W. S. OSBORNE.

APPARATUS FOR DESICCATING FLUID SUBSTANCES.

APPLICATION FILED OCT. 26, 1910.

1,028,267.

Patented June 4, 1912.

5 SHEETS—SHEET 1.

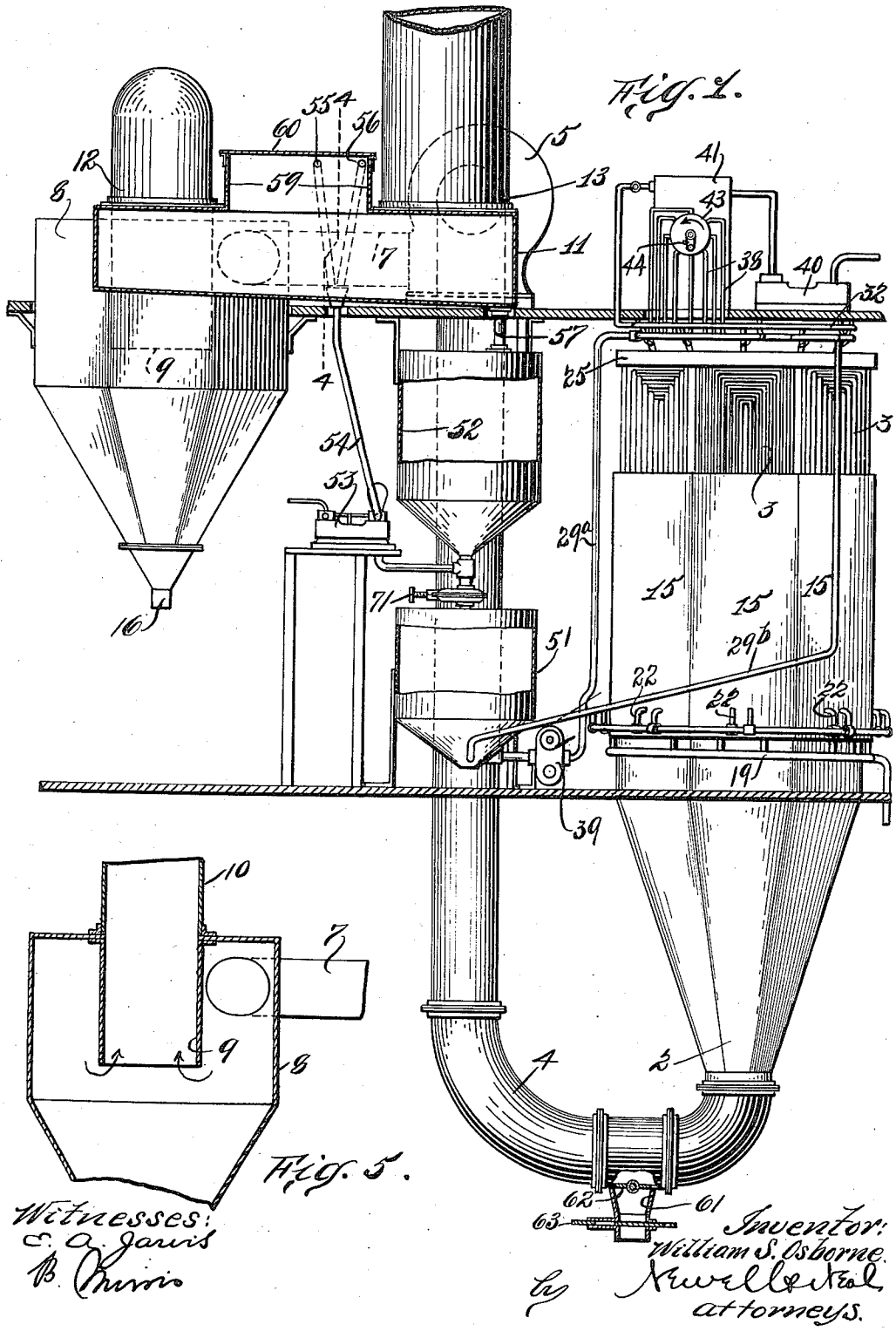


Fig. 5.

Witnesses:
E. A. Jarvis
B. Morris

Inventor:
William S. Osborne.
by Newell & Teal
attorneys.

W. S. OSBORNE.

APPARATUS FOR DESICCATING FLUID SUBSTANCES.

