Jan. 17, 1950 C. A. J. LINDQUIST 2,494,951

PROCESS FOR MANUFACTURING REGENERATED CELLULOSE WEBS

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Fig 1A

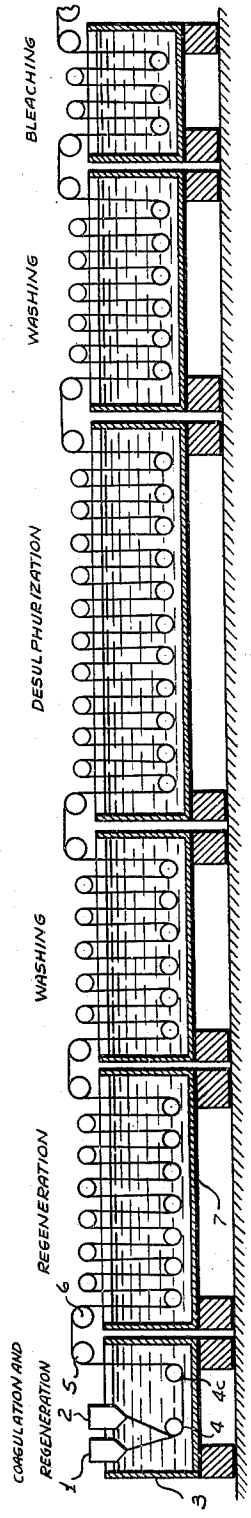
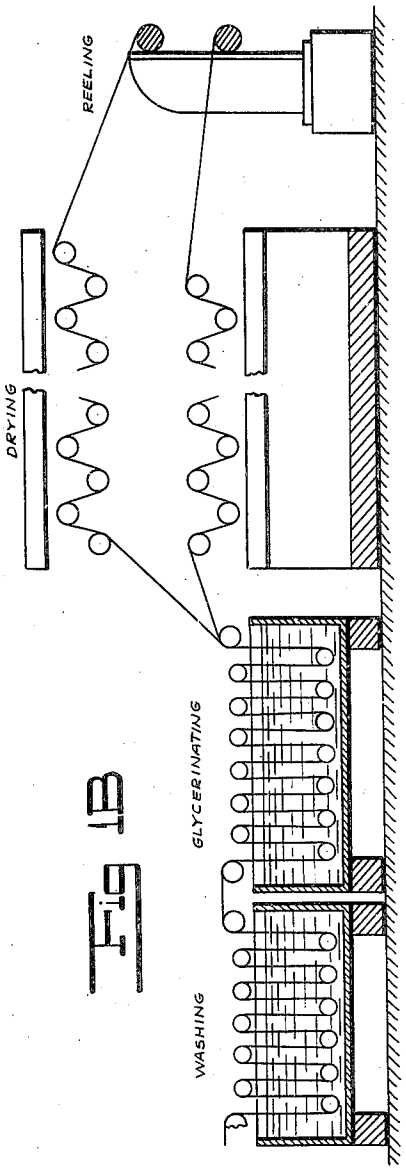


Fig 1B



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Fig 2

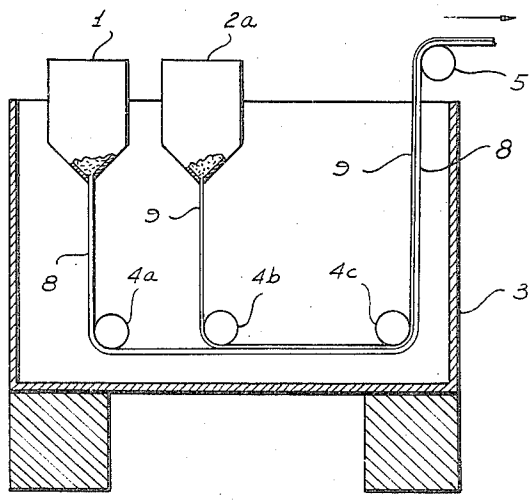
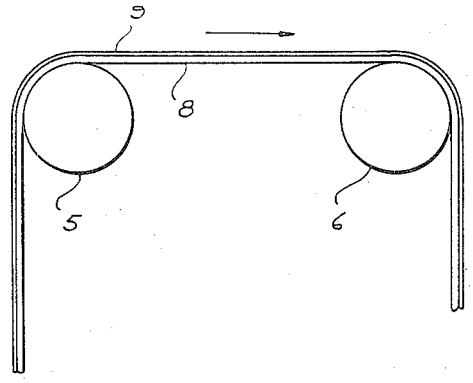


