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MANUFACTURE OF ARTIFICIAL SILK

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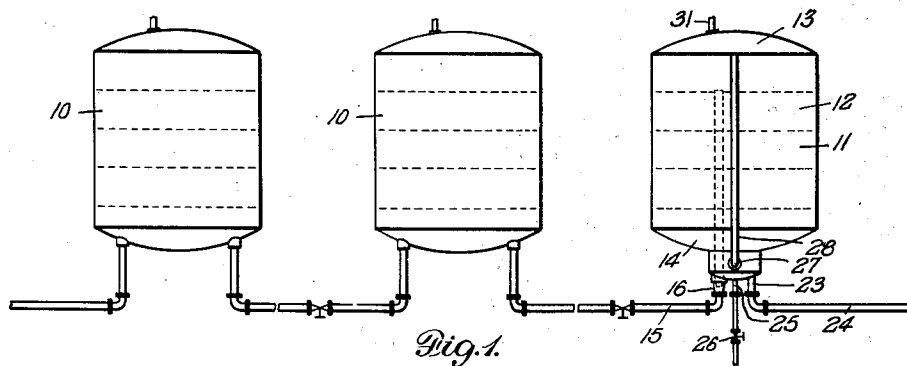


Fig. 1.

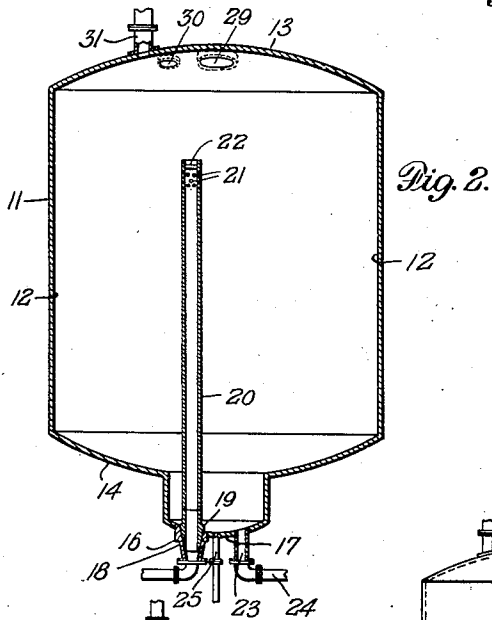


Fig. 2.

Fig. 3.

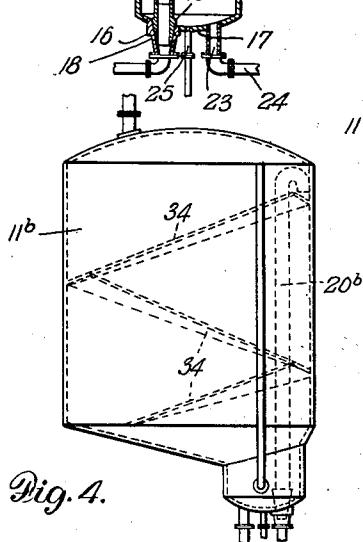
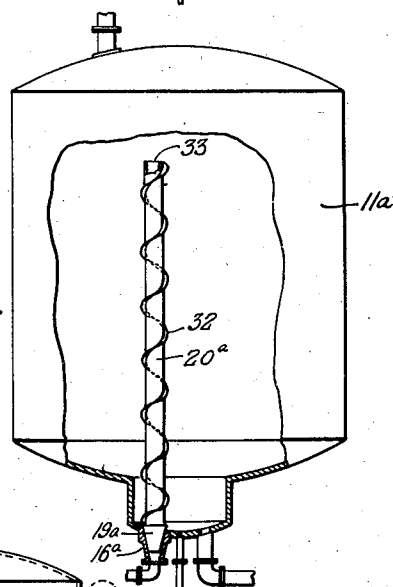


Fig. 4.

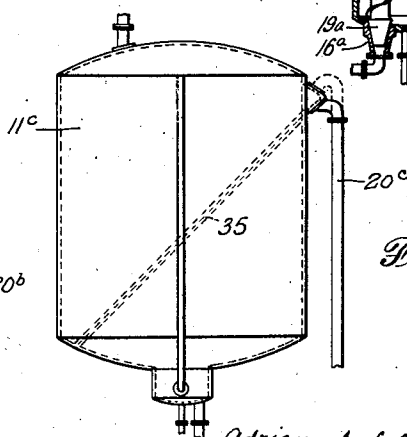


Fig. 5.