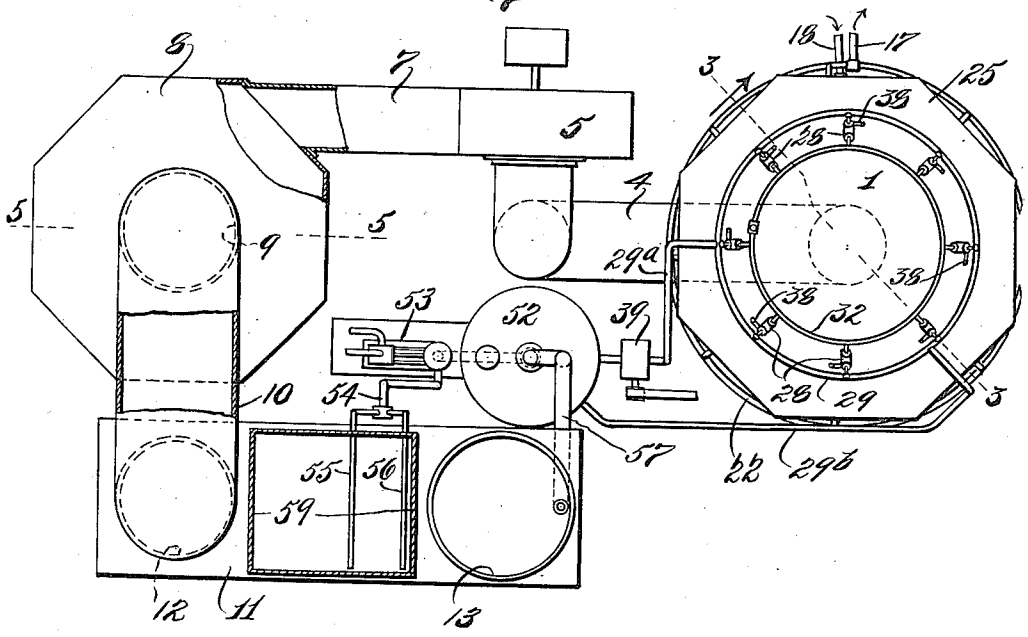
APPLICATION FILED OCT. 26, 1910.

1,028,267.

Patented June 4, 1912.

5 SHEETS—SHEET 2.

Fig. 2.



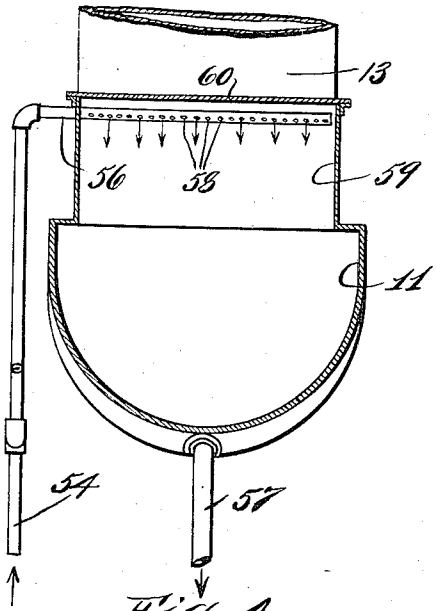


Fig. 4.

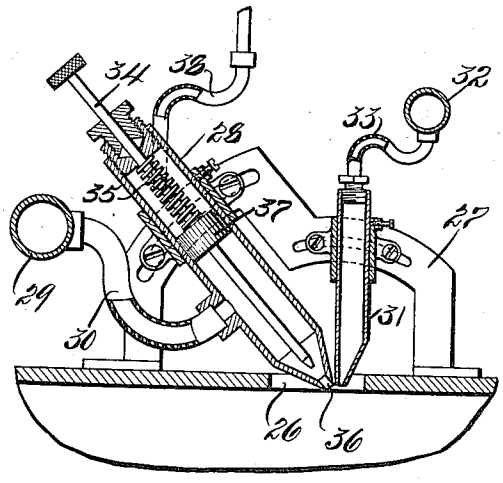


Fig. 10.

Witnesses:
C. A. Jarvis
B. Morris

Inventor:
William S. Osborne
by Howell & Neal
attorneys.

