

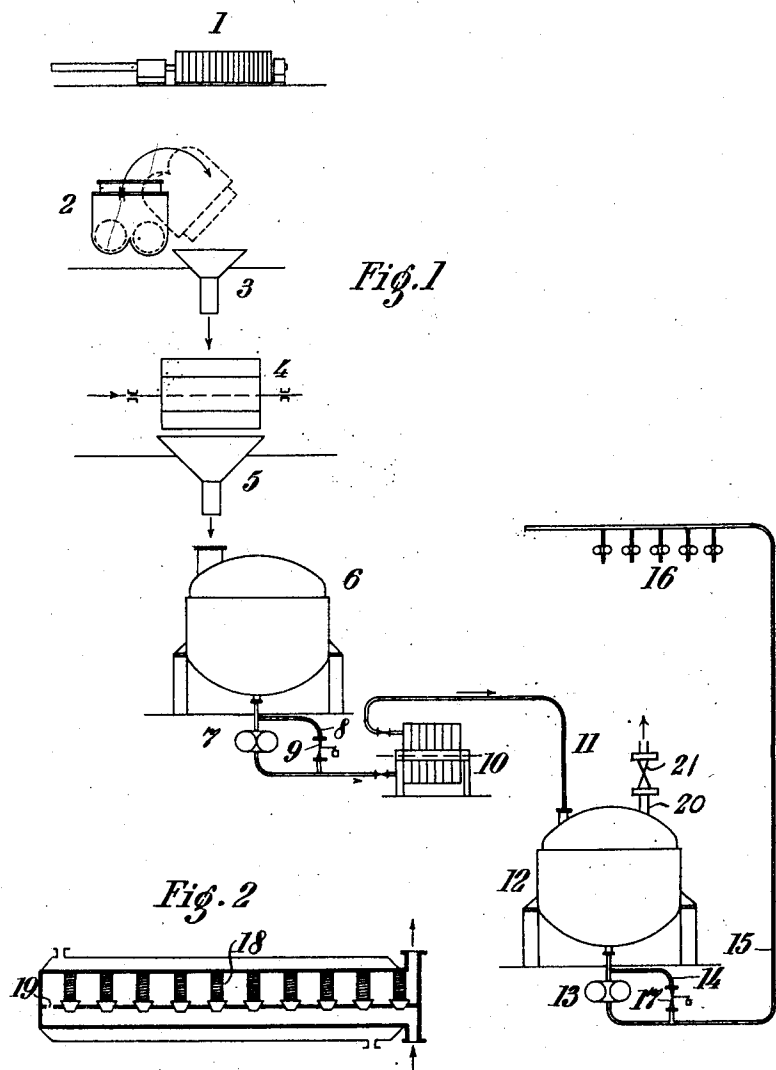
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SPINNING CELLULOSE SOLUTION

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UNITED STATES PATENT OFFICE

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SPINNING CELLULOSE SOLUTION

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My present invention relates to an improvement in the manufacture of artificial products from cellulose solutions and more particularly to a new method of forwarding such solutions through the different parts of the machine, necessary for filtering, deaerating, blending and so on. Another object of my invention is a new arrangement of the piping connecting the said different parts of the machine. Further objects of the invention may be seen from the detailed specification following hereafter.

It is known that the manufacture of artificial silk, bands, films or the like, which is uniform in all essential properties, from cellulose solutions is beset with considerable difficulties. So far as variations in the properties of the cellulose or cellulose compound used for making the solution are not the origin of the difficulty, such lack of uniformity in the final product with respect to its capacity for being dyed or in other respects may be attributed to various causes. By the present invention one of the most important of such causes is eliminated.

It is known that many colloid solutions have a high capacity for dissolving gases. This solubility of gases in colloidal solutions of any kind (solutions of viscose, nitro-cellulose, acetyl cellulose, cellulose ethers and other colloidal materials) increases as might be expected with decrease of temperature and increase of pressure.