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## UNITED STATES PATENT OFFICE

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## MANUFACTURE OF ARTIFICIAL SILK

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3 Claims. (Cl. 18—8)

The present invention relates to a process of and apparatus for the manufacture of artificial silk and, while it relates particularly to that stage of the process wherein the cellulosic solution to be spun, for example viscose, is passed through a series of tanks where it is filtered and aged prior to being pumped to the spinning room, the invention may be utilized in general in the aging of chemicals as well as in the treatment of any cellulosic solutions where it is necessary that these solutions undergo a treatment similar to that required of viscose prior to the spinning thereof.

In the conversion of wood pulp into artificial silk, it is the practice to first soak sheets of wood pulp in a solution of caustic alkali and to thereafter press the sheets to remove excess lye therefrom. After this treatment the sheets exist generally as sodium cellulose. These sheets of sodium cellulose are mascerated so as to produce crumbs, and the crumbs are aged for a desired length of time, usually for a period of about 60 to 75 hours, whereafter they are introduced into a xanthating churn to which is added carbon disulphide. The carbon disulphide reacts with the sodium cellulose crumbs to form cellulose xanthate which exists in the form of yellow crumbs, and these crumbs are formed into a solution by being dissolved in very dilute sodium hydroxide.

A solution produced as above described is commonly termed viscose and it is from such a solution that artificial silk is formed, although the viscose should first be aged before it is spun. Extreme care must be exercised during the aging period if the optimum spinning characteristics are to be obtained. To make a good spinning solution the aging, temperature, viscosity and other conditions must be carefully controlled.

Prior to this invention the ordinary procedure followed during the aging period involved the pumping of the viscose solution progressively through a series of aging tanks, and the subjection of the solution to a filtering step by passing the same through filter presses as it was passed between each two of the tanks. After the viscose had been aged and filtered to the desired extent it was ready to be forced into the last storage or spinning tank which has been, up to the present time, of a construction similar to the aging tanks.

Several very serious objections result from the practicing of a procedure as above outlined, particularly since the viscose is caused to be forced from the spinning tank and into the spinning room by means of air pressure which makes it necessary to leave a substantial amount of viscose in the bottom of the tank after the discharging

of a portion thereof in order to insure that no air will be introduced into the pipe lines. Upon filling the spinning tank with fresh batches of viscose following such a discharging operation the viscose is ordinarily injected through the bottom of the tank and this causes the remainder or "heel" of the old batch of viscose to be positioned at the top of the new batch and, therefore, when the step of forcing the new batch of viscose from the spinning tank into the spinning room is repeated, this "heel" becomes at least partially mixed with the bulk of the solution and the yarn spun therefrom is of a low grade.

To overcome the above referred to difficulty, it has been found to be necessary to substantially completely empty the spinning tanks after each operation by discharging the "heel" in the form of waste. Such an operation consumes considerable time with resultant expense as well as the loss incurred by the wasting of a substantial portion of the viscose.

It is, therefore, an object of the present invention to overcome the above stated objections and difficulties.

It is another object of the present invention to provide an improved process for introducing viscose into spinning tanks in such a manner that the layer of viscose which has been aged the most assumes a position at the bottom of the tank and is therefore the first of the batch to be transferred into the spinning rooms for the spinning of the yarn.

This invention has an additional object, the provision of an apparatus in which the present process may be practiced.

Other objects and advantages of the invention will be apparent from the following detailed description when considered in connection with the accompanying drawing wherein:

Fig. 1 illustrates a plurality of aging tanks connected together and a spinning or storage tank, made in accordance with this invention, connected at the end of the series of aging tanks.

Fig. 2 is a cross sectional view of Fig. 1 and illustrating the spinning tank in detail, and

Figs. 3, 4 and 5 illustrate modified forms of the spinning tank shown in Fig. 2.

In referring to the drawing in detail, and particularly to Fig. 1 thereof, the reference numeral 10 designates aging tanks of normal construction which are connected together in series in the usual manner with press filters (not shown) for effecting the customary filtering steps. While only two such aging tanks are illustrated, any

number may be employed depending upon conditions.