Fig 3



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PROCESS FOR MANUFACTURING REGENERATED CELLULOSE WEBS

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Application February 15, 1949, Serial No. 76,571
In Sweden May 10, 1946

6 Claims. (Cl. 18—57)

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This invention relates to a process for manufacturing regenerated cellulose in the form of a continuous web from a viscose solution by casting or extruding the viscose in sheet form into a coagulating liquid and effecting regeneration, purification and other treatments, such as bleaching and glycerinating, by passing the web progressively through a succession of baths, following which the web may be dried and then reeled or cut and stacked, as desired.

The wet strength of the nascent web, which is a minimum during the coagulation, progressively increases during the regeneration and as a result of its subsequent treatment, but throughout its travel through the baths the pulling strain to which the web is subjected is apt to rupture the web. In fact these breaks sometimes occur with disturbing frequency and add much to the labor and expense involved in making regenerated cellulose webs, and lower the quality of the resulting web, because of varying process conditions.

The process of this invention is calculated to reduce and under proper conditions virtually to eliminate these breakages. The invention contemplates casting two webs simultaneously and using the webs for mutual support and reinforcement throughout their whole wet treatment and until they have reached the condition of full wet strength. Specifically this is done by bringing the two webs together in laminated relation as soon as a regenerated cellulose film is formed on their surface, sufficient to prevent adhesion of the two webs, and running them through the rest of the wet treatment in this laminated relation, following which they are separately dried.

In other words, as soon as the occluded liquid between the surfaces has reacted, the surfaces are brought into immediate contact and the strength is mutually increased according to the well known principle of lamination. Although but one surface of each web is thus exposed to the treating liquids, it has been found that the resulting quality of the web is in no wise impaired and that conventional and even higher rates of operational speed may be maintained.

The web increases in strength during the stage of regeneration or conversion from the xanthate to cellulose, and it continues to develop strength throughout its wet treatment. However the strength is temporarily materially reduced in the hot alkaline desulphurizing bath in which the web swells, and breakages are very apt to occur during the passage through that bath. The maintaining of the webs in mutual supporting relation has been found to be effective in avoiding breakage

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during that critical treatment, and the invention contemplates that the virtue of the mutual support be continued, preferably, right up to the drying.

The mutual reinforcement which each web affords the other with which it is in contact, in addition to virtually eliminating breakage in the running of webs of the usual weight, from twenty-eight to thirty grams per square meter or more, also, it has been found, makes readily possible the production of the thinner gauge cellophane, from fifteen (or less) to twenty-five grams per square meter, for example, which heretofore has been produced only with difficulty and at high cost. The delicacy and weakness of so thin a sheet when run by itself into and through the chemical baths, make impossible an operation at any considerable speed, and even at excessively slow speeds frequent breakages occur. Besides at equal speeds of operation on a particular machine, only a fraction of the production by weight of that obtained with the heavier gauges is possible. Because of the reduced depth of penetration required for the chemicals due to the thinness of the web, the purification is easier and more complete in a given length of time than with the heavier gauges and, therefore, the high speed which the mutual reinforcement makes possible may be maintained. The light weight webs may be thus formed in conjunction with a standard gauge web, or it has been found that two light weight webs may be formed together, each providing sufficient support for the other. The fact that this invention brings within the realm of economic operation the production of this extremely thin sheeting is one of its important aspects.

