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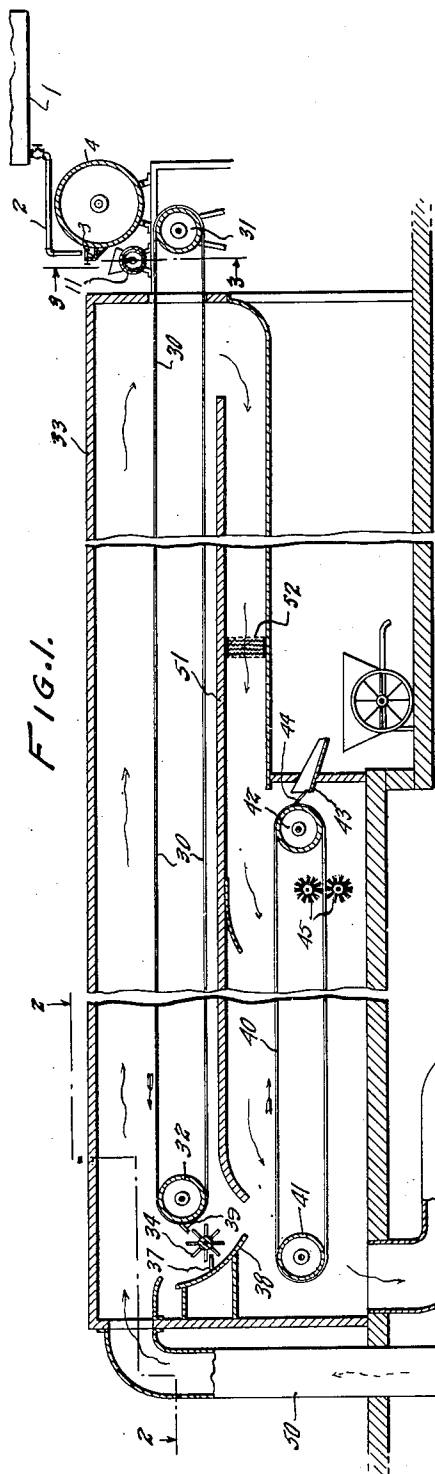
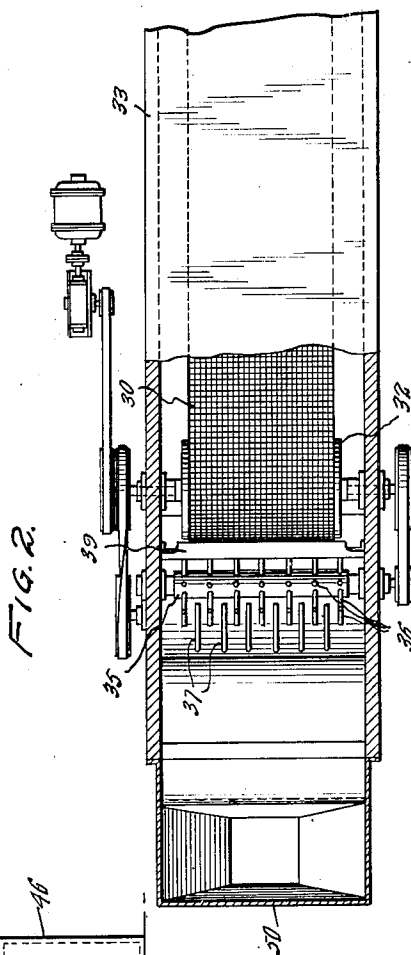
D. ABERNETHY