A spinning tank is designated at 11 and this tank is preferably constructed as shown in Fig. 2 although various modifications of the same may be utilized of which the forms shown in Figs. 3 to 5 inclusive are examples. In referring first to Figs. 1 and 2 it will be seen that the size and shape of the walls, top, and bottom of this tank are similar in construction to the ordinary aging tanks employed, and these are indicated as 12, 13 and 14 respectively. A pipe 15 is arranged between the last aging tank 10 of the series, and the tank 11 for conducting the spinning solution from the aging tank to an extending boss 16 which is preferably welded to the wall of a sump 17 which is in turn formed as a part of the bottom 14 of the tank 11. Boss 16 flares outwardly in an upward direction as indicated as 18 so that it is capable of receiving an exteriorly tapered base 19 of an upstanding pipe 20. The interior wall of the flared boss 16 and the extending wall of tapered base 19 are arranged at corresponding angles whereby the boss acts as the sole support for the pipe 20, and the pipe is maintained in place entirely by gravity. Pipe 20 preferably extends upwardly within the tank 11 to about three feet below the top thereof, and the pipe is provided with a series of openings 21 in the wall adjacent its upper end. The upper end of the pipe 20 is open except for a handle 22 which is welded in the upper end of the pipe and provides a means by which the pipe may be moved to permit cleaning.

It has been found desirable to form the base 19 of pipe 20 as a steel casting and to secure the pipe to the base by a weld.

Secured to the bottom of the sump 17, diametrically opposite from boss 16, is another boss 23 which is arranged to serve as a connection for a discharge pipe 24. Pipe 24 is utilized for the purpose of conducting the solution to the spinning rooms. An additional but smaller boss 25 is attached to the sump at the center thereof, whereby a valve controlled outlet 26 is attached to the tank so that the tank may be completely drained.

Another pipe 27 is attached to the sump 17 and this pipe extends from the side thereof to a point beyond the tank, the pipe being secured in position by a bracket which is attached to the tank bottom 14. This pipe 27 provides a connection between the tank and a glass level gauge 28 whereby the height of the viscose within the tank may be readily ascertained.

Tank 11 is further provided in its top 13 with manhole and handhole openings 29 and 30 respectively which openings are sealed by appropriate covers, and a boss 31 is provided in the top for attachment to a branched pipe (not shown) through which a vacuum pull may be exerted on the interior of the tank or through which a fluid pressure may be exerted for discharging the material from the tank depending upon the specific step of the process then involved.

The modifications of the spinning tanks as shown in Figs. 3 to 5 inclusive each involves a particular manner of delivering the solution from the last aging tank and into the spinning tank, the constructions of the respective modifications being substantially the same as the construction of tank 11 except for the arrangement of the pipe 20. Upon referring to Fig. 3 it will be seen that the tank 11<sup>a</sup> differs from tank 11 in that the pipe 20<sup>a</sup> supported on the base 19<sup>a</sup> by the boss 16<sup>a</sup>, has

a spiral conducting or directing fin 32 upon which the solution flows as it is forced from the open end 33 of the pipe, the solution being thereby conducted downwardly to the surface of the solution existing in the tank at which level it then flows outwardly without substantial agitation.

In the form of apparatus illustrated in Fig. 4, the tank 11<sup>b</sup> is similar to the previously described spinning tanks but the inlet pipe 20<sup>b</sup> is arranged adjacent the wall of the tank and a spiral fin or trough 34 is mounted on the interior wall of the tank in such position that the solution discharged from the pipe is conducted downwardly by the fin until the surface of the solution within the tank is reached whereupon the newly admitted solution spreads out over the solution existing in the tank.

The modified tank 11<sup>c</sup> as shown in Fig. 5 involves the use of a pipe 20<sup>c</sup> which is arranged exteriorly to the tank, and the pipe which may optionally be constructed as shown in full or dotted lines, is connected to a trough 35 which may extend in a straight direction downwardly at an angle toward the tank bottom. In this modification the trough acts to conduct the solution from the pipe in the manner described in connection with the other forms of apparatus.

In practicing the present process in the system illustrated involving the use of either one of the spinning tanks, three tanks are preferably utilized since it is ordinarily the practice to have at least two filtering steps. The spinning tank also acts as an aging tank. When the viscose is introduced into the first aging tank 10, as illustrated in Fig. 1, the layer of viscose first introduced will be gradually raised to the top of the tank as solutions forming the succeeding layers are introduced and later elevated to different heights in the tank. The layers of solution are indicated by dotted lines in Fig. 1 of the drawing. It will be seen that the oldest or first formed layer will be positioned at the top of the tank and that the newest layer will be at the bottom of this tank, and when the layers are thereafter withdrawn from the first tank to be subsequently forced into the second tank, the layers will exist in the reverse order. Now in order for the viscose to be introduced into the third, or spinning tank, so that the oldest layer will be adjacent the bottom, that is, as above stated, on the top of the "heel", it will be necessary to force the solution through the inlet pipe of the spinning tank.

