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MECHANISM FOR AND METHOD OF PRODUCING CELLULOSE TUBING

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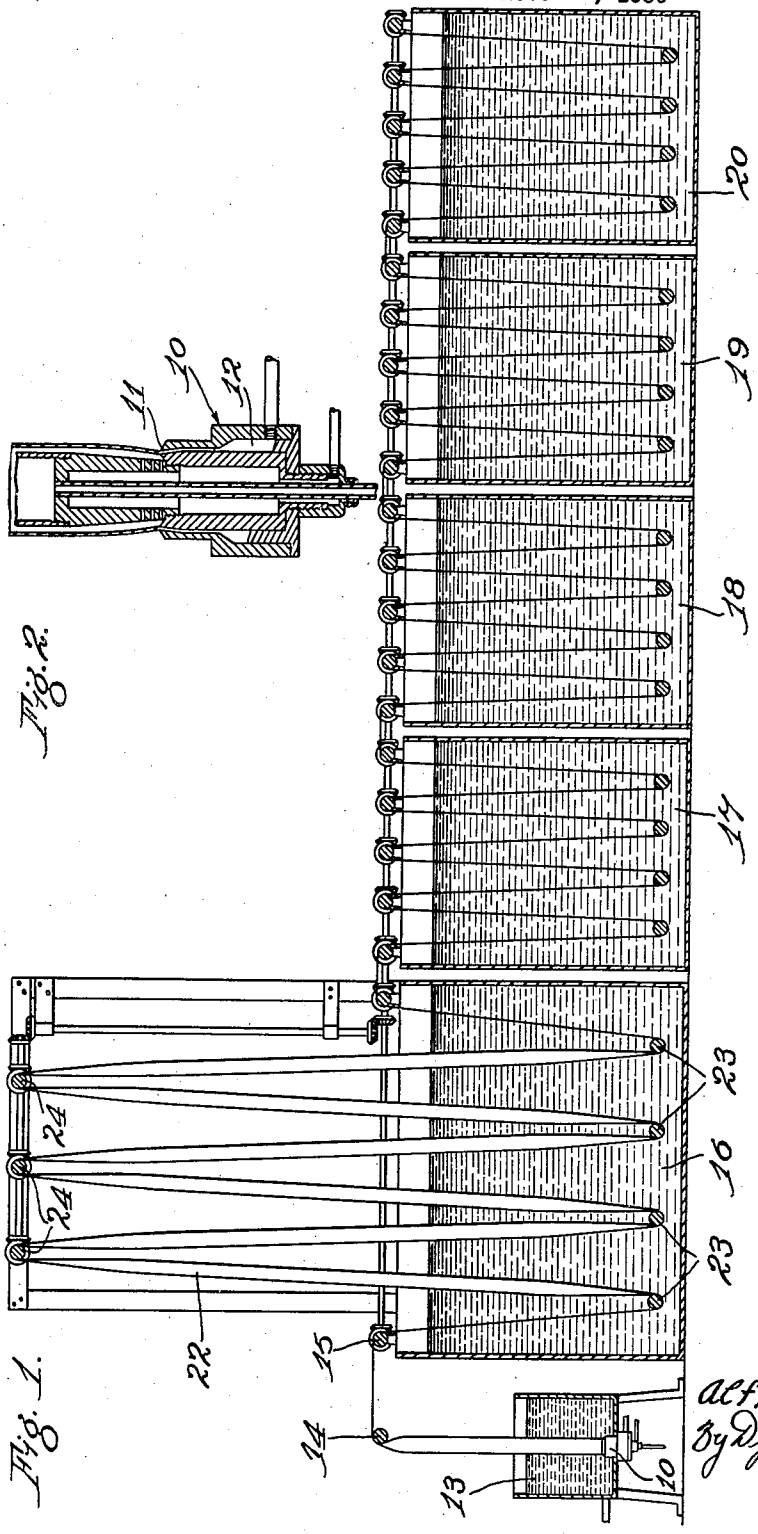


Fig. 1.

Fig. 2.

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MECHANISM FOR AND METHOD OF PRODUCING CELLULOSE TUBING

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The invention relates to mechanism for and a method of producing cellulose tubing, and a primary object of the invention is to provide apparatus for and a method of producing such tubing efficiently so that there will be a minimum loss thereof due to punctures, etc., made in it to permit the escape of gas evolved during the chemical reactions which take place.

Cellulose tubing is formed from cellulose which may be obtained by practicing the method briefly described in U. S. Letters Patent granted to William F. Henderson and Harold E. Dietrich, December 28, 1926, No. 1,612,508. The viscose is extruded through an annular orifice and is subjected to coagulating and regenerating baths, after which the tubing is washed in water. The washed tubing is then treated with a hygroscopic agent and dried.

In the conversion of viscose back into cellulose a considerable quantity of gaseous by-products is evolved. In the formation of thread and film from viscose, this becomes a difficulty only in so far as bubbles of gas are entrapped within the walls of the product and is ordinarily avoided by retarding the conversion in such manner that the gaseous by-products will escape as rapidly as they are evolved. This same difficulty is experienced in the formation of seamless tubing from viscose and, to some extent, is overcome in a like manner. However, another difficulty from these gaseous by-products is experienced. The evolved gas is released to the inside of the tubing and cannot escape without breaking the wall of the tube. Each such rupture or puncture in the wall of the tube causes a loss of tubing, and for this reason it is highly desirable that these punctures be made as infrequently as is possible.