1,980,898

METHOD AND APPARATUS FOR RAPIDLY DRYING GELATINOUS MATERIAL

Filed Sept. 29, 1931

3 Sheets-Sheet 1



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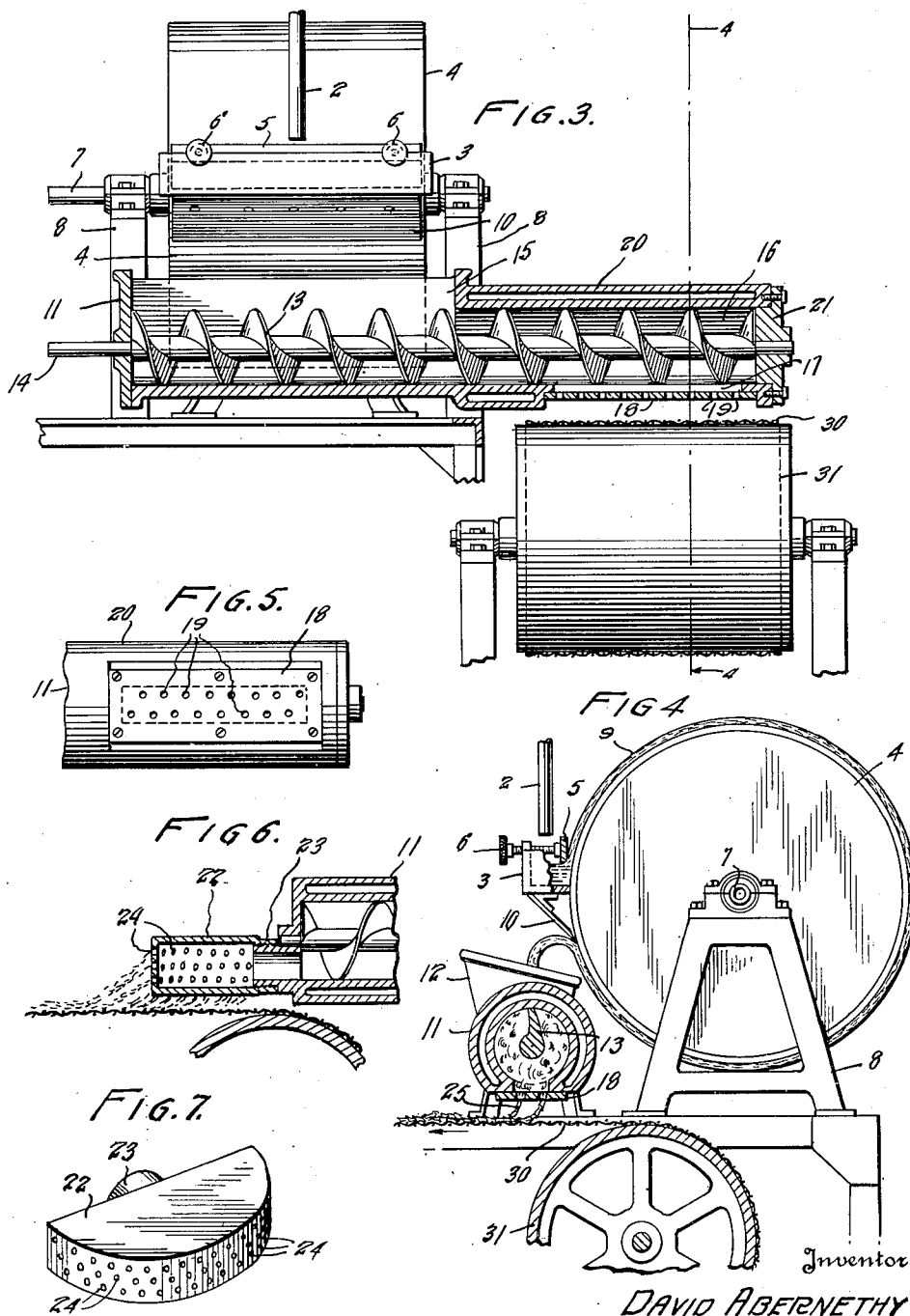
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3 Sheets-Sheet 2



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FIG. 8.



FIG. 9.

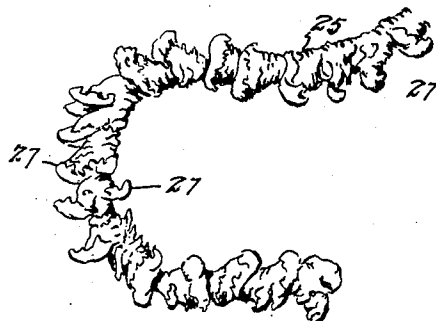


FIG. 10.