In the use of the spinning tank shown in Figs. 1 and 2, the viscose is introduced through the bottom of the spinning tank into the pipe 20 whereupon it is forced upwardly within the pipe, from which it thereafter overflows through the openings in the upper portion of the pipe, and if the feeding is rapid it also overflows from the upper end of this pipe. Due to the relatively high viscosity of the viscose solution, the solution tends to flow down the sides of the pipe so that the "heel", or the portion of the old batch remaining in the bottom of the tank after a previous discharging step, is maintained at the bottom of the tank and is the first layer of the solution to be discharged when the solution batch is passed from the tank during the next step of process.

Each of the forms of the spinning tanks illustrated is substantially tightly constructed in order that the particular spinning tank in the system may be filled while it is maintained under vacuum. The reduced pressure may be maintained in the tank by the application of suction at the boss 31. However, when the tank is filled

while under vacuum there is likelihood of leakage of air into the system in advance of the spinning tank and, while such leakage in an ordinary system would be serious since it is almost impossible to create sufficient vacuum in the tank to entirely free the solution of air bubbles, the manner of filling the spinning tank in the present system results in the solution being subjected to the vacuum while in a comparatively thin body and the bringing of the solution containing the air bubbles to the top of the tank as the solution is introduced through the tank inlet pipe which results in the air bubbles being substantially removed. When the spinning tank is to be discharged fluid pressure may be placed upon the upper layer of solution by admitting air through boss 31, and the layers existing therein will be forced from the tank progressively from bottom to top until the uppermost layer reaches the bottom of the tank. At this stage the valves in the system are properly manipulated, and the step of filling the spinning tank with layers of the differently aged solutions is repeated. It will be clear that the aging tanks 10 are charged and discharged with the layers, as indicated, as the next succeeding tank is emptied. The aging tanks may be filled and discharged in the same manner as the spinning tank if desired.

It will be obvious to those skilled in the art that by my improved apparatus all of the above stated advantages will be realized when employing the spinning tank as the odd numbered tank. If it be desired to employ an even number of tanks including the spinning tank, then the pipes 20, and corresponding pipes in the modifications of the spinning tank may be constructed of such length as to terminate just above the level of the "heel". In this manner the reverse order of the layers of the several batches may be used.

Whereas the invention has been described as applied to the drawing, it is to be understood that the scope of the invention is not intended to be limited thereto as the method of this invention is directed among other features broadly to the introduction of a viscose solution into a spinning tank.

What I claim is:

1. The method of aging cellulosic solutions prior to the spinning thereof comprising establishing a batch of cellulosic solution in separate layers arranged with the oldest layer at the top, conveying said solution to form another batch while maintaining the solution in the respective

layers substantially intact with the layers in the second batch being arranged therein in inverse order of that of the first batch, conveying the solution from the second batch to form another batch while maintaining the solution in the respective layers substantially intact with the layers in the third batch being arranged in the same order as that of the second batch, and effecting a filtering of the solution of the layers as they are passed between each of the respective batches, withdrawing the layers of solution from the last batch progressively with the oldest layer then existing in the three batches being that which is withdrawn first.

2. The method of aging cellulosic solutions prior to the spinning thereof comprising filling an aging tank with separate layers of cellulosic solutions arranged with the oldest layer at the top, discharging said solution from the aging tank and filtering the same, passing the filtered solution into another aging tank, maintaining the solution in the layers substantially intact during the passage between the tanks and positioning the layers within the second mentioned aging tank in an inverse order to that of the first mentioned tank, forcing the solution from the second tank and filtering the same, and drawing the filtered solution into a spinning tank by creating a vacuum therein, maintaining the solution of the layers substantially intact during the passage thereof from the second mentioned tank to the spinning tank and positioning the layers within the spinning tank in the same order as that of the second aging tank, and withdrawing the solution for spinning from the bottom of the spinning tank whereby the solution withdrawn first will be that of the oldest layer being aged.

3. A storage tank for aging cellulosic solutions prior to their manufacture into artificial silk filaments comprising a cylindrical container having a convex top integrally affixed thereto, said top having an opening therein through which pressure or vacuum may be applied, and means for conducting a solution and delivering the same into the upper portion of the tank, which means includes an inlet pipe and a pipe, having a spiral fin attached thereto, extending upwardly into the tank and supported by the bottom thereof whereby the incoming solution is directed to the bottom of the tank without agitation of the said solution.

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