In the artificial silk industry and other industries involving the coagulation of cellulose solutions (under which term solutions of all cellulose compounds in any solvent are to be included) it is necessary to forward the solution from the place at which it is produced, through various intermediate operations, (such as filtration through a filter press, transference from one vessel to another, or from a container to the spinning pumps—which may be of the known toothed wheel type—or directly to the spinning nozzles) to the place at which it is coagulated. In these industries, it is customary to use air or gas pressure for causing the flow of the solution through a part or the whole of its passage to the place of coagulation. In this application of air pressure it is unavoidable that a certain, often quite considerable quantity of air should become dissolved in the spinning solution. The proportion of gases dissolved varies with the temperature and pressure used. The content of gases in the solution is also different in the surface layer which is in contact with the compressed gases than at the bottom of the containing vessel and again different in the neighbourhood of the cooled walls of the vessel than in the middle of the mass of the solution.

If the spinning solution, for instance viscose solution, has been de-aerated by means of an air pump, in the subsequent use of compressed air it cannot be avoided that the solution becomes more or less again saturated with air and, indeed, to a varying extent. When such a solution issues from the spinning nozzle its physical and also, as in the case of viscose, chemical condition may become quite different. In each case the dissolved air has to become separated from the solidifying solution.

It need not be stated that the dissolved air may be chemically active, for instance in the case of viscose. In spinning from successive charges of one and the same container of the spinning solution, there are periodic differences in the solution, the avoidance of which is essential if it is desired to bring the solution continuously into a condition for spinning as uniform as possible.

According to this invention, the spinning solution is forwarded from the place at which it is produced to the place at which it is coagulated by mechanical means only (such as pumps or suitable heads), the use of compressed gas being entirely avoided. If the spinning solution is to be forced against a uniform pressure, as for example on the way to the filter or to the spinning pump, it suffices that the force pump (for example a toothed wheel pump) should be provided with a return-flow duct or by-pass having an adjustable valve between the pressure side and the suction side, in order to adjust the desired pressure. If the force pump is arranged under the stock container so that the liquid can flow conveniently to the pump

under the pressure of its own weight, there is obtained without difficulty a liquid, such as viscose, deaerated in the vacuum pump, to be further forwarded by means of a partial vacuum. The separation of air from or the prevention of the entry of air into a spinning solution may be facilitated where this is possible by a suitable maintenance of the temperature of the liquid.

Fig. 1 is a diagrammatic showing of apparatus embodying this invention and Fig. 2 is a detail diagrammatic showing of a modified form of valve 17 of Fig. 1.

With the aid of Fig. 1 of the accompanying drawing, there will now be described an example of how the invention may be carried into effect. It must be expressly remarked that this description is only one of many modes of giving effect to the underlying principle of the invention. All other possible modes of application of this principle are embraced by the claims herein.

Fig. 1 illustrates the application of the invention to the manufacture of unmaturred viscose. The arrangement of the chamber for maturing the alkali cellulose, which is in some cases necessary, is not within the scope of this invention and therefore is omitted from the drawing.

In the drawing, 1 represents an immersion press in which the cellulose is saturated with caustic soda lye in known manner and subsequently pressed. The pressed alkali cellulose is comminuted in the disintegrator 2 and is then charged directly or after a certain maturing period, through a funnel 3 into the sulphiding drum 4. The finished xanthate falls from the open drum through a funnel 5 into the dissolving vessel 6 where the xanthate is dissolved in dilute caustic soda lye and transformed into viscose.

Up to this stage of the preparation of the viscose the travel of the material has been essentially by means of gravity, since the half manufactured material has fallen freely from one apparatus to the next. From the dissolving vessel 6 onwards the viscose, according to this invention, is not forwarded by means of air pressure but only by means of mechanical pumps.

For this purpose, quite near to the discharge of the dissolving vessel 6 the pump (for instance a toothed wheel pump 7) is placed. To this pump the viscose (spinning liquid) is fed by gravity. The discharge pipe from the pump is connected directly with the filter-press 10. The latter, however, suffers in the course of the filtration, owing to the dirt which it removes, a diminution of its permeability. In order, therefore, that the pressure may not rise unduly, the pump 7 must be provided with a device which maintains the pressure of the pump at a constant level.

This is achieved by the by-pass pipe 8 be-

tween the pressure side and the suction side, in which pipe there is a pressure regulating valve 9. This back-pressure valve 9 must be so constructed that in some cases even the whole of the viscose forwarded by the pump 7 may return from the pressure side to the suction side.