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR RAPIDLY
DRYING GELATINOUS MATERIAL

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Application September 29, 1931, Serial No. 565,888

12 Claims. (Cl. 34—24)

This invention relates to the treatment of gelatinous materials and more particularly has reference to methods and apparatus for rapidly drying gelatinous materials.

5 Gelatinous materials, such as animal glues and gelatins, are generally extracted from the raw material in the form of solutions which are evaporated to a desired concentration, and then are further dried to produce a marketable product. Various methods and apparatus have been developed for transforming the gelatinous materials, such as glues and gelatins, from the jelly-like mass into a finished dried product. In some instances, the evaporated solution may be chilled to produce a stiff jelly, and after being cut into bodies of desired size, are subjected to the action of a drying medium. In other instances, the glue jelly in solution is chilled to produce films or other bodies of the stiff jelly, and these bodies are dried by the action of a drying gas.

In other instances, the glue jelly may be contacted with a heated revolving wheel and the dried glue may be scraped off from the revolving wheel as the same is dried.

In all of these processes, however, difficulties are experienced in that considerable time is required to effect the drying of the gelatinous product to such a stage that the same will be converted into a marketable condition. Attempts have been made to improve the prior art processes so as to reduce the time required for drying the gelatinous material into a marketable form, but as yet, no outstanding satisfactory methods have been developed.

A major object of this invention is to devise methods and apparatus for rapidly drying gelatinous materials.

Another object of this invention is to devise methods and apparatus for drying gelatinous materials which are free from the inherent disadvantages of the prior art.

Another object of this invention is to devise a method and apparatus for forming gelatinous material into bodies which may be rapidly dried.

Yet another object of this invention is to devise a method and apparatus for treating gelatinous material so as to granulate the jelly of the same and incorporate air therein to produce a porous mass, which may be rapidly dried upon exposing the mass to the action of a drying gas.

Still another object of this invention is to devise a method and apparatus for rapidly drying gelatinous materials wherein the gelatinous material is granulated and aerated and extruded

from a zone of high pressure into a zone of low pressure in the form of catkin-like porous bodies, which upon subjecting the same to a drying gas, may be rapidly dried into a hard, marketable product.

With these and other objects in view, which may be incident to my improvements, the invention consists in the process steps, parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In accordance with the present invention, gelatinous material, such as glue or gelatin, in the form of a solution is evaporated to a predetermined consistency depending upon the particular material undergoing treatment. This concentrated solution is chilled so as to produce a stiff jelly. The stiff jelly which is preferably in the form of a thin film is then treated to granulate the same and incorporate air therein. After the mass has been sufficiently treated to produce an aerated granulated mass of gelatinous material, the mass is forced into a compression zone from which it is extruded through small apertures into the atmosphere.

Upon being extruded into the atmosphere, the mass swells and bursts, producing string-like bodies of the mass which have an intumesced appearance. The bodies extruded from the compression zone generally take the form of catkins and consist of porous string-like bodies, the outer surface of which is covered with a multiplicity of sponge-like spicules.

The material in this form has a relatively high surface-volume ratio and may be very rapidly dried. The mass of extruded catkin-like bodies may be deposited upon a conveyor belt which conveys the same through a drying chamber in which the material is exposed to the action of a drying gas.

In order to make my invention more clearly understood, I have shown, in the accompanying drawings, means for carrying the same into practical effect, without limiting the improvements in their useful applications, to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Figure 1 is a diagrammatic sectional view of a plant for carrying out the present invention.

Figure 2 is a view taken on line 2—2 of Figure 1.

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Figure 3 is an enlarged sectional view taken on line 3—3 of Figure 1, showing structural details.

Figure 4 is a sectional view taken on line 4—4 of Figure 3.

Figure 5 is a detail view showing a portion of the apparatus shown in Figures 3 and 4.

Figure 6 is a sectional view of the apparatus shown in Figure 3, having a modified form of nozzle associated therewith.

Figure 7 is a perspective view of the nozzle shown associated with the apparatus in Figure 6.

Figure 8 is a view of a mass of the catkin-like product produced in accordance with the present invention.