W. S. OSBORNE.

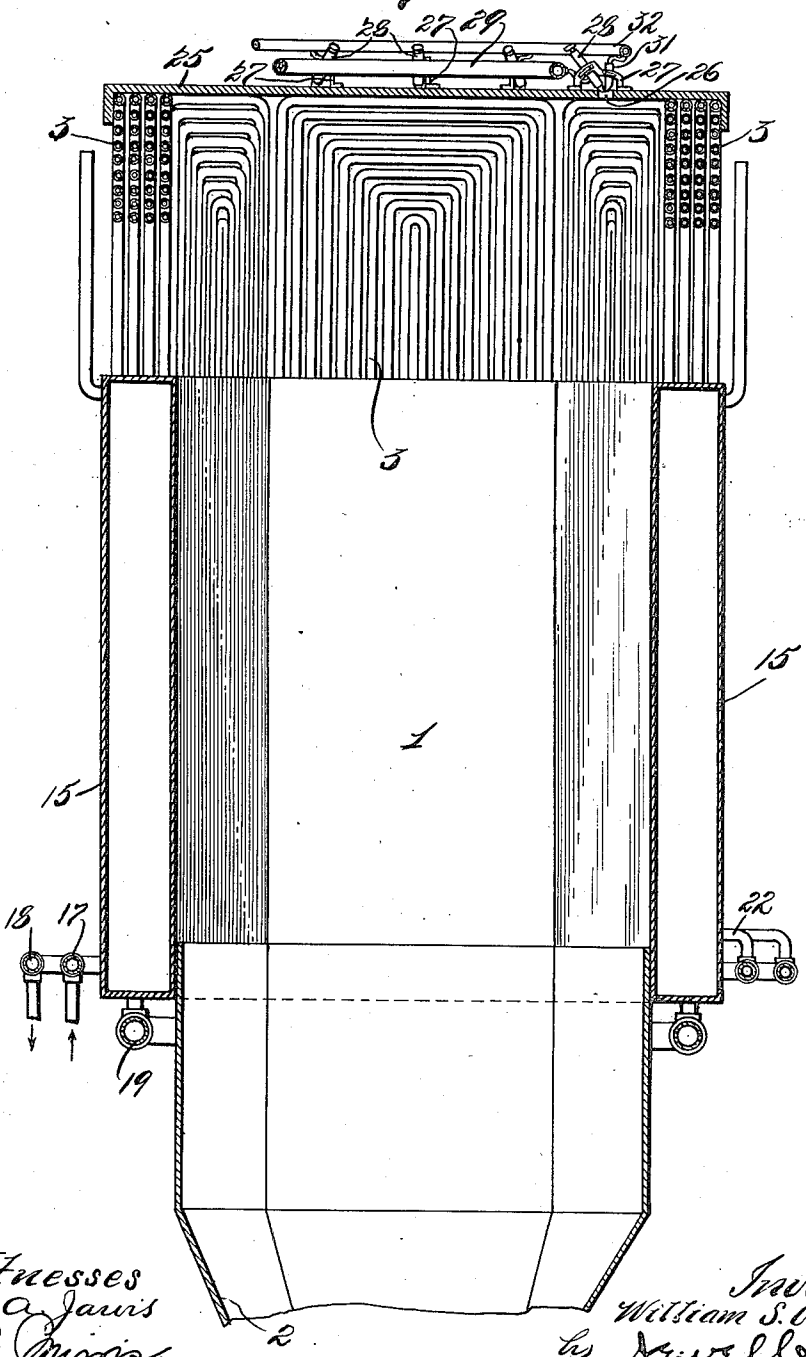
APPARATUS FOR DESICCATING FLUID SUBSTANCES.

APPLICATION FILED OCT. 26, 1910.

1,028,267. Patented June 4, 1912.

5 SHEETS—SHEET 3.

Fig. 3.



Witnesses
C. A. Jarvis
B. Morris

Inventor
William S. Osborne
by Howell & Read
attorneys.

W. S. OSBORNE.

APPARATUS FOR DESICCATING FLUID SUBSTANCES.

APPLICATION FILED OCT. 26, 1910.

1,028,267.

Patented June 4, 1912.

5 SHEETS—SHEET 4.

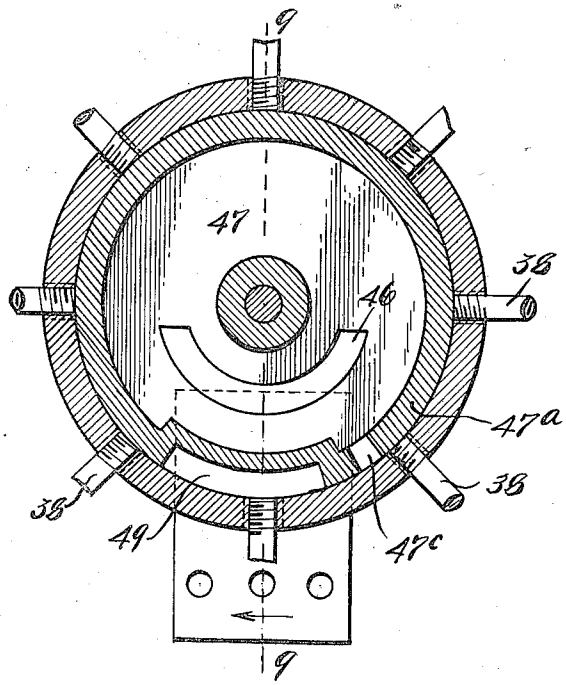


Fig. 8.