From the filter-press the viscose (spinning liquid) passes through the pipe 11 into the spinning vessel 12. Here, in order to separate some emulsified, or even dissolved, air, the viscose is subjected to reduced pressure, the air being sucked away from the vessel 12 through the tube 20 provided with a valve 21 by a vacuum pump. Hereon either after the reduced pressure has been eliminated or while it is wholly or partly maintained, the viscose is forwarded by the pump 13 which is provided with the by-pass pipe 14 analogous to that provided for pump 7 to the spinning machine. The necessary fluid pressure in the connecting pipe 15 between the pump 13 and the spinning machine 16 may be obtained in the same manner as in the filtration by suitably adjusting the pressure regulator 17 of the by-pass 14.

The invention is equally applicable whether the viscose (spinning liquid) is conducted directly to the spinning nozzles or each spinning nozzle has a separate spinning pump through which the liquid to be spun in a given time is apportioned to the several spinning nozzles. If the spinning is conducted without these spinning pumps by means of the direct pressure of the viscose on the spinning nozzles, it is desirable that there should be provided a special means of conducting the spinning liquid uniformly and without jerks and pressure, so as to produce a uniform fiber.

For this purpose the by-pass valve 17 on which the spinning pressure depends, is formed as an aggregate of a number of similar valves. Such an aggregate of valves is shown diagrammatically in Fig. 2 in a form suitable for forwarding viscose. 13 is again the toothed wheel pump, 14 the by-pass and 15 a duct leading to the spinning machine.

The viscose (spinning liquid) passes through the pipe 14 and the valve 17 in such a manner that it actuates from below the valves 18, passes through the valves according to the degree of pressure and then again enters the pipe 14. The several valves 18 may be regulated with great accuracy, so that they are all actuated within the limits of small pressure variations. The limits of pressure within which this aggregate of valves is to pass the spinning liquid may advantageously also be determined by adjustment of the resistance to pressure afforded by the several valves.

When one is dealing with a spinning liquid like, for example, viscose, which may vary in properties with age, an arrangement must

be found which will operate to prevent at any place of the apparatus a part of the spinning liquid from stagnating and thereby becoming thickened. In order, for example, to avoid the dead corner at the place 19 of the aggregate of valves shown in Fig. 2, there is arranged at this place a small opening between the intake side and the discharge side of the valves; through the small opening a portion of the viscose passes continuously from the pressure side to the suction side of the pump 13 and in this manner is avoided any collection above the valves of ageing viscose. This opening is obviously not so large that it can detract from the pressure necessary for forwarding the liquid in duct 15.

Obviously the aggregate of valves shown in Fig. 2 may be placed in another position of the whole system; for instance near the forwarding pump in front of the filter-press.

The process described is of special importance when the pressure which is necessary in order to force the spinning liquid through the nozzles is essentially high; if such a high pressure were to be produced by compressed air there would be dissolved in spinning liquid an extraordinarily injurious quantity of air, particularly in the case of unmatured viscose, the preparation of which must be conducted at low temperature.

When the high spinning pressure for each separate spinning nozzle is produced by a separate spinning pump, it has been found particularly advantageous according to this invention that the pressure produced by the spinning pump 13 and controlled by the by-pass 14 should be as nearly as possible equal to that pressure which is produced by the spinning pumps 16 operating the spinning nozzles. If this expedient be omitted it must be expected when using high spinning pressures that there will be great irregularity in the output of the spinning pumps 16, accordingly as these are used a trifle more or less. On the other hand, good uniformity in the quantity supplied by the spinning pumps is obtained if the pressure before or behind the pumps is maintained at about the same degree. Numerous other embodiments are possible and I contemplate as included within my invention all such modifications and equivalents as fall within the scope of the appended claims. In these claims the term "liquor pumps" is to include toothed wheel pumps, piston pumps, rotary pumps, centrifugal pumps, and so on.

What I claim is:

1. An apparatus for the manufacture of artificial materials from a solution containing a cellulose compound, comprising a dissolving vessel, filter presses, a deaerating and spinning vessel, and a spinning machine, tubes connecting the aforesaid parts of the machine, liquor pumps arranged in the said

tubing and by-passes between the pressure side and the suction side of the said pumps.

2. An apparatus for the manufacture of artificial materials from a solution containing a cellulose compound, comprising a dissolving vessel, filter presses, a deaerating and spinning vessel, and a spinning machine, tubes connecting the aforesaid parts of the machine, liquor pumps arranged in the said tubing, by-passes between the pressure side and the suction side of the said pumps, and adjustable valves in said by-passes.

In testimony whereof, I affix my signature.

ADOLF KÄMPF.