating or evaporating apparatus comprising the following: a comparatively high drying-chamber provided at the top and centrally with a vapor-outlet; a deflector arranged within the upper portion of the drying-chamber and in under the said vapor-outlet; a pipe which extends from externally of the said drying-chamber into the lower portion of the said chamber and is provided, centrally of the said portion of the drying-chamber, with an upwardly and laterally discharging outlet, which pipe is employed in feeding the liquid or material to be evaporated or desiccated to the drying-chamber; a valved air-conducting pipe extending into the drying-chamber and provided in suitable proximity to but below and at one side of the aforesaid pipe-outlet, with an upwardly-projecting outlet arranged as required to have the discharge therefrom intersect the discharge from the pipe employed in conducting the liquid or material to be desiccated or evaporated, and the outlet of the last-mentioned pipe being considerably smaller in transverse area or capacity than the outlet of the air-conducting pipe, and means for delivering heated air under pressure to the fluid-receiving end of the said air-conducting pipe.

15. Desiccating or evaporating apparatus comprising the following: a drying-chamber provided with a vapor-outlet; a pipe which extends from externally of the said drying-chamber into the said chamber and is provided with two outlets arranged to discharge upwardly and toward each other; a receptacle containing the liquid or material to be evaporated or desiccated; means whereby liquid or material is forced from the said receptacle into and through the pipe; a valved air-conducting pipe extending into the drying-chamber and provided, centrally between but below the aforesaid pipe-outlets, with an upwardly-projecting outlet arranged as required to have the discharge therefrom intersect the discharges from the outlets of the pipe employed in conducting the liquid or material to be desiccated or evaporated, and means for supplying hot air under pressure to the said air-conducting pipe.

In testimony whereof I sign the foregoing specification, in the presence of two witnesses, this 17th day of November, 1902, at Cleveland, Ohio.

WILLIAM E. JAQUES.

Witnesses:
C. H. DORER,
TELSA SCHWARTZ.