It has been the practice to puncture the tubing above the regenerating bath to permit the escape of evolved gas from the interior of the tubing. This method would be quite satisfactory but for the fact that the time between punctures or ruptures is too short, or, in other words, the loss is entirely too great.

Apparatus embodying a preferred form of the present invention comprises a tank holding a regenerating bath, the tubing being trained over a plurality of rollers, both above and in the bath. The rollers above the bath are spaced a considerable distance therefrom so that long leads of the tubing reach from the bath to these rollers. These leads of tubing accommodate a relatively large quantity of gas and, therefore, it becomes unnecessary to puncture the tubing at frequent intervals. To retard the formation of gas in the tubing so that gas will accumulate in all of the leads thereof extending from the regenerating bath to the rollers mounted above it, the acid content of the bath is reduced below that, which has heretofore been the general practice. The bath is acidified to such an extent that the conversion from viscose into cellulose takes place at a rate which causes the gas to collect in the leads above the bath in substantially equal quantities. Then it only becomes necessary to puncture the tubing at relatively long intervals.

Other objects and advantages of the invention will become apparent as the following detailed description progresses, reference being had to the accompanying drawing, wherein:—

Figure 1 is a central vertical section taken through apparatus which embodies the invention, and

Fig. 2 is an enlarged central vertical section through extruding apparatus which forms part of the apparatus shown in Fig. 1.

Referring to the drawing wherein a preferred embodiment of the invention is illustrated, the reference character 10 designates generally apparatus for extruding viscose through an annular orifice 11 (see Fig. 2). Briefly, the viscose is introduced into an annular chamber 12 and is extruded through the annular orifice 11 into a coagulating bath 13 and thence over rollers 14 and 15 into a regenerating bath 16. From the bath 16, the tubing is led through a series of tanks 17, 18, 19 and 20. The tank 17 contains a water which is acidified by the acid carried over from the bath 16 to the tubing. The tanks 18 and 19 preferably contain running water in which the tubing is thoroughly washed. The tank 20 contains an aqueous solution of some softening agent, preferably glycerine. After the tubing has been treated with the softening agent, it is dried in suitable apparatus (not shown) after which the tubing is ready for use.

The tubing, which is indicated by the reference character 22, is trained around a plurality of idler rollers 23 in the bottom of the bath 16 and is also trained around a plurality of rollers 24 mounted above the bath 16, the arrangement being such that relatively long leads of the tubing extend from the surface of the bath to the rollers 24.

In the preferred embodiment of the invention the lengths of tubing extending above the bath 16 to the rollers 24 are preferably equal to or longer than the lengths of tubing extending from the surface of the bath to the rollers 23 so that relatively large quantities of gaseous by-

products may accumulate in the leads of tubing above the bath. Obviously, when the tubing passing through the regenerating bath has been distended to an undesirable degree by the evolved gases resulting from the regenerating operation, the tubing may be slit before it passes into the bath and as the slit passes up and down over the rollers 23 and 24 the gas which has accumulated in the several leads will escape through the slit. Therefore a single slit will permit the escape of gas which has accumulated during a relatively long period of operation and comparatively little of the tubing will be lost due to the slits or punctures formed therein.

It has been common practice heretofore to employ a regenerating bath which consisted of an aqueous solution comprising 4 to 6% of sulfuric acid and a percentage of sodium sulfate which accumulated in the bath. In practicing the present invention, the acid content of the bath is preferably reduced to such an extent that the conversion of viscose into cellulose is retarded, the conversion being preferably at a rate which permits the gas to accumulate in substantially equal quantities in the several leads of tubing extending from the surface of the bath 16 to the rollers 24. Of course, gas also accumulates in those portions of the tubing submerged in the regenerating bath. It is readily understood that the lengths of tubing extending between the rollers 23 and 24 can hold large quantities of gas and if this gas is evenly distributed through these lengths all the lengths will hold a maximum quantity of the gas before it becomes necessary to puncture the tubing. Then when the tubing is punctured the puncture passes over the rollers 23 and 24 so that the gas in each length may escape.

In practice I have found that if the regenerating bath is about three feet deep and if the rollers 24 are spaced about seven feet above the bath, the tubing may be punctured only at infrequent intervals. Of course, the rollers 24 may be placed higher above the bath if it is so desired, but this distance is determined largely by the accessibility of the rollers to the operator when the tubing is being threaded through the apparatus. To obtain good results, the rollers 24 should be at least two feet above the surface of the bath.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as possible, in view of the prior art.

What I regard as new, and desire to secure by Letters Patent, is:

1. In apparatus of the kind described comprising means for extruding viscose to form a seamless tube thereof, a regenerating bath, a plurality of rollers in the bottom of said bath, and a plurality of rollers above said bath, the upper rollers being positioned at least two feet above the bath, said tubing being trained over said rollers and being advanced thereby, and said regenerating bath being of such strength that the gas evolved during the regenerating operation collects in substantially equal quantities in the lengths of tubing extending between the upper and lower rollers.

2. A method of forming cellulose tubing, which method comprises extruding viscose through an annular orifice to form seamless tubing thereof, and passing said seamless tubing through a relatively weak regenerating bath a plurality of times in such manner that the gas evolved during the regenerating operation will collect in substantially equal quantities in a plurality of long lengths of the tubing extending above the bath.

3. A method of forming cellulose tubing, which method comprises extruding viscose through an annular orifice to form seamless tubing thereof, and passing said seamless tubing through a regenerating bath a plurality of times in such manner that the gas evolved during the regenerating operation will collect in approximately equal quantities in a plurality of long lengths of the tubing extending above the bath.

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