Figure 9 is an enlarged view of one of the catkin-like bodies prepared in accordance with this invention.

Figure 10 is a sectional view of one of the catkin-like bodies showing the interior structure thereof.

In carrying out the present invention, gelatinous materials, such as glue or gelatins, are extracted from the animal matter in the form of solutions. These solutions are preferably evaporated to a desired concentration, depending upon the properties of the material undergoing treatment and the subsequent conditions of treatment to be applied to the material. These solutions are chilled, preferably in film form, and then are treated to granulate the stiff jelly produced as a result of the chilling, and to incorporate air in the granulated mass. The aerated granulated mass is then extruded from a pressure zone into the atmosphere, resulting in the bursting of the material into string-like bodies having a multiplicity of spicules formed on its outer surface.

Referring to the drawings, there is shown in Figure 1 a diagrammatic representation of an apparatus in which the present invention may be carried out. A solution of the gelatinous material such as glue or gelatin is evaporated to a predetermined specific gravity or concentration and is introduced into the reservoir 1. From this reservoir the concentrated glue solution is conveyed by means of the conduit 2 to a trough 3 associated with a chilling apparatus. As clearly shown in the drawings, and more particularly in Figures 3 and 4, the chilling device consists of a large metallic roll 4, which is so constructed that a cooling medium may be circulated in heat exchange relation with the surface of the roll, thus insuring that the temperature of the surface will be maintained sufficiently low to produce the desired cooling effect upon the gelatinous solution introduced into the trough 3. The trough 3 is so associated with the roll 4 that the solution contained in the trough 3 will be in contact with the outer surface of the roll 4 as the roll revolves.

In order to regulate the thickness of the film of jelly adhering to the outer surface of the roll 4, the trough 3 has associated therewith, an adjustable bar 5, carried by the screws 6 mounted in the wall of the trough 3. By adjusting the screws 6, the bar 5 may be moved toward or away from the surface of the roll 4, and thereby vary the thickness of the film of jelly adhering to the roll.

The roll 4 may be mounted upon a shaft 7, which is in turn carried by suitable supports 8. Roll 4 may be caused to revolve at any desired speed by connecting the same with a source of power, not shown.

A film of jelly of the gelatinous material 9

will form on the outer surface of the roll 4, and by the time the roll makes substantially a complete revolution, the jelly will be sufficiently stiff for further treatment and may be removed from the surface of the roll by means of a scraping knife 10, shown associated with the lower portion of the trough 3.

The cooled film of stiff jelly removed from the roll 4 is next subjected to a treatment for granulating the same and simultaneously incorporating air in the granulated mass. One form of apparatus for carrying out this operation has been shown in the drawings. As is clearly shown in Figure 3, a device 11 which may be termed a catkinizer, is positioned adjacent the knife 10 so that the jelly removed from the roll will be deposited into the hopper 12 of the catkinizer 11. This apparatus consists of a chamber, preferably tubular, in which is mounted a screw conveying element 13 carried by a suitable shaft 14 which may be connected to a source of power, not shown. As shown in Figure 3, the casing of the catkinizer consists of two sections, one of which is open and in communication with the hopper 12, and the other of which is of tubular formation, the interior bore of which is of substantially the same diameter as the exterior diameter of the screw conveyor 13. For purposes of convenience, we may term the open portion of the catkinizer casing the granulating and aerating chamber 15, and the closed portion the compression chamber 16.

Flakes of the glue jelly which are scraped from the surface of the roller 9 are deposited into the hopper 12 of the catkinizer, and due to the rotation of the screw 13, the flakes are finely granulated and are mixed with air. The granulated mass is moved toward the closed or compression chamber 16 of the catkinizer and will be forced into this portion of the chamber under a slight mechanical pressure. In Figure 3, the end of the chamber 16 of the catkinizer is shown to be closed and the lower wall or bottom of this chamber is provided with an opening 17, into which is fitted a plate 18 having a plurality of spaced openings 19 formed therein. Apertures 19 are of a predetermined bore adapted to produce a desired product.