The accompanying drawings illustrate apparatus for carrying out the process of the invention, in which

Fig. 1A is a diagrammatic showing of a portion of the apparatus from the extrusion end through the bleaching bath;

Fig. 1B is a diagrammatic showing of the remainder of the apparatus through the driers and including the final reeling;

Fig. 2 is a diagrammatic showing on a somewhat larger scale of a first or coagulating tank with apparatus for casting two webs of different gauge or weight and suitable for the production of light weight film;

Fig. 3 is an enlarged detail showing a short length of the two webs produced by the apparatus of Fig. 2 as it passes over a guide rod.

The two webs formed by the apparatus of Figs.

1A and 1B may be of the same or different thickness. If of different thickness the heavier web is run as the lower one, as in Fig. 3. For the purpose of this description it may be assumed that they are of the same thickness.

Two extruding nozzles 1 and 2 are shown as extruding viscose solution into a coagulating and regenerating bath in tank 3, the resulting films being subsequently brought together in this bath. It will be understood that if desired they may be extruded into separate baths and brought together outside of their respective initial baths before being led into the next bath.

The liquid in the tank 3 has both a coagulating and regenerating property; that is, it neutralizes the free caustic in the extruded webs and starts the process of regeneration or conversion of the coagulated sodium cellulose xanthate to cellulose. The webs are maintained separate in the bath until all of the free caustic is neutralized, or, in other words, until the cellulose xanthate is completely precipitated or coagulated. By this time a surface film of regenerated cellulose is formed and the two webs can be brought together. This conjunction is effected, for example, at a common guide rod 4 where the two nascent webs are brought together. The double web is then guided through and out of tank 3 and over external guides 5 and 6 into treating tank 7, containing dilute sulphuric acid, for a continuance and completion of the conversion or regeneration to cellulose. It will be understood that the showing of the tank 7 is diagrammatic and that there may be and in most cases will be a plurality of regenerating tanks.

The chemical treatment of the webs in the ensuing baths is conventional and well known, and follows substantially the process of the United States patent to Brandenberger No. 1,548,864, passing through the stages of washing, desulphurizing, washing, bleaching, washing and glycerinating. While in the diagrammatic illustration each of these steps is indicated as performed in a single tank, some of them, as is well known, may require passage through more than one tank.

As shown, the two webs are maintained in physical contact so as to make in effect a two ply laminated web throughout the entire web treatment. This mutual reinforcement is at least continued during the entire period during which the strength of the webs is developing and increasing, which includes the desulphurization and subsequent washing and to a lesser extent the bleaching and glycerinating. Throughout these chemical baths, therefore, only one side of each web is exposed to the liquid and the time of exposure must be sufficient to permit of the necessary penetration from the one side.

From the glycerinating tank, in the illustrated apparatus, the webs pass into the drier, and for that purpose the webs are separated and are dried separately, being shown as passing from the driers on to separate reels. It is feasible, though not essential, to separate the webs before glycerinating since the maximum wet strength is substantially reached at that point.

The invention may be applied to any even number of webs which can be simultaneously treated and run in coupled pairs while being processed in the manner described above. The nozzles may extrude the viscose solution into the same or separate coagulating baths, as desired.

In Figs. 2 and 3 there is illustrated the application of the invention to the production of light weight films or webs. The two nozzles 1 and 2*a* of Fig. 2 are shown as extruding into the coagulating and regenerating tank 3. Nozzle 1 has a casting opening of a width to extrude a sheet of viscose solution of the usual commercial weight, say, thirty to thirty-five grams per square meter. Nozzle 2*a* has a narrower casting opening of a width to cast a light weight sheet, say, from fifteen to perhaps twenty or twenty-five grams per square meter. The web 8 runs under guide rods 4*a*, 4*b* and 4*c* and thence to guide rod 5 as in Fig. 1A, the nozzle 1 being shown as directly above guide 4*a*. The web 9 runs under guide rods 4*b*, 4*c*, over 5 and so on, the nozzle 2*a* being directly above guide 4*b*. In other words, the two webs are joined at guide 4*b* and run in contact throughout their entire wet processing, as above described, and shown in Figs. 1A and 1B. It will be appreciated that the light weight web will be sustained and reinforced by the heavier web through the hazards of the chemical baths, as a consequence of which it may be subjected in conjunction with its supporting web to the same speed of processing as in the commercial practice with the standard webs, and breakages are materially reduced in frequency.