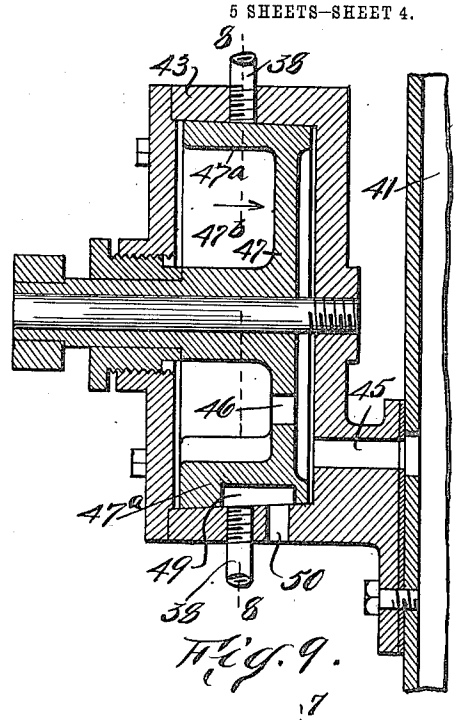


Fig. 9.

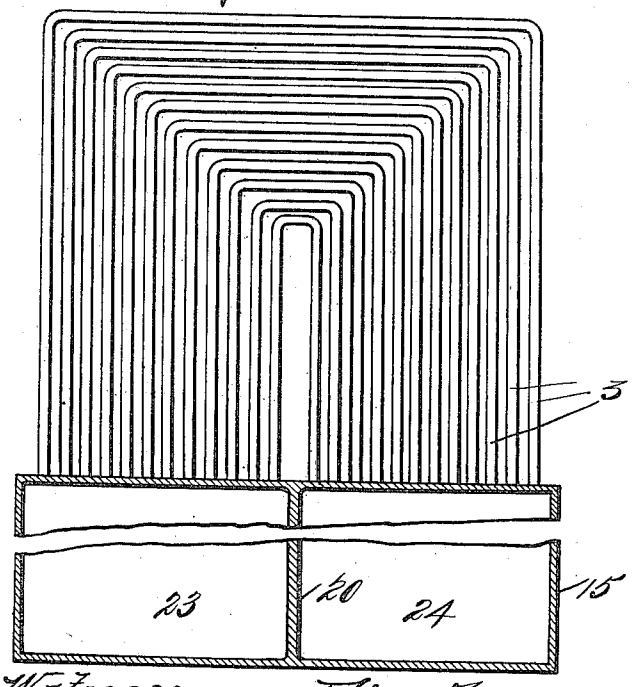


Fig. 7

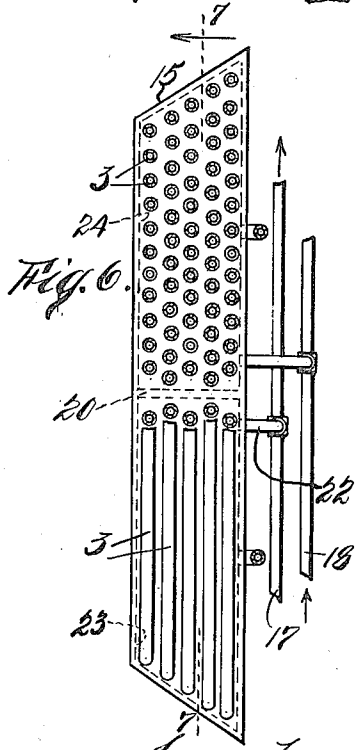


Fig. 6.

Witnesses.
E. A. Davis
B. Morris

Inventor:
William S. Osborne.
by Howell & Neal
attorneys.

W. S. OSBORNE.

APPARATUS FOR DESICCATING FLUID SUBSTANCES.

APPLICATION FILED OCT. 26, 1910.

1,028,267.

Patented June 4, 1912.

5 SHEETS—SHEET 5.

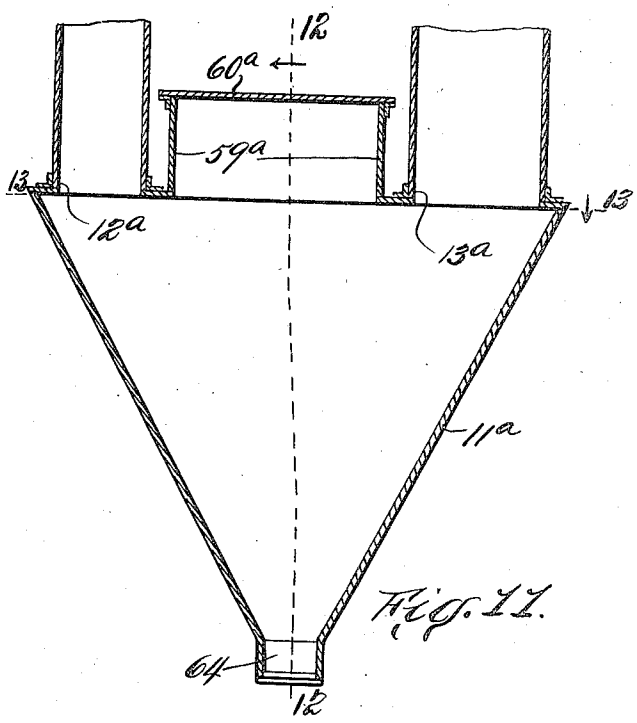


Fig. 11.

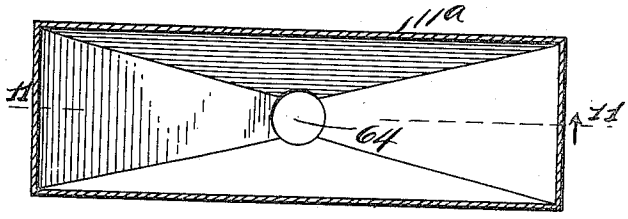


Fig. 13.

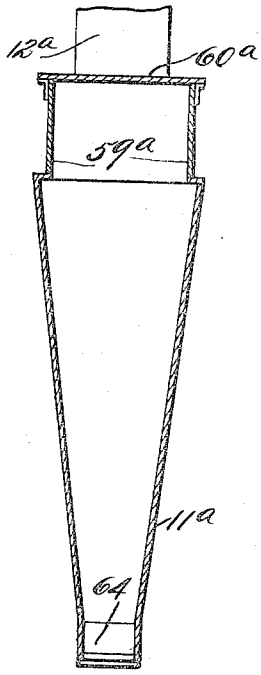


Fig. 12.

Witnesses:
C. A. Jarvis
B. Jarvis

Inventor:
William S. Osborne
by Howell & Read
attorneys

UNITED STATES PATENT OFFICE.

WILLIAM S. OSBORNE, OF NEW YORK, N. Y., ASSIGNOR TO THE GRISCOM SPENCER COMPANY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR DESICCATING FLUID SUBSTANCES.

1,028,267. Specification of Letters Patent. Patented June 4, 1912.

Application filed October 26, 1910. Serial No. 589,111.

To all whom it may concern:

Be it known that I, WILLIAM S. OSBORNE, a citizen of the United States, residing at New York city, New York, have invented certain new and useful Improvements in Apparatus for Desiccating Fluid Substances, of which the following is a full, clear, and exact description.

My invention relates to an apparatus for desiccating fluid substances by maintaining the same in a suspended condition in an air current, and more particularly to an improvement over the method and apparatus shown in my Patent #962,781, granted July 28, 1910 in which the main feature lay in atomizing the fluid material tangentially into a desiccating chamber, wherein a whirling motion of the air was induced to maintain the particles in suspension until desiccated. In this former apparatus the withdrawal of the air from the desiccating chamber by a vortex action counteracts the centrifugal effect of the whirling particles to more or less maintain said particles in suspension for a sufficient length of time to become desiccated, but in my present method I prefer to introduce the material to be desiccated in a finely divided state at the upper end of a vertical desiccating or drying chamber and to cause a current of heated air to flow downwardly through said chamber to take up and carry in suspension said particles of material. The desiccating chamber for this purpose is preferably of sufficiently large area throughout its length to permit a large volume of air to move down slowly through the same whereby the particles carried in suspension may be desiccated while passing therethrough. Means for heating the air entering the desiccating chamber are preferably located at the upper end thereof so that any material incompletely held in suspension will not fall in contact with said heating means to thereby burn and become insoluble but will always be carried away from the same, by gravity.

My improved desiccating process consists briefly in causing a current of air to flow through heating means adjacent the entrance of the desiccating chamber and to pass down slowly through said chamber and in introducing material to be desiccated in a sufficiently divided state to be taken up by said current of air and carried in suspension therein. The length and area of said chamber is sufficient to give the proper length of travel to said air and suspended material whereby the separated globules thereof will become sealed into individual particles so as not to reunite upon reaching the contracted exit from which the air and suspended material is withdrawn at a comparatively high speed and delivered tangentially into a pneumatic separator wherein a whirling movement of the air is induced to precipitate the particles of desiccated material on the walls of said chamber by centrifugal action. The air issuing from this pneumatic separator and freed from the bulk of the desiccated material is then conducted to a second separator or scrubbing chamber wherein it is subjected to a shower of liquid to extract the residual particles of material therein.

Although I understand that my process may be carried out by various means, yet I prefer to carry it out by means of the apparatus shown in the accompanying drawings, in which—

Figure 1 is a side elevation of the entire apparatus with certain parts shown in section; Fig. 2 is a plan view of the entire apparatus having portions shown in section; Fig. 3 is a vertical section of the desiccating chamber through line 3—3 of Fig. 2; Fig. 4 is a transverse section of the scrubbing chamber through line 4—4 Fig. 1; Fig. 5 is a detail section through the exit of the pneumatic separator; Fig. 6 is a plan view of the steam manifold and pipes; Fig. 7 is a section of the same through line 7—7 of Fig. 6; Fig. 8 is a section of the rotary valve through 8—8 of Fig. 9; Fig. 9 is a section of the rotary valve through 9—9 of Fig. 8; Fig. 10 is a detail of an atomizer showing the parts in section; and Figs. 11, 12 and 13 are sections of a modified form of separating chamber.

Referring to the drawings, the desiccating chamber indicated at 1 is provided with an entrance of large area surrounded by heating coils 3 and with a contracted outlet 2. The walls of this desiccating chamber 1 are preferably formed by adjacently disposed heating manifolds 15 with groups of heating pipes 3 leading therefrom. The desiccating chamber preferably octagonal in cross section, is surrounded by eight of these manifolds 15 and pipes 3, the detail of one section of which is shown in Figs. 6 and 7.

Each manifold is divided by partition 20 into two chambers 23 and 24, to the upper side of which the steam coils are connected leading from one chamber to the other. A supply pipe 17 for steam or other heating element extends around the chamber and is connected with each manifold by a suitable branch such as 22, the exhaust steam passing out through exhaust pipe 18. A drain pipe 19 connected to all of the manifolds may also be provided. By this construction it will be observed that the air enters the desiccating chamber through the series of steam pipes 3 to become thoroughly heated and passes down through the chamber, the walls of which continue to heat it. Covering the open end of the chamber 1 and preferably resting upon the top of the coils is a crown plate 25 upon which is supported the means for introducing material into said desiccating chamber, which in the present embodiment consists of a series of atomizers spaced apart around the entrance of said chamber as shown in Fig. 2. Each atomizer consists of a nozzle 28 for supplying liquid material and a nozzle 31 for air having its point adjacent to nozzle 28 for atomizing the material. Both nozzles 28 and 31 are adjustably mounted upon a bracket 27 as shown in Fig. 10, and have their mouths directed through an opening 26 of the crown plate 25. Each nozzle 28 is supplied with material from a circular pipe 29 by a flexible branch tube 30, and air under pressure is supplied to the nozzles 31 by pipe 32 and branches 33. The circular pipe 29 is connected with the main supply tank 51 containing the fluid substance to be desiccated, by supply pipe 29^a, and return pipe 29^b. Pump 39 forces the material through pipe 29^a under pressure and to maintain the pressure in pipe 29 and atomizers constant, return pipe 29^b is provided to take off the excess. Since some liquid food products are extremely viscous in their nature and liable to clog the orifice of nozzle 28, I prefer to provide means for clearing the same and for this purpose have shown a reciprocating stem 34, mounted in each nozzle. The stem 34 is provided with a collar 37 behind which air is supplied through flexible tube 38 to throw the stem forward into orifice 36 and clear the same. As soon as the air is released from behind collar 37, the stem 34 is retracted by a spring 35. I preferably show means for supplying air to each nozzle for operating the stems successively so that the operation of atomizing the material into the chamber will not be seriously interfered with. The means for thus supplying the air to the nozzles successively preferably consist of a pump 40, reservoir 41, and a controlling air valve 43 from which lead the various branches 38 to the various nozzles. The controlling valve 43 may be turned by a handle 44 or operated if desired from some moving part of the machine, so as to clean out the nozzles at regular intervals. The details of the controlling valve are shown in Figs. 8 and 9. Within the casing 43 is a rotatable member 47 having flanges 47^a to form chamber 47^b between the same and the front plate of the valve chest 43, having an annular opening 46 leading therethrough. As shown in Fig. 9 a port 45 leading from the reservoir 41 admits air to the outer side of this rotatable member 47 and an annular opening 46 admits air through the same into chamber 47^b. The rotatable member 47 also has a port 47^c as shown in Fig. 8, which registers in its rotation successively with each pipe 38 to admit air thereto. Immediately behind port 47^c is formed an annular channel 49 in the flange 47^a of member 47, which channel opens communication with each pipe 38 and an exit 50 opening into the air as shown in Fig. 9. It is apparent from this construction that the rotation of member 47 provides an admission and exhaust of air for operating each nozzle stem successively.

The lower contracted end of the desiccating chamber is connected by an upwardly turned pipe 4 to the eye of a fan-blower 5, and from said fan is a trunk 7 leading tangentially into the pneumatic separator 8. This separator is of the usual octagonal type having the contracted outlet 16 for the separated and desiccated material which issues therefrom in the form of a fine powder, and a depending tubular exit 9 as shown in Fig. 5 for the air. It is understood that the air being blown tangentially into this separator 8 is given a rapidly whirling motion to precipitate particles of desiccated material against the side walls of said chamber and finally pass out through exit 9 freed from a greater portion of the particles in suspension. The exit 9 is connected to trunk 10 which leads upwardly out of separator 8 and turns downwardly into the inlet 12 of a second separating chamber 11. As shown in Figs. 1 and 2 this second separating chamber 11 may be in the form of a rectangular box with inlet 12 and outlet 13 at the upper side thereof, said outlet 13 being somewhat larger than the inlet 12 and spaced therefrom a suitable distance as shown. The bottom of the chamber 11 is preferably concave in cross section as shown in Fig. 4 and inclines gradually toward one end to drain the same through an outlet pipe 57. The construction of a chamber in this way with spaced inlet and outlet upon the same side thereof, acts to divert the current of air passing therethrough in such a way as to precipitate further particles of material therefrom and furthermore causes a dead space in said current of air between the inlet and outlet at which there is very

little pressure. As shown in Fig. 1 this dead space is contained within walls 59 covered by lid 60 which may be removed when desired to view the operation of the apparatus. Within this dead space of chamber 11 I preferably introduce a shower of liquid by means of pipes 55 and 56, which have perforations 58 therein, as shown in Fig. 4 to direct the liquid in small jets against the direction of air current passing from entrance 12 to exit 13. It will be apparent that the air thus subjected to a drenching shower of liquid will be almost entirely relieved of any further particles of material which may remain in suspension therein after passing through the pneumatic separator. This feature is very important in any economical and efficient desiccating apparatus, for if all of the desiccated material is not recovered from the air before finally leaving the machine, the expense of the operation far outweighs any speed of production which might be obtained.

The liquid for producing the shower in chamber 59 is supplied from a concentrating tank 52 by a pump 53 through a pipe 54 which may branch as shown at the entrance to the chamber into separate pipes 55 and 56. The drain pipe 57 of the box 11 empties into the concentrating tank 52, and the liquid supplied to this tank may be either pure water or the fluid substance which is being desiccated, and in any case the liquid being drawn from this tank 52 and delivered into the box 11 and returning to the tank 52 with the particles of desiccated material in solution gradually becomes thicker and thicker until it is concentrated enough to be introduced into the desiccating chamber and redesiccated. This may be accomplished by delivering the contents of the concentrating tank 52 into the supply tank 51 and a hand valve 71 is shown for controlling the passage of material from tank 52 to tank 51.

The lowest portion of the upwardly-turned pipe 4 is preferably supplied with an outlet 61 for any material which may collect therein, and an air lock is preferably provided therein consisting of an upper oscillating gate 62 and a lower sliding gate 63.

In Figs. 11, 12 and 13, I have shown a modified form of supplemental separating chamber into which the air issuing from the pneumatic separator may be delivered to separate further particles of material. The entrance 12^a and exit 13^a are similarly spaced as in box 11 of Fig. 1, but the shape of the chamber is that of a narrow inverted pyramid with an outlet 64 for material at its lower end. In such a construction it has been found that the air entering through inlet 12 will pass downwardly to the lower end of said chamber and be deflected upwardly again to the exit 13^a to precipitate particles of material and the friction of the walls 11^a upon the current of air, further acts to recover said particles. If desired a water spray may also be employed in connection with the modifications shown in Figs. 11 to 13, inclusive, to more completely recover the residual particles.

What I claim is:

1. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an enlarged inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and a contracted outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccated material from said air.

2. In a desiccating apparatus, a desiccating chamber having an entrance for air adjacent its upper end surrounded by a plurality of heating coils, means for producing a current of air downwardly through said chamber, and means for introducing material to be desiccated into said downwardly flowing current and maintaining the same therein until desiccated.

3. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccated material from said air.

4. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccating material from said air, a second separating chamber provided with means for moistening the air discharged from said first separator to further extract desiccated material.

5. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end provided with heating means

adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccating material from said air, a second separating chamber provided with means for directing a shower of liquid against a current of air discharged from said separator to further extract said desiccated material.

6. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccating material from said air, a second separating chamber provided with means for directing a shower of liquid against a current of air discharged from said separator, to further extract said desiccated material, and means for collecting said liquid and introducing the same into said desiccating chamber.

7. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a separator, means for producing a downwardly flowing air current in said chamber, and means for introducing material into said air current to be desiccated while in suspension, said separator acting to collect the bulk of desiccating material from said air, a second separating chamber for receiving the air discharged from said separator, having an inlet and outlet arranged to sharply divert the course of said air current to precipitate further particles of desiccated material.

8. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber, means for introducing material to be desiccated therein, said chamber having an inlet for air at its upper end provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet at the bottom thereof connected with a centrifugal separator, a blower intermediate said desiccating chamber and separator for drawing a current of air downwardly through said desiccating chamber and driving the same directly into said separator.

9. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber, a pneumatic separator, a blower intermediate said desiccating chamber and separator communicating with the lower end of said desiccating chamber for drawing a current of air downwardly through said desiccating chamber and driving the same directly into said separator, means for introducing material to be desiccated into said downwardly flowing current, said separator acting to collect said material by centrifugal action.

10. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber, means for producing an air current therethrough, means for introducing material to be desiccated in said air current, and a supply tank for said material, a separating chamber provided with means for moistening said air to collect particles of desiccated material therefrom, and a concentrating tank for receiving and returning said moisture directly to said separating chamber and means for delivering the contents of said concentrating tank to said supply tank when desired.

11. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having walls the upper portions of which are formed of a plurality of heating coils, means for causing the current of air to flow between said coils and downwardly through said chamber, and means for introducing material to be desiccated into said downwardly flowing current.

12. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having walls the upper portions of which are formed by a plurality of heating coils, and the lower portions of which are formed by the heat supply manifolds of said coils, means for causing a current of air to flow between said heating coils and downwardly within said manifolds, and means for introducing material to be desiccated into said downwardly flowing current.

13. In a desiccating apparatus, a desiccating chamber having an entrance for air at its upper end provided with heating coils adjacent thereto for raising the temperature of the incoming air, means for causing a current of air to flow downwardly through said chamber, and a series of nozzles located at said entrance adjacent said heating coils for spraying material to be desiccated into said downwardly flowing current of air.

14. In a desiccating apparatus, a desiccating chamber, means for heating the air passing therethrough, one or more nozzles for spraying material to be desiccated into said heated air, and means adapted to be driven through said nozzles for clearing the orifices thereof when clogged.

15. In a desiccating apparatus, a desiccating chamber, means for heating the air passing therethrough, one or more nozzles for spraying material to be desiccated into said heated air, and means for successively clearing the orifices of the several nozzles when clogged.

16. In a desiccating apparatus, a desiccating chamber, means for heating the air passing therethrough, one or more nozzles for spraying material to be desiccated into said heated air, and means pneumatically operated for successively clearing the orifices of the several nozzles when clogged, comprising reciprocating stems in said nozzles, and a rotary controlling valve for said pneumatic means.

17. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end and provided with heating means adjacent thereto for raising the temperature of the incoming air, and an outlet for said air at the bottom of said chamber, means for producing a downwardly flowing air current through said chamber, and means for introducing material into said air current to be desiccated while in suspension.

18. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having an inlet for air at its upper end and provided with heating means adjacent thereto for raising the temperature of the incoming air, an outlet for said air at the bottom of said chamber, means for producing a downwardly flowing air current through said chamber, and means at the upper end of said chamber for introducing material in a divided state into said incoming air current for being desiccated while in suspension.

19. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having side walls, the upper portions of which are formed of a plurality of heating coils, means for causing currents of air to flow between said coils and downwardly through said chamber, and means above said heating coils for introducing material in a divided state into said incoming air currents.

20. An apparatus for desiccating fluid substances, comprising in combination a desiccating chamber having side walls, the upper portions of which are formed of a plurality of heating coils, means for causing currents of air to flow between said coils and downwardly through said chamber, and means above said heating coils for directing material to be desiccated in a counter-direction to said downwardly flowing air currents.

Signed at New York city, New York this 24th day of October, 1910.

WILLIAM S. OSBORNE.

Witnesses:

BEATRICE MIRVIS,

FLORENCE JACKSON.