As the mass of finely granulated gelatinous material and air is forced into the closed chamber 16 of the catkinizer, there will be a relatively high pressure built up in the chamber, depending, of course, upon the speed of rotation of the screw 13 and the size and number of the apertures 19 in the plate 18. In order to control the temperature of the mass of granulated gelatinous material and air in the chamber 16, a jacket 20 is provided which surrounds this chamber, and through which a cooling medium may be circulated. As clearly shown in Figure 5, the plate 18 is detachably associated with the opening 17 in the lower portion of the chamber 16. With this construction, it will be appreciated that other plates having various numbers of apertures and of various sizes may be substituted for the plate 18 shown in the drawings. In some instances, it will be found that apertures of small bore work more satisfactorily than larger apertures. Of course, the construction of the apertures will depend upon the material undergoing treatment and the character of the product to be produced.

It is, of course, within the concept of the present invention to modify the construction of the catkinizer. In Figures 6 and 7, for instance, there is shown a modified form of construction. In-

stead of the opening 17 in the lower wall of the compression chamber 16, the end wall 21 is provided with relatively large openings through which the mixture may be forced, and means are provided on the end of the chamber so that a nozzle 22 may be threaded thereon. Figure 6 illustrates a catkinizer having a nozzle threaded on the end thereof. As shown in the drawings, the nozzle may be of semi-circular construction, or of any other desired shape. The nozzle comprises the internally threaded collar 23 which is adapted to be threaded on the end of the chamber 16 and the enlarged compartment, the semi-circular surface of which is provided with a plurality of distributing apertures 24.

The distributing apertures in the nozzle 22 may be of varied sizes and any desired number may be provided in the surface, depending upon the material being treated and the product to be produced.

As before stated, the mixture of finely granulated gelatinous material, the particles of which are surrounded by minute pockets of air, are placed under pressure in the compression chamber 16 by reason of rotation of the screw 13. Upon extrusion of the fine streams of the aerated granulated mass through the apertures in the wall of the compression chamber, an expansion takes place resulting in enlargement and bursting of the particles to form a semi-porous light and fluffy catkin-like formation of the material.

As shown in Figures 8, 9 and 10, the fine streams of material which are extruded from the compression chamber contain air pockets 26 distributed therethrough. Also, it will be noted from an inspection of the drawings that the strings of material 25 have their surface covered by a multiplicity of sponge-like spicules 27. Upon a close inspection of the enlarged view in Figure 9, it will be noted that the spicules are of petticoat formation and are evenly distributed along the length of the string-like catkin of gelatinous material.

The catkin-like bodies of gelatinous material produced as the result of the expansion of the mass of granulated aerated gelatinous material have a high surface-volume ratio. In some instances, it has been found that the surface area of the material has been increased several hundred times. Therefore, it will be appreciated that the surface exposed to a drying medium will be greatly increased, resulting in the effecting of a very rapid drying of the material upon exposing the same to a drying gas. Furthermore, the products extruded from the apertures in the compression chamber of the catkinizing apparatus have their volume increased approximately six times, due to the granulation and incorporation of air therein. This results in the production of a very porous product which also aids in the rapid drying of the material.

In some instances, it may be found advantageous to so operate the apparatus as to form the catkin-like bodies with or without hollow centers. Of course, where the stems of the catkin-like bodies are hollow, the surface area will be increased.

As the catkin-like strings of material 25 are extruded from the compression chamber of the catkinizer, they may be deposited upon the conveyor belt 30 for conveying the material into a drying apparatus. It is preferable to construct the belt 30 of porous or woven material so that the gelatinous substance deposited thereon may have ready access to the drying medium circu-

lated in the drying apparatus. Belt 30 which is mounted upon pulleys 31 and 32 is positioned so as to travel on a single pass through the upper portion of the drying chamber 33. The catkins of gelatinous material deposited upon the belt 30 will be conveyed into the chamber in the directions indicated by the arrows, and upon reaching the other end of the chamber will be discharged into the rotary cylindrical breaker 34. As more clearly shown in Figure 2, the breaker consists of a rotating cylinder 35 having a plurality of spines 36 positioned thereon. These spines rotate between projecting members 37 fixed to a directing baffle 38, positioned adjacent the end of the chamber 33. In order to insure the removal of all of the material from the belt 30, the scraping device 39 is provided.