The greater material in web 8 may require a slightly longer time for the neutralization of all of the free caustic than is the case with web 9. For that reason, it may have a slightly longer run in the coagulating liquid from its extruding nozzle to the point of conjunction with web 9 than web 9 has from its extruding nozzle to that point, and this condition is shown in Fig. 2. As above stated, there must also have been formed a regenerated cellulose film on each web surface by the time the two webs are brought into conjunction.

While certain advantages inhere in forming a light weight web in conjunction with a standard or heavier gauge web, it is not obligatory that web 8 be heavier than web 9, and it is entirely feasible to form two light weight webs together, each providing the reinforcing support for the other. With two light weight webs running in contact, throughout the wet process, such composite web may be run at relatively high speed with small likelihood of breakage.

It will be understood that this double casting lip principle may be applied to the production of regenerated cellulose webs by processes in which the chemical treatment is at variance with the precise steps above described and illustrated in the drawings, the prime essential being that the mutual support of the laminated webs be maintained until the webs have attained their full wet strength.

What is claimed is:

1. The process of manufacturing continuous regenerated cellulose webs which comprises simultaneously extruding viscose solution from a pair of spaced nozzles in sheet form into a liquid having coagulating and regenerating properties and keeping the nascent webs segregated in said liquid until completely regenerated surface films are formed on each web, then bringing the webs together with their adjacent surfaces in contact with each other and maintaining said surfaces in contact at all times while advancing said webs through regenerating liquid until the conversion from the xanthate to cellulose is effected entirely through the webs, and through subsequent after-treating baths and finally separating said webs as they continue their movement and passing them individually through drying means.

2. The process set forth in claim 1 in which the nascent webs are kept segregated until the free

caustic in the webs is completely neutralized as well as until the regenerated surface films are formed.

3. The process set forth in claim 1 in which the subsequent baths through which the webs are passed in contact include successively desulphurizing and bleaching baths together with the necessary washing baths, the separation being effected as the webs emerge from the last bath.

4. The process of manufacturing a light weight continuous regenerated cellulose web which comprises simultaneously extruding viscose solution from an elongated nozzle having a narrow slit opening of a proportion to form a web when finished and dry of a weight not exceeding twenty-five grams per square meter, and also from another elongated nozzle into a liquid having coagulating and regenerating properties and keeping the two nascent webs thus formed in said liquid out of contact with each other until a completely regenerated film is formed on the surface of each web, then bringing the two webs together with their adjacent surfaces in contact with each other and maintaining said surfaces in contact at all times while advancing said webs through regenerating liquid until the conversion from the xanthate to cellulose is effected entirely through the webs, and through subsequent baths and

finally separating said webs as they continue their movement and passing them individually through drying means.

5. The process set forth in claim 4 in which the slit opening in the second mentioned nozzle is wider than that of the first and the web extruded therefrom is comparatively of heavier weight and supports the light weight web during the process.

6. The process set forth in claim 5 in which the run of the heavier nascent web from its extrusion nozzle to the point of conjunction of the webs is longer than that of the lighter web.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,548,864	Brandenberger	Aug. 11, 1925
1,590,595	Hill	June 29, 1926

FOREIGN PATENTS

Number	Country	Date
423,365	Great Britain	Jan. 29, 1935

Certificate of Correction

Patent No. 2,494,951 January 17, 1950

CURT AXEL JOHN LINDQUIST

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 3, line 48, for the word "web", second occurrence, read *wet*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.