As the catkins of gelatinous material fall onto the breaker 34, they are broken up into smaller bodies and are discharged onto a belt 40 which moves in the opposite direction and serves to discharge the catkins of material from the drying chamber. Belt 40, which may be of the same construction as belt 30, is mounted upon the pulleys 41 and 42, and moves the material through the chamber and discharges it onto the shoe 43. In this instance, a scraper 44 is provided for removing the material which may tend to adhere to the belt 40, and discharging the same into the shoe 43.

If desired, means may be provided for cleaning the belts 30 and 40. As shown in Figure 1, a pair of rotary brushes 45 is provided for removing any of the gelatinous material which may adhere to the belt 40. A similar apparatus may, of course, be associated with the belt 30.

In order to dry the catkin-like bodies of gelatinous material as the same are moved through the several passes of the drying chamber 33, means are provided for circulating a drying medium therethrough. As shown in Figure 1, an air conditioning chamber 46 is provided having inlet 47 and discharge outlet 48. Conventional means are provided in the chamber 46 for conditioning the gas circulated therethrough so as to bring the same to the proper condition for effecting drying of the gelatinous material. Means have been shown diagrammatically in chamber 46 for cleaning the gas by spraying moisture therein and for removing the moisture therefrom.

Other means have been shown diagrammatically as at 52 for heating the gas to the proper temperature for effecting most satisfactory drying of the gelatinous material. The gas in the proper condition is withdrawn from the discharge outlet 48 and is forced by the fan or blower 49 up through the distributing conduit 50 into the upper portion of the chamber 33. It will be noted that the drying chamber is so constructed that the drying medium is caused to circulate countercurrent to the path of movement of the gelatinous material being conveyed upon the belts. A baffle 51 is positioned within the drying chamber 33 between the belts 30 and 40. This baffle serves to cause the air or gas introduced into the chamber 33 to travel in the direction of the arrows. Upon causing its flow through the drying chamber, the conditioning gas is recycled to the conditioning chamber by way of the conduit 47.

It will be found that the gelatinous material will be discharged from the drying chamber in the same catkin-like body from which it was deposited upon the belt for conveying the material into the drying chamber.

The success of the present invention depends upon controlling the operating conditions during the converting of the gelatinous material into the form of the catkin-like bodies. The degree to which the solution is evaporated will depend upon the particular type of gelatinous material undergoing treatment. It is also found that the speed of rotation of the screw 13 upon which the pressure in the chamber 16 is dependent will influence the product obtained. In addition, the temperature should be controlled during the operation.

In treating a medium grade or quality of glue, it was found that satisfactory results were obtained by evaporating the solution to 14° Baumé, containing 31% dry solids and 69% water. In this instance, the speed of the screw in the catkinizer was controlled to produce a pressure between 50 and 70 pounds per square inch in the compression chamber. In treating a good grade of glue, it was found that best results were obtained by evaporating the solution to 10° Baumé at which it contained 21.5% dry solids and 78.5% water. In this instance, it was only necessary to maintain a pressure of 30 to 40 pounds per square inch in the compression chamber 16. In the case of a hide glue of high grade quality, ideal results were obtained by evaporating a solution to 7° Baumé, at which it contained 14.5% dry solids and 85.5% water. The pressure in this instance was between 20 and 30 pounds per square inch.

It has also been found that the temperature of the jelly during the treatment in the catkinizer should be accurately controlled in order to obtain the best results. Very satisfactory results may be obtained by maintaining the temperature between 36 and 40° F.

The present invention is highly advantageous in that gelatinous material such as glue may be converted from the solution form into a finished dry product within two hours, whereas heretofore, a considerably longer time was required. Furthermore, the product obtained in accordance with the present invention is more completely dried than the products obtained as the result of carrying out the prior art drying processes.

In addition to the rapid drying of the gelatinous material when treated in accordance with the present invention, it should be noted that the finished product has properties which are of advantage. For instance, glue in the form of the catkin-like bodies produced as a result of the present invention, may be soaked in cold water and be ready for joint work in thirty minutes. The advantage of this will be appreciated when compared with the ten to twelve hours required for preparing ordinary ground glues. The finished product is in the nature of a porous granular sponge-like structure having the appearance of catkins. The porosity of the material as well as the catkin-like formation adds to its advantageous properties.

While in describing the present invention, reference has been made to specific conditions of temperature, pressure and concentrations, it should be noted that these may be varied within reasonable limits, depending upon the particular material undergoing treatment, and such variations are within the scope of the present invention.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the

precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. A method of rapidly drying gelatinous material comprising intimately mixing the material, compressing such mix and extruding the same into a zone of reduced pressure whereby the glue is formed into bodies having transverse fissures and of a high surface-volume ratio, and exposing them to a drying atmosphere.

2. A method of drying gelatinous material of the character of glue comprising mixing the material with air, forcing the mixture through small apertures into the atmosphere to cause the mass to expand to produce catkin-like bodies, and subjecting these bodies to the action of a drying gas.

3. A method of rapidly drying gelatinous materials comprising evaporating a solution of the material to a concentration whereby a stiff jelly will form on cooling, cooling the solution to produce a stiff jelly, incorporating air in the jelly and forming the same in the shape of catkins and then subjecting the catkins to the action of a drying medium.

4. A method of drying gelatinous material comprising incorporating air in a mass of the material, mechanically forcing the aerated mass into a chamber having apertures in the wall thereof and through the apertures into the atmosphere whereby expansion of the mass takes place, and exposing the expanded aerated mass to a drying gas.

5. A method of rapidly drying gelatinous material comprising forming a stiff jelly, agitating the jelly to form a mass of discrete particles, compressing such mass and extruding the same into a zone of reduced pressure to form glue bodies having transverse planes of cleavage and of a high surface volume ratio, and exposing such bodies to a drying atmosphere.

6. A method of drying gelatinous material comprising granulating and aerating a jelly of the material, forcing the same through small apertures from a zone of high pressure into a zone of low pressure to produce catkin-like bodies of the material and subjecting the catkin-like bodies to the action of a drying gas.

7. A method of drying gelatinous material comprising evaporating a solution of the material to a desired concentration, depositing a film of the concentrated solution on a chilled roll, scraping the stiff jelly film from the roll, agitating the same to granulate it and to incorporate air therein, forcing the granulated aerated mass into a compression chamber, extruding the mass through apertures in the wall of the compression chamber to form porous string-like bodies, the outer surface of which is covered with a multiplicity of spicules, and exposing the bodies to a drying gas.

8. A method of drying gelatinous material comprising evaporating a solution of the material to a concentration at which a stiff jelly will form on cooling, agitating the jelly to form a mass of discrete particles, forcing the mass into a zone under pressure and maintained at a low temperature, extruding the mass from the pressure zone into the atmosphere in the form of catkin-like bodies covered with a multiplicity of spicules, and subjecting the bodies to the action of a drying gas.

9. An apparatus for preparing gelatinous material, comprising in combination means for granulating the material to be prepared, means for incorporating air in the material, and means for forcing the material into a compression chamber and extruding the same therefrom.	80
10. A process of drying glue comprising reducing the glue to a suitable plastic state, feeding said glue to a pressing means, extruding the glue through orifices situated close to the pressing means into a zone of reduced pressure so as to form glue particles having transverse fissures, and then drying said glue particles.	85
11. A process of drying glue comprising reducing the glue to a suitable consistency, intimately mixing said glue and feeding it to a pressing means, extruding the compressed glue through orifices situated close to the pressing means into a zone of reduced pressure so as to form glue particles having transverse fissures, and then drying said glue particles.	90
12. A process of drying glue comprising reducing the glue to a suitable consistency, feeding the glue to a pressure means of the screw type, extruding said glue through orifices into a zone of reduced pressure so as to form glue particles having transverse fissures, and then drying said glue particles.	95
DAVID ABERNETHY